

Innovation challenges of utilities in informal settlements: combining a capabilities and regime perspective

Abstract

The provision of basic services is falling short in informal settlements of cities in the Global South. In particular, public utilities have had difficulties expanding their services to the urban poor. Why is this the case despite utilities having improved their capabilities substantially over the last years? This paper investigates how innovation strategies of utilities are aligned or misaligned with the broader contexts in informal settlements, which are populated by different socio-technical regimes. We propose a framework to identify new capabilities needed by utilities to deal with these different regimes. The paper reconstructs pro-poor initiatives of a water and sewerage utility in a large East-African city and explains why they tended to fail in terms of livelihood improvement. We show how the alignment between capability portfolios and specific regime structures have set limits to the success of pro-poor innovation strategies in informal settlement contexts.

Keywords: Utilities; pro-poor innovations; water and sanitation; socio-technical regimes; capabilities; informal settlements

1. Introduction

The provision of basic services is notoriously falling short in informal settlements of cities in the Global South¹. Despite major international initiatives in the context of the Millennium Development Goals (MDGs) and more recently the Sustainable Development Goals (SDGs), services like water and sanitation continue to lag behind set targets (WHO, 2015). In particular, public utilities have had difficulties expanding their services to the urban poor, even more so to those living in informal settlements (Njiru et al., 2001; Cross and Morel, 2005; Murungi and Blokland, 2016a; Nyarko et al., 2016; Van Dijk and Blokland, 2016). This failure is despite the fact that over the last few decades, utilities in cities in the Global South have substantially improved their capabilities (see for example the overview by Danilenko et al. (2014)). Especially in urban water management, they have increasingly aligned with the standards set by the worldwide large-scale centralized infrastructure paradigm (Fuenfschilling and Binz, 2018). In cities in the Global South this global standard has been linked to the ideology of modernization (Nilsson, 2017). It is perceived by many city planners and utility managers as the aspirational standard to supply utility services in an appropriate way (Schwartz and Sanga, 2010; Monstadt and Schramm, 2017). However, in reality millions of poor people have been waiting for decades to see the promises realized (McGranahan, 2015; Nilsson, 2017).

One of the core reasons for this failure is that the large-scale centralized infrastructure paradigm depends on a number of institutional and organizational conditions that are often only weakly developed or even absent in informal settlements of cities in the Global South. Expanding operations into these areas therefore challenges the conventional rationales and capabilities of most utilities. These utilities need to tackle much higher complexities associated with multiple informal institutional arrangements, poor infrastructure conditions, inefficient governance structures and very heterogeneous user needs, that typically go hand in hand with rampant poverty. In other words, informal settlements represent unfamiliar business contexts for the utilities. They would have to develop entirely new organizational structures, business models and, as a consequence, new capabilities in order to successfully expand their operations to reach the entire population in the respective urban areas.

While these conditions may explain the limited provision of water and sanitation services in many cities in the Global South, utilities are increasingly called on to expand their services to poor residents in informal settlements (see Cross and Morel (2005); Murungi and Blokland (2016a)), resulting from pressure to fulfil the human right to water and sanitation and meet the SDGs (UN, 2014). Additionally, informal settlements may represent a new market for state-owned utilities that operate as a business, so a number of utilities have started to tap these. As a consequence, utilities have increasingly started to

¹ The terms Global South and Global North in this paper are not a direct reference to the Northern or Southern Hemispheres, but applied to differentiate nations in terms of socio-economic capabilities and related characteristics. Global North are higher-income nations (with a GNI per capita > \$3,956), while Global South are lower-income nations (GNI per capita < \$3,955) (<http://data.worldbank.org/about/country-and-lending-groups>; accessed 29 January 2018). For more discussions on these contested terms, see Pagel et al. (2014).

pursue innovation strategies in order to expand their business activities and to develop new kinds of capabilities (see for example Castro and Morel (2008); Murungi and Blokland (2016a); Tinsely and Navarette (2017); NAWASCO (2018)). Innovation related to new organizational structures, new business models and new capabilities is, however, a challenge that utilities are often not well prepared for in the Global South as well as in the Global North (Kiparsky et al., 2013).

This paper analyses innovation strategy challenges faced by utilities that aim to expand services into informal settlements. We want to explain why initiatives often fail and thereby identify potentially successful innovation strategies. We posit that this requires conducting an analysis from two different vantage points. The first perspective focusses on the utility as a specific form of service provider, which tries to explore radically different business contexts. This implies a considerable expansion of the utility's capability portfolio. In the management literature, this problem has been widely addressed under the label of ambidexterity (Duncan, 1976; Gibson and Birkinshaw, 2004). It elaborates how companies may balance explorative strategies (developing new capabilities, innovation) in order to address new business contexts successfully with exploitative strategies at the same time (using an organization's conventional capabilities) (March, 1991). The second perspective focuses on how to understand the new business contexts, in order to identify the need for new capabilities. These business contexts encompass much more than merely market preferences, but also include local institutional arrangements, or competing technological paradigms or business models. We propose analysing these business contexts through the lens of alternative socio-technical regimes (Fuenfschilling and Truffer, 2014). Specific organizations, have typically optimized their organizational structures and capabilities in order to operate in particular socio-technical regimes. Serving radically different regime contexts therefore poses major challenges in terms of adapting their capability portfolios.

In the case of urban water management, most of the utilities worldwide have been optimized to run in the context of the "centralized regime" aligned with centralized large-scale infrastructures. Even though governance and regulatory frameworks of water sectors differ from place to place, this underlying regime rationality guides actions of water utilities in a similar way all around the world (Fuenfschilling and Binz, 2018). As a consequence, utilities around the world have installed very similar organizational structures and capabilities, which shapes how they conceive their products and services, the way they run their infrastructures and operational processes, and what to expect from its users (Kiparsky et al., 2013; Fuenfschilling and Binz, 2018). Conditions for service provision in informal settlements typically do not accord with taken-for-granted assumptions in the centralized regime, such as: non-existence of infrastructures, unclear land tenure rights, prevalence of crime, users having to cope with unsteady income streams, informal vendors who will defend their existing businesses, and so on (Gulyani et al., 2006; UN-Habitat, 2016). Informal settlements are, however, not devoid of service offerings. Alternative service regimes which fit the diverse and unstable context conditions have emerged over the years (van Welie et al., 2018). These alternative service regimes encompass different core technologies

(e.g. public and shared toilets vs. in-home toilets), dominant suppliers of the services (e.g. CBOs vs. utilities), steadiness of service provision (e.g. few business hours vs. 24 hours per day), payment models (e.g. per use payments vs. monthly bills), and so on. In order to identify which sort of capabilities a utility would have to build up in order to operate successfully in informal settlements, these alternative service regimes may provide useful insights. The proposed framework will elaborate how utilities have to leverage explorative and exploitative strategies in order to balance running their conventional business in the centralized regime while being able to successfully operate in contexts served by alternative service regimes. This framework will be illustrated by analysing successes and failures of pro-poor strategies of a state-owned water and sewerage utility of a major city in East-Africa. This utility has recently started to expand its operations to informal settlements while its core business had until then been focused on high-income neighbourhoods.

The paper is organized as follows. In the next section we review the literature on service provision by utilities in cities in the Global South and advocate the virtues of a combined socio-technical regime and capabilities perspective to better understand what is needed in this context to successfully operate basic services in different regimes. Section three introduces the specific context of the case study and presents the methodological approach. Section four reconstructs the innovation strategies of the utility and how it dealt with the balance between explorative and exploitative strategies when exposed to the context of informal settlements. Section five discusses how the proposed framework can explain the observed successes and failures. The final section concludes and proposes lines for further research.

2. Combining capabilities and socio-technical regimes

Only a few previous studies have addressed the challenges of utilities when providing water and sanitation services to the urban poor in informal settlements (Njiru et al., 2001; Cross and Morel, 2005; Castro and Morel, 2008; Murungi and Blokland, 2016a; Schwartz et al., 2017). Most of these studies pay attention to possible “solutions” that utilities can focus on when working in informal settlements, such as innovative (delegated) service models, new financial mechanisms, innovative technologies, or possible structural reforms. These studies are mostly descriptive (see for example, Ravet (2016); Chan (2009); Schwartz and Sanga (2010); Wakiru and Kayaga (2013)), and often lack a theoretically-grounded understanding of the challenges that utilities face when applying pro-poor strategies in terms of capabilities.

In this section, a framework is proposed which relates the capability perspective to public utilities and characterizes the new business contexts by means of alternative socio-technical regimes. There are a number of previous studies that have explored the potential of combining management literature with insights from transition studies, mostly to better understand the role of actors in transition processes. Some of these studies draw on the management literature to analyse the behaviour of incumbent/regime actors (Wesseling et al., 2015; van Mossel et al., 2018). Others studied the dynamic capabilities of

investors in onshore wind power to understand investments in renewable energy (Darmani et al., 2017), or the leveraging of dynamic capabilities under different regulatory framework conditions in the urban water sector (Lieberherr and Truffer, 2015) or the relationship between innovations and dynamic capabilities for water system transitions (Hartman et al., 2017). Yet another line of transition research explored the business model innovation literature in order to strengthen the firm-level perspective in transition studies (Sarasini and Linder, 2018). Business models were, for instance, proposed to enable the assessment of potential niche upscaling (van Waes et al., 2018), or to argue that business models embedded in specific socio-technical contexts could inform the governance of sustainability transitions (Bolton and Hannon, 2016).

In this paper, we build on the capability approach from management studies and focus on how such a perspective can provide insights into the challenges and opportunities that utilities face within their organization when they move into new business environments. The socio-technical regime perspective enables a systemic analysis of the structure and dynamics of this new business environment to which the capabilities have to match.

2.1 Capabilities and ambidexterity within organizations

The management literature has dealt extensively with the innovativeness of organizations in dynamically changing business environments. A changing environment requires an organization to reconfigure or acquire new resources and capabilities (Eisenhardt and Martin, 2000). Organizations can sustain their competitive advantage through the “... ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments” (Teece et al., 1997, p. 516). An organization’s capabilities are embedded in routines inside the organization, and thus conditioned by its history (Teece and Pisano, 1994).

To adapt capabilities, Lavie (2006) introduced three capability reconfiguration mechanisms in response to technological change: *capability substitution*, *evolution*, and *transformation*. These processes are based on different learning sources and mechanisms and lead to newly acquired, transformed, or modified capabilities (Table 1).

Table 1. The 3 capability reconfiguration mechanisms as proposed by Lavie (2006)

Reconfiguration mechanism	Explanation
<i>Capability substitution</i>	The replacement of obsolete capabilities by newly acquired ones. The learning source for this mechanism is the external environment. Substitution is the most drastic response to new requirements and “offers an immediate response at the level of the overall capability portfolio” (p.154).
<i>Capability evolution</i>	The modification of existing routines or adaptation of existing capabilities to new requirements. As capabilities are strongly path dependent, dynamic capabilities are key in this mechanism. The learning source is internal to the organization. This mechanism involves “continuous experimentation that occurs at the level of particular routines” (p.154).
<i>Capability transformation</i>	An intermediate response to new requirements and involves “objective-driven capability transformation, in which some routines are modified, others are discarded, and new ones are acquired, resulting in a transformed capability, which incorporates both existing and new knowhow” (p.158). The learning stems from a combination of internal and external sources. It is “an intermediate response that applies at the level of a particular capability” (p.154).

The newly acquired, transformed, or modified capabilities are to be managed within the existing organization. An organization which has to deal with such dynamics is more likely to succeed if the organization embraces ambidexterity. Ambidexterity is the ability of an organization to pursue seemingly paradoxical routines at the same time, for example responding to existing market demands, while simultaneously being adaptive to changes in the market environment (Duncan, 1976; March, 1991; Gibson and Birkinshaw, 2004). Various forms of ambidexterity have been distinguished in the literature. Early work on ambidexterity did not discuss pursuing opposite goals simultaneously, but rather recommended a sequential mode of operation, called *temporal ambidexterity* (Duncan, 1976). Later, March (1991) argued that organizations need to simultaneously balance the need to *exploit* an organization’s conventional capabilities versus the need to *explore* new capabilities and hence to innovate. This requires *structural ambidexterity* that is characterized by having distinct units within an organization enabling both explorative and exploitative activities at the same time. The successful operation of structural ambidexterity requires managing the contradictions between the differentiated sub-units (Aoki and Wilhelm, 2017). An organization needs to coordinate explorative and exploitative activities. Therefore, certain targeted integration mechanisms might be needed to successfully enable operation of newly developed capabilities in the entire organization (Jansen et al., 2009). External partnerships can complement or even substitute the building of separate internal organizational structures, to simultaneously grapple with the exploration/exploitation tension. Different types of external partnerships can help to build up new capabilities (Hoffmann, 2007; Jansen et al., 2009; Kauppila, 2010; Lavie et al., 2011).. The literature on *contextual ambidexterity* does not focus on achieving ambidexterity through structural separation, but sees it as the behavioural capacity to coherently reconfigure all activities in a business unit. In such a constellation individuals are enabled

and encouraged to divide their time between conventional tasks and reconfiguring activities to adapt to new market environments (Gibson and Birkinshaw, 2004).

Ambidexterity of an organization may help to understand how an actor shapes and reshapes its organization to enable the reconfiguration of its capabilities. Using a capability approach to study a utility is original since, generally, management innovation studies tend to focus on private (social) enterprises and not on (public) utilities. We claim, however, that the capability perspective provides general insights into how organizations may adapt to new contexts. We thus argue in line with Dominguez et al. (2009) that also public service organizations have to deal with capability related constraints.

2.2 Socio-technical regimes as structures in business contexts

The capability perspective provides an inside view on the necessary reconfigurations an organization has to manage when confronting dynamic environments. In the simplest case, new “environments” appear when novel market segments emerge (Weerawardena and O’Cass, 2004), which emphasize new customers with specific needs, preferences, and requirements. However, customer segments are only one dimension of business environments. As Teece et al. (1997, p. 522) put forward, “environments cannot be defined in terms of markets alone”. Other aspects such as institutional arrangements, infrastructures, and governance structures can also shape business environments. A systemic perspective might be useful to take these interdependent dimensions of (business) environments into account. The concept of *socio-technical regimes*, elaborated in the sustainability transition literature, provides a potentially fruitful approach to tackle this problem (Markard et al., 2012). Socio-technical regimes consist of aligned technological paradigms, organizational modes, technology, institutional arrangements, as well as user practices and preferences (Geels, 2002; Fuenfschilling and Truffer, 2014). These dimensions create highly institutionalized interdependencies over time which lead to strong path dependencies.

van Welie et al. (2018) proposed a specific operationalization of socio-technical regimes of basic service sectors in city contexts in the Global South. To be able to account for the complexities typically observed in these cities, they distinguish the two levels of *service* and *sectoral regime*. A sectoral regime consist of one, or more service regimes. In cities with informal settlements, the sectoral regime of basic services consists of multiple service regimes that cater for the social and economic inequalities and distinct contextual characteristics of the different neighbourhoods. These service regimes are unevenly distributed across different neighbourhoods in the city. In high-income residential neighbourhoods, sectoral regimes are typically dominated by one service regime (e.g. the centralized service regime), while more complex constellations of service regimes are found in informal settlements. Because of these characteristics, such sectoral regimes are called *splintered regimes*. In contrast, in western cities, sectoral regimes are typically much more homogeneous, based on one dominant service regime that covers the whole sector, which are called *monolithic regime structures* (van Welie et al., 2018). In this paper we build on this understanding of regimes to analyse the challenges that an actor is confronted

with when moving from operating in one service regime (e.g. the dominant service regime in high-income neighbourhoods) to another context where another constellation of service regimes prevails (e.g. in informal settlements).

Service regimes are specific configurations of technologies and their associated user and provider practices. An example is the routinized practice of commuters taking the train, which runs at scheduled times. Providers and users both know when, where, and how to make use of, and arrange this transport service. To operationalize the identification of service regimes van Welie et al. (2018) differentiate five dimensions: artefacts and infrastructures, rationale and meaning, organizational mode, social interactions, and time and space (see Table 2), all of which are derived from recent elaborations of practice theory (Shove, 2010; Shove and Walker, 2010; Jones and Murphy, 2011). This approach is based on the idea that socio-technical regimes structure everyday practices of users accessing and providers providing basic services. A practice interpretation of regimes is particularly well suited for elaborating on the micro-meso link, as institutional structures (that are key to a regime) express themselves in the everyday activities and practices of specific providers and users. The five dimensions are interdependent. For example, for a service to function well, there is a need for a shared understanding among users and providers about their roles and the timing and location of a provided service. This shows interdependencies between social interaction, the organizational mode, and the timing and location of a service. Another example is that artefacts of a service need to be accepted by the users, which shows the interdependency between rationale/meaning and artefacts in a service regime.

Table 2. Dimensions of a service regime (following van Welie et al. (2018))

Infrastructure and artefacts	- Artefacts (e.g. toilets, water taps, cars trains, etc.) - Physical structures that enable functioning of an artefact (e.g. water pipelines, rails, roads, power lines, etc.)
Rationale and meaning	- Mental activities, emotions and motivational knowledge - An actor's role and expectations, and the (informal) rules that govern the provision and access to a service
Organizational mode	- Group of actors (utility, customer, regulator, and so forth) with complementary strategy to fulfil the provisioning of a service (e.g. maintenance, activities for the day-to-day running of a service) - Shared understanding about the hardware and services to be provided
Time and space	- The when? And where? of accessing and providing a service - Locations of services and the regulated timing for accessing a service
Social interaction	- The exchanges between people that enable or hinder the user's access to services and for providers to maintain regular practices - Leads to trust building, social capital, identification of roles and identities

2.3 Framework for analysis

Based on these conceptual elaborations, we propose a combined approach that builds on insights from the two perspectives. Actors have developed optimized capability portfolios in order to operate in a specific service regime. As a consequence, organizational capabilities tend to exhibit obduracies at the micro-level that are connected to the obduracies of the corresponding service regime at the meso-level. It is exactly the congruence between internal capabilities and routines and the specific service regime structures that makes it challenging for actors to operate in different business contexts that are interpreted here by alternative service regime structures. This requires acquiring thorough and comprehensive knowledge of these structures and their internal interdependence, and capability portfolios have to be adapted accordingly. For example, major automobile manufacturers have optimized their capability portfolio to the service regime of personal mobility, where individual ownership of cars is a key institution (Truffer et al., 2017). Interactions with customers are therefore mostly limited to “selling cars”. More recently the automobile manufacturers have moved into car sharing and integrated mobility services (which we consider different kinds of service regimes) and are confronted with challenges to interact more intimately with the users in terms of renting, maintaining and tracking cars over the car’s whole lifetime, an activity that is nearer to the core capability portfolio of car rental companies. Automobile manufacturers showed great difficulty moving into these new business environments (Truffer, 2003; Canzler and Knie, 2016).

In order to identify what type of new capabilities a utility would need to operate in informal settlements, we propose to look at the kind of service regimes that have actually evolved there. Informal settlements are populated by different service regime structures in which a host of different service providers have built up capabilities that are aligned with these structures. Utilities should therefore carefully analyse these other service provider’s capabilities and try to build them up internally. The comparison between different service regimes therefore provides a systematic basis for identifying alternative sets of capabilities that a utility might have to develop and manage for successful operation in informal settlements.

This suggests the following analytical procedure: (1) analyse the characteristics of the current service regime in which the actor operates; (2) identify the matching capabilities for this service regime; (3) analyse the characteristics of alternative service regimes that have been established in the new business context; (4) determine capabilities that would enable the actor succeeding in the alternative service regimes; (5) identify the capability reconfiguration mechanisms that are applied by the actor, in order to reconfigure its capability portfolio in line with the new business context.

3. Case & Methodology

To gain in-depth understanding of the challenges of utilities' pro-poor innovation strategies in informal settlements and to illustrate the explanatory ability of the framework, we conduct a case study (Yin, 2014). We build on qualitative methods to develop thick and detailed descriptions (Gray, 2004; Creswell, 2013). This approach enables the identification of the micro-practices and meso-structures that we outlined in section 2. The selected case is that of a water and sewerage utility in a major East-African city characterized by large inequalities. 36% of the population live in informal settlements (Mansour et al., 2017), which are unplanned areas with houses that have mostly been constructed illegally (UN, 1997). We understand informal settlements also as places in the city where activities take place, which are not registered, taxed, or regulated by the state (Fourchard, 2011, p. 235). The city's water and sanitation sector is characterized by an unequal distribution of services. The city's wealthy neighbourhoods are equipped with the centralized service regime consisting of large-scale centralized water and sewer infrastructure. Since its establishment the utility has mainly been active in high-income neighbourhoods and is perceived by many as the main service provider of water and sanitation services in the city. The alternative service regimes in informal settlements are characterized by a wide variety of water and sanitation services like domestic, shared and public services, but also encompass a fair share of coping strategies like open defecation (van Welie et al., 2018). The case is informative for the aim of this paper, because the city's informal settlements are large and complex, and the utility has employed a variety of strategies in the settlements over the years. The case is furthermore chosen because it represents a typical major city in the Global South, because of its persistent and complex problems of basic service provisioning in its informal settlements.

The utility is a state-owned, but privately operating company established in 2004. The company has seven directorates that are further divided into departments and sections. In addition to this structure, there are six business departments serving different regions in the city, which are headed by department managers who report to the managing director (Figure 1) (Castro, 2009). These business departments are responsible for operations, support, maintenance, and revenue collection (meter reading and billing) in a specific area of the city. Only recently has the utility started to expand its operations to informal settlements in order to tap into this new market. Another inducement was the new constitution in 2010, which gave all citizens the right to clean and safe water and access to sanitation. Consequently, the state-owned utility could no longer justify the inequalities in public service supply between different areas in the city (Katko et al., 2013, p. 170). Moreover, international goals such as the SDGs have pushed the utility to try to extend their services to informal settlements (12, 37).

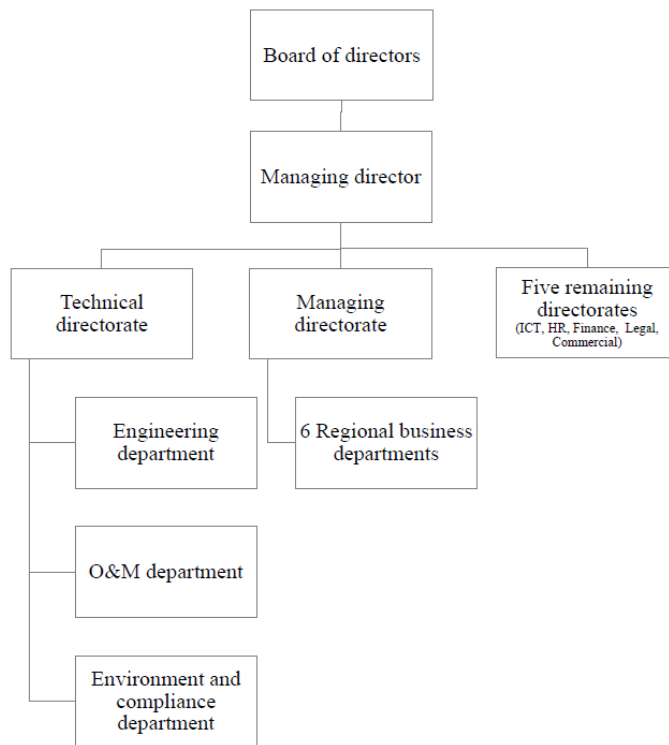


Figure 1. Organizational structure utility

(ICT - Information and Communication Technology; HR - Human Resources; O&M - Operation and Maintenance)

The empirical analysis of this paper is based on qualitative data collected through semi-structured interviews, project visits, and participant observations between October-December 2016. A total of 37 semi-structured in-depth interviews were conducted. An overview of the interviewees is presented in Table 3. The qualitative approach enabled the utility to be studied in its local context and led to rich, in-depth data that give insight into the complexity of the case (Miles et al., 2013, p. 11). In addition, we used various secondary data sources: reports, online articles, and literature to triangulate the information and thereby increase the validity of the study (Cresswell, 2009).

We selected the interviewees using snowball sampling (Gray, 2004). The sampling was iterative and progressed in line with the study. Observations, semi-structured interviews and documents led to new “samples” of interviewees, observations and documents. This process led to an in-depth understanding of the case (Miles et al., 2013, pp. 32-33). Besides utility personnel, we also approached and interviewed partners of the utility in order to triangulate different perspectives to increase validity (Cresswell, 2009). This was especially necessary as some utility employees seemed to feel uncomfortable talking about challenges and problems in the respective projects. All interviews were recorded and transcribed, and coding was done by means of MAXQDA software. The service regime dimensions from van Welie et al. (2018) were used as starting concepts to structure the first steps of the coding process. Most codes, however, emerged inductively during the coding process. The coding process led to an extensive coding scheme, which is presented in the Annex. The coded data lead to an iterative updating of the conceptual framework.

Table 3. List of interviewees (Numbers in the first column refer to individual interviewees)

Interview number	Interviewee function	Organization
1-6	Managers (various sections and departments, all managers have an engineering background)	Utility
7-9	Engineers (pro-poor unit/department ⁱ and other departments)	Utility
10-17	Sociologists (pro-poor unit/department ⁱ)	Utility
18-19	Former utility employees	-
20-21	Engineer and social expert	Water Board
22-25	Project and program officers	International development agency 1
26	Senior adviser	International development agency 2
27	Coordinator	International Non-Governmental Organization 1
28	Country director	International Non-Governmental Organization 2
29-31	Manager and program officers	Local Non-Governmental Organization 1
32	Program officer	Local Non-Governmental Organization 2
33-34	Manual pit emptiers	Community Based Organization 1
35	Founder	Social enterprise
36	Specialist	International development bank
37	Lecturer	University

ⁱ In order to operate in informal settlements the utility established a “pro-poor unit” and transformed this into a “pro-poor department”. The next Sections will extensively introduce and discuss these exploratory units of the utility.

4. Results: changing capabilities for pro-poor innovations

4.1 Identifying fitting capabilities to different service regime contexts

Following the first four steps in the analytical procedure introduced in section 2.3, we describe the centralized service regime, the aligned capabilities of the utility, the alternative service regimes in informal settlements, and finally the new capabilities that the utility would have to develop.

The centralized service regime and aligned capabilities of the utility

The water and sanitation service regime for which the utility has established most capabilities is characterized by centralized infrastructure with domestic connections of water taps and flushing toilets. This “centralized service regime” is predominant in high-income residential areas. The utility and the local Water Board take care of installing infrastructures, the supply of water, and the treatment of waste water. Customers in this service regime pay monthly service fees and are accustomed to access their own toilet and water tap 24/7. The utility’s capabilities are strongly aligned with the characteristics of this centralized service regime and largely congruent with water utilities in other more developed countries (Fuenfschilling and Binz, 2018). Its protocols guide the installation of infrastructure and maintenance activities in these safe, planned and spatially well-organized areas of the city. The utility’s offices are mostly located in middle- and high-income areas. Customers’ apply for connections and complaints are handled in written form. Payments are expected on a monthly basis, based on the

assumption that customers earn a regular income. The utility does not promote its services very actively. At best, it informs potential customers about its service offerings. The characteristics of the centralized service regime and the aligned capabilities of the utility are summarized in Table 4.

Alternative service regimes

The centralized service regime is not present in informal settlements, because expansion of centralized infrastructure often proves to be too costly, the location of settlements in river beds and flood plains makes expansion not possible, sewer lines suffer from water scarcity, and it requires skills for operation and maintenance which are often lacking. The alternative water and sanitation service regimes that prevail in informal settlements consist of different sanitation services (shared, public, and domestic), coping strategies (van Welie et al., 2018) and diverse water services provided by vendors, stand pipes or water kiosks. The sectoral regime is thus splintered, as it consists of several distinct service regimes.

The majority of the sanitation facilities in informal settlements are thus not connected to the central sewer system. Commonly established services are ablution blocks with pit latrines, but also hanging toilets above rivers are sometimes used. However, sometimes houses have been built on-top of old broken-open sewer lines (6, 10, 18, 23). These illegal connections combined with the habit of disposing of solid waste in toilets leads to frequent sewer blockages in informal settlements (14, 19, 20, 23). The water facilities are mostly public standpipes. Many water pipes are connected illegally, to provide the “last mile” of water supply in these areas (Blomkvist and Nilsson, 2017, p. 293). The large diversity of sanitation and water facilities is necessary to enable supply of services in the context of informal settlements, which are often difficult to access because of their lack of space and complex, unplanned housing structures and high population densities (4, 5, 6, 12, 17).

These alternative water and sanitation service regimes are characterized by specific actor groups with distinct capabilities, and institutional contexts. The services are provided by private enterprises, informal water vendors, Community-Based Organizations (CBOs) and Non-Governmental Organizations (NGOs). Many residents are actively involved in providing services themselves through their membership in CBOs (Cherunya and Truffer, 2017). The different actors possess capabilities that align with characteristics of these alternative service regimes. For example, they have developed several types of service models for residents who are mostly transient tenants and who are not formally registered and lack land ownership certificates (17, 20). Another example are the payment models, which are differentiated according to individual customers and often based on trust. These trust-based and flexible payment schemes are necessary because most residents earn an irregular income, making regular payment difficult (14, 17).

Residents in the informal settlements also have to develop specific capabilities that fit with the diversity of alternative service regimes. They have to combine a variety of different services (public, shared, and domestic) on a daily basis depending on their location, the time of the day and their access to money. Coping strategies are also commonly used when residents have no money, and during the night when it

is unsafe on the streets. Residents combine these options frequently (Cherunya et al., 2018) and they seem unaware about the potential benefits of having utility services and thus do not demand them (1, 6, 11, 12, 13, 14, 18). Educational levels are generally low, which results in a low awareness of the importance of having hygienic water and sanitation services (13, 14, 18).

In terms of institutional conditions, residents fear formalization of water and sanitation services because they assume it would lead to higher costs to access services and, moreover, threaten the business of their CBOs that provide services. Local leaders, CBOs and informal water vendors have strong power positions and regulate the service provisioning. Sometimes these organizations fuel mistrust towards the utility among residents. Utilities are consequently faced with a highly insecure business environment as regime ‘outsiders’ working in informal settlements, which necessitates close collaboration with these local actors. Utilities need to put a lot of effort into social-relationship building (10, 17, 18, 19). The characteristics of the alternative service regimes are summarized in Table 4.

Capability challenges for the utility operating in informal settlements

By comparing characteristics of the centralized service regime with those of the alternative service regimes, we now identify challenges in terms of its capability portfolio that the utility is confronted with, when operating in informal settlements. A summary of these results is presented in Table 4. As it is common practice to use multiple technologies in each of the various locations and diverse operating hours in the alternative service regimes, the utility needs to use multiple infrastructures and artefacts, provide services at a larger variety of locations, and at different times compared to their normal operations in high-income areas. Providers in the alternative service regimes are, by comparison, very flexible, for example when looking at service registration procedures and payment options. The utility would need to develop service models that can fit the paying ability of customers. Furthermore, the utility should learn how to install toilets and water taps in dense unplanned neighbourhoods. Promotion activities would need to place greater emphasis on education, informing potential users about the general importance of safe water and sanitation services, addressing in particular lower-educated customers. This might also help to overcome potential customers’ fears concerning the formalization of water and sanitation services. As a consequence, the utility would need to develop strong social skills to be able to actively expand their customer base in informal settlements. It needs to adapt its communications to the capabilities of various new types of customers and have more frequent social interactions with residents. Related to the latter, the utility could actively involve the residents in their planning and operation activities. The utility should also develop skills to communicate and negotiate with informal water vendors. All-in-all, the utility needs to reconfigure many of its existing capabilities of its capability portfolio to align with the interrelated dimensions of the alternative service regimes. It therefore needs to learn how to balance explorative and exploitative strategies, so that it aligns its capabilities to more than one service regime context.

Table 4. Summary of utility's capabilities related to the centralized service regime, and the alternative service regimes, leading to the identification of new capabilities the utility would have to develop.

Dimension	Centralized service regime	Aligned existing capabilities utility	Alternative service regimes	New capabilities the utility would have to develop
Infrastructure and artefacts	Central network with domestic connections	Use of "modern" piped infrastructure and fitting artefacts	Diversity of infrastructures and artefacts	Employ a diversity of other (innovative) technologies
Rationale and meaning	Users demands comfortable "modern" domestic services	Utility assumes that users are aware of the benefits of utility services	User fears formalization and is unaware of most benefits derived from utility services	Active demand creation for utility services to overcome fear of formalization
Organizational mode	One mandated service provider	Utility rarely collaborates with other service providers	Various providers of services: NGOs, CBOs, entrepreneurs	Establish essential collaboration with actors in alternative service regimes
	Daily maintenance by households	Utility not involved in daily cleaning toilets and water taps	Public service providers responsible for daily cleanliness of service offering	Capacity to consider collaborative daily management services (social interaction)
	Waste (water) management by the service provider	Waste (water) management by utility	Waste (water) is managed by CBOs, NGOs and entrepreneurs	Capacity to collaboratively manage waste (water) (social interaction)
	Payments on a regular basis	Monthly payment system	Various different payment models	New payment models that allow for flexible payments by user
	Illegal connections are not tolerated	Utility disconnects illegalities and considers informal water vendors illegal that should be stopped	"Illegal" connections are commonly used and informal water vendors have strong positions in service provisioning	Negotiation skills to deal with illegal connections and to interact with informal water vendors
	Installation of domestic connections	Formal, written procedures for applications and complaints based on land titles	Public/shared services do not require formal registration	Flexible administrative procedures to apply for a connection
	User requests are dealt with by customer services in centrally located offices	Utility offices in high-income areas	Service providers are reachable and close to user	Offices in the informal settlements
	Installation points are located in safe places	Procedures to install infrastructure in high-income areas	Informal settlements can be insecure for "outside" actors	Skills to deal with unsafe situations
Time and space	Domestic connections, 24/7 access in planned areas	Use of private toilets and individual water taps in high-income areas	Shared/public services at different locations fitting dense and unplanned areas	Increase variety of service models to fit people's daily lives and installation in dense, unplanned neighbourhoods
Social interaction	Business relationship between provider and customer	Interaction with customers is formal and adheres to a hierarchical manner	Providers interact intensively with customers	Capacity to interact, built trust and sensitize residents in informal settlements
	Provider operates alone	Users are not involved in service provisioning	Users often act as providers as members of CBOs	Utility should consider involving users in service provision

4.2 Analysing the utility's pro-poor innovation strategies

Based on the mapping of different capabilities that we identified for the centralized and the alternative service regimes, we now reconstruct two innovation strategies that the utility implemented consecutively in order to establish service offerings in informal settlements. We furthermore identify the capability reconfiguration mechanisms that were used, following the 5th step of the analytic procedure introduced in section 2.3.

In a first phase spanning from 2008 to 2015, the utility established a largely detached “Pro-Poor Unit” (PP_{unit}) with rather large autonomy in how they organized their activities. Thereby, the utility created an ambidextrous organizational structure. The PP_{unit} tried to establish the services in a way that aligned with alternative service regimes. After a number of problems encountered with this organizational structure, the structural ambidexterity was reversed, and the unit was turned into a “Pro-Poor Department” (PP_{dep}) from 2015 onwards (Figure 2). The PP_{dep} was organized according to the model of the regional business departments that operate in specific middle or high income neighbourhoods. Instead of focusing on a specific city area, it had to take care of all the informal settlements in Nairobi. The mandate, organizational structure and performance criteria were identical to those of the regional business departments. In the following, we will outline the motivations, set-up, problems, and achievements of both the PP_{unit}, and the PP_{dep}.

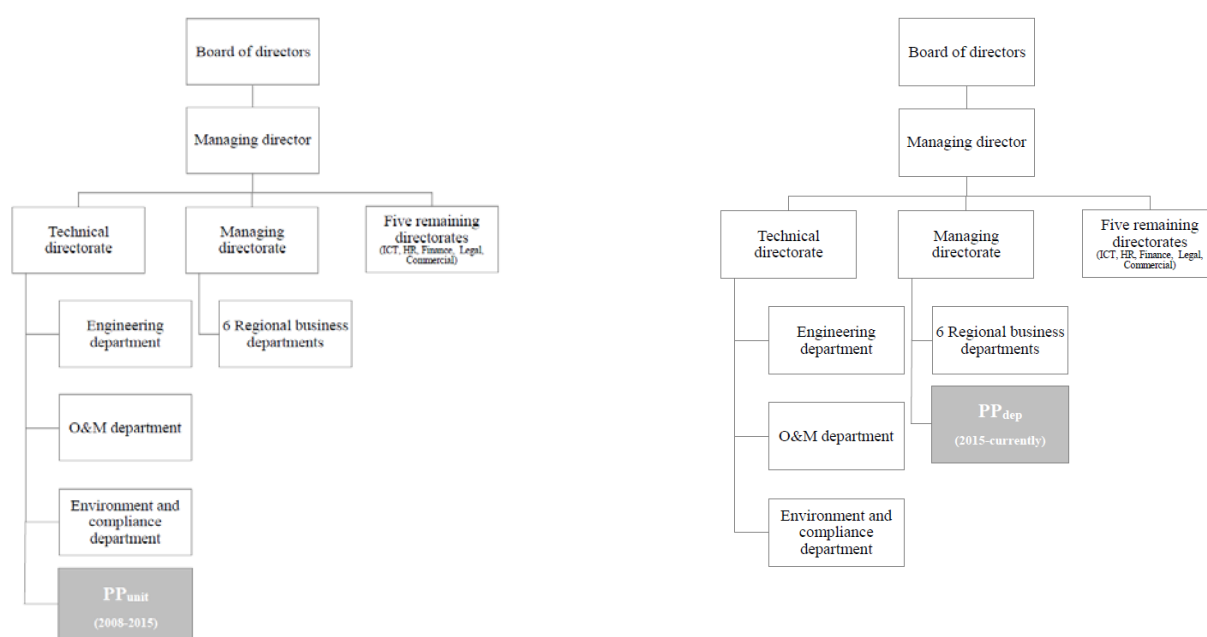


Figure 2. Organizational structure utility including the Pro-Poor Unit (PP_{unit}, 2008-2015) on the left and the Pro-Poor Department (PP_{dep}, 2015-currently) on the right.

Set-up of a pro-poor unit (2008-2015)

A major reason for the city government officials to not serve informal settlements so far was that the residents were considered “illegal”. However, the general recognition that these residents deserve access to basic services increased through advocacy of civil society organizations and international agreements

over the years, as well as a human right to water and sanitation recognized by the UN in 2010. When the water and sewerage utility was established as a privately operating company in 2004, it started to deliberate on how to serve informal settlement residents, which was also considered a business strategy to tap into a new market. The first step was the development of a strategic plan, which resulted in the foundation of a separate pro-poor organizational unit (the PP_{unit}), which was implemented in 2008. Its mandate was to specialize in providing services in informal settlements (4, 16, 19, 23). The utility recognized the limitations of its conventional capabilities in informal settlements and therefore kept the unit separate from the existing regional business departments so as to provide it with substantial leeway to develop new offerings and develop specialist skills and knowledge (1, 2, 10, 11, 16, 19).

The utility's management "acknowledged the inadequacy of a pure engineering approach" (Ruhio et al., 2009, p. 4) and added sociologists to the unit to complement the engineering competence base of the majority of the utility's employees. One of the sociologists involved (16) explained the shortcomings of a pure engineering approach in informal settlements:

"For engineers, (...) they think: 'These people need water, so why should I sit with them and talk? Talk about what? If they need water, lay water', but (...) even the way you lay that water could be offensive to them. These people (informal settlement residents) think 'We have lived here for years without those pipes of yours (...) and we have never died and we had water.' But when you tell the engineers that they think you are a joke, but they really, really need to understand the social aspect of a human being."

The sociologists developed new capabilities in following ways. First, they set-up collaborations with experienced partners such as NGOs, CBOs and international development agencies to learn about working in informal settlements (18, 19, 23, 29). Together with several partners, strategic guidelines were developed to guide service supply for the poor in the city (18). Second, the utility's managers visited several utilities in other countries to learn from their service models for the urban poor (4, 10, 24, 29, 36). These activities helped the PP_{unit} to substitute existing capabilities and develop new ones. For example, in order to overcome the lack of trust, the sociologists of the PP_{unit} organized community meetings in which they intended to (i) increase awareness about the people's rights to adequate water and sanitation services (1, 4, 11, 12, 13, 19); (ii) explain the benefits of formal services above illegal connections (e.g. safety, water quality); and (iii) explain why people should pay for such (4, 10, 11, 16, 19). The sociologists consulted the residents about their priorities for improvements (2, 11, 16) and involved them in projects as security guards, for manual work, and for monitoring and evaluation (1, 11, 16, 17). One of the utility's sociologists (11) explained:

"During the stakeholder engagement (...) we ask stakeholders to assist us in managing the issues that arise. We try to get in the different interest groups, especially youth, women and the disabled to be represented so that we get their views (...) we are engaging community based

organizations to run the facilities and we try to give priority to the disabled, the youth and women”

The increased attention to residents and local leaders led to trust building. By cooperating with NGOs, the utility could strengthen the social relations with communities (Wamuchiru and Moulaert, 2017). Local chiefs and opinion leaders helped to negotiate with informal water vendors, which originally offered much resistance against the utility’s presence in the informal settlements (19). The PP_{unit} managed to “legalize” several illegal water connections through negotiations with the residents and informal water vendors, instead of shutting them down (18, 19). For example, if an informal water vendor would register itself and get a water meter, it would not have to pay for all the years that it had been selling illegally acquired water (18). The PP_{unit} also developed models to support the installation of public service facilities, such as communal water kiosks and ablution blocks². CBOs were trained and licensed to manage these facilities, and sold the water and sanitation services for regulated tariffs (20). An engineer of the Water Board (20) explained this argument as follows:

“after we identify (...) the CBO which will manage the facility, even during construction they are trained (...) “this is how you are supposed to appoint the committee members”, “this is how you are supposed to bank your money”, and “this is how you are supposed to invest” (...) By the time you hand over it (the facility) is something they are able to manage”

In order to gain more interest among CBOs to work with the utility, the PP_{unit} promoted the running of public service facilities as a business. Additionally, the sociologists would listen to the group’s problems, such as low water pressure, and try to resolve some of their issues (18). The PP_{unit} opened local offices in several informal settlements to better assist residents with complaints and applications. The application procedure was adapted so that people that illegally occupy houses could be allowed to apply for household water connections. Flexible payment systems via SMS were introduced in some areas to enable customers to pay for water and sanitation service more frequently instead of only once a month (4, 10, 12, 17).

All said, during a period of seven years, the PP_{unit} developed many new capabilities (substitution) and transformed several conventional capabilities. Thereby it aligned its services with those of the alternative service regimes. This was for a great part achieved as a result of increased recognition of the shortcomings of the existing capabilities and the involvement of sociologists within the unit. All-in-all the innovation strategy of the utility therefore consisted of drawing on radically new capabilities (e.g. by hiring sociologists) and granting the unit leeway to learn about the business contexts and their associated

² Public service models were not new for the residents of informal settlements (Njoroge, 2004). The City Council (the utility’s predecessor in service provisioning) had already installed water kiosks. Those water kiosks were predominantly owned by individuals (Bousquet, 2010, p. 140) authorized to sell water by obtaining a license from the City Council’s Water and Sewerage Department (WSP, 1997).

service regimes in informal settlements (e.g. by setting less stringent profitability targets for the unit). Table 5 summarizes the capabilities the PP_{unit} developed.

Through the PP_{unit}, the utility was successful in providing services in the informal settlements. For example, the unit was able to gain trust among the local customer base. Furthermore, it developed new public service offerings (e.g. water kiosks and ablution blocks), supported existing public sanitation facilities, opened new offices, developed flexible payment systems, and expanded infrastructure networks in informal settlements.

These offerings created, however, a number of tensions with the rest of the organization. After the completion of the establishment of a service, the PP_{unit} would typically hand the operation and management to the respective business department (meter reading, billing, etc.). The conventional departments had, however, not been involved in the reconfiguration of capabilities, but rather learned in an incremental, evolutionary manner. The department's employees largely lacked specific competences, knowledge and time to work in these areas (1, 11, 18). The transfer of PP_{unit}'s projects to the conventional departments was thus problematic as they mismanaged or sometimes even ignored the facilities in informal settlements because the staff was reluctant to serve the poor (1, 11, 18) (Castro, 2009, p. 13).

“...the infrastructure used to be developed (by the PP_{unit}) and then it was handed over to the [business departments] for operations and maintenance. (...) it never used to work very well, because informal settlement people have different needs and requirements than those who are in the formal areas. The people in the [PP_{unit}] worked closely with the communities. They used to know a lot about them unlike the [business departments]. (...) when the project was to be handed over to the [business departments] they more or less leave it to suffer because there used to be a disconnect between the employees of the [business departments] and the community.” – a former manager of the PP_{dep} (1)

A former utility employee (18) explained how the lack of motivation, time, and energy invested in informal settlement projects by employees of conventional departments hindered the success of the PP_{unit}'s projects, which caused tensions within the utility:

“... Then came the operational aspect when people (projects in informal settlements) needed to be connected, to be metered on time, their bills to come on time, the bills to be correct... the operation failed because there was not enough energy invested in dealing with the operations (by the business departments) as there was in the project (by the PP_{unit}).”

A former employee of the utility (18) detailed some of the specific limitations of the department's capabilities in informal settlements:

“if he (a business department's employee) has to read in an informal settlement, and he has been allocated three days to read the 1000 meters that are in [the informal settlement], he can't even read 10% of those because all of them requires him to do a lot of community engagement,

it requires a lot of negotiation a lot of good will also was required. They did not have the skills or the time, for them the capacity wasn't there to do the routine services in the informal settlements"

Transformation of the pro-poor unit into a conventional business department (2015-currently)

To solve the tensions with the conventional departments, the utility decided to extend the mandate of the PP_{unit}. For that purpose it had to be reorganized to operate very much like a conventional department. Its name was changed into Pro-Poor Department (PP_{dep}) in 2015 (Figure 2) (1, 2, 4, 11, 13, 17). With this change, the ambidextrous organizational structure was reversed. The PP_{dep} became responsible for the operation and management of the facilities. The PP_{dep} lost its special status and room for manoeuvre, because its mandate was aligned with those of the other business departments which are mostly focused on revenue collection. To meet its new objectives, the innovation strategy of the PP_{dep} therefore focused more on new service models and approaches that created less tensions with the capabilities available in the rest of the utility.

We focus on two innovative service approaches that the PP_{dep} prioritized in its strategy. A first service that got promoted was communal "Pre-Paid Dispensers" (PPDs). These are communal water points that deliver water via a standpipe at which users pay with a pre-charged token. The goal of the PPD model was to (i) sell water for low water prices to outcompete the informal water vendors (13, 15, 16, 17); (ii) reduce illegal water connections (15); and (iii) solve the problems with non-revenue water³ (2). The PPD model aimed at cutting out "intermediaries", the CBOs that are responsible for daily operations of water kiosks. This saved the PP_{dep} time and difficult interactions with such groups. It enabled the utility to collect revenue directly from the customer, as a utility's manager (2) explained:

"With the new innovations, the customers buy the actual credit direct from (the utility) and there is no middleman."

The underlying assumptions of the PPD innovation align with the centralized service regime's focus on modern infrastructures and artefacts, as stated by a utility's manager (1): *"We have come up now with ways of now modernizing the water dispensing module by using prepaid solutions"*. And another utility's manager (2) also emphasizes the focus on new technologies: *"now with the creation of the (department) we are more sophisticated with technological oriented supply methods of the water ATMs (a certain type of PPD)"*. The model also aligns with the centralized service regime's rationale of having access to services 24/7:

"They (the customers) are also able to access water twenty four hours per day, unlike before when they could only get water when the kiosks were open" - a utility's manager (2)

³ Physical water leakage or water that is pumped and then lost or unaccounted for.

As a positive outcome, PPDs in the city resulted in lower water prices compared to what people paid for water from a water vendor or kiosk (Heymans et al., 2014, p. 15). However, the PPDs faced several challenges. The PP_{dep} did not always manage the social interaction with CBOs well. As a utility's sociologist (17) explained about the conflicts around a PPD in a certain area, which a CBO opposed: *"...the group that deals with selling water never wanted it (a PPD) because they never saw any profit, but they (the utility's management) said (...) you cannot remove this meter.* The utility thus faced issues with the residents concerning the locations of installing PPDs:

"...the launching was to be on Monday, but the communities' guys said 'no this thing (the launch of the project) is not going on, unless you remove the machines (the PPDs) from where you have installed them and install them where we want'..." - a utility's sociologist (15)

Moreover, providing security for the standpipes in public space was an issue. The PPDs were sometimes vandalized because the community did not possess a sense of ownership of the standpipes, which they did with respect to the water kiosks that they operated (15, 17). The lack of interactions of the PP_{dep} with communities about PPDs also led to undesirable ways of using them. For example, some alcohol producers connected pipes to PPDs and used them all day. As a result they blocked it for other users. There was also local political opposition against the idea of pre-paid water in some neighbourhoods, because people in other neighbourhoods did not have to pre-pay for their water. People also feared the lack of access to water using PPDs in the case of outbreaks of fire, which are common in informal settlements.

The second innovative service arrangement that the PP_{dep} prioritized was the "social connection policy". One of the projects under this policy was the expansion of water and sewer networks and household connections in one of the city's low-income areas. The utility rehabilitated pit latrines and turned them into pour-flush toilets using PVC simplified sewer systems. This project was a cooperation of the PP_{dep} and the engineering department. The connection fees were subsidized and a local bank provided loans to the customers to pay back the connection fee gradually (WorldBank, 2012). As part of the social connection policy, a self-metering system was developed, which allowed customers to read their own meter and pay their bills through text messaging in instalments at their convenience (12). This allowed customers to pay bills in line with their piecemeal, irregular incomes (4, 10).

The expansion project also faced challenges. The necessary behaviour change when using flushing toilets was difficult to achieve, which sociologists spent substantial effort on. People were educated on how to use the flushing toilets properly (e.g. by not throwing in solid waste, pampers, menstrual hygiene products, and so forth.) (9, 14). The sociologists were, however, only involved during the infrastructure installation period, which was too short to establish substantial behavioural change. Sewers still clogged regularly, also resulting in part from the water scarcity in the area.

All-in-all, the PP_{unit} mostly focused on projects that required new capabilities developed by transformation and substitution mechanisms. The transformation from the PP_{unit} to the PP_{dep} resulted in a loss of several of the formerly acquired capabilities, because of the focus on new service models and approaches that required less new capabilities. The PP_{dep} still reconfigured some existing capabilities, but mostly using evolutionary mechanisms, instead of transformation and substitution. Table 5 indicates which capability reconfiguration mechanisms were used by the PP_{unit} and PP_{dep}, and to what extent both the PP_{unit} and PP_{dep} thereby managed to apply new capabilities that align with requirements of the alternative service regimes.

Table 5. Summary of newly developed capabilities by PP_{unit} versus PP_{dep} (Yes – fully applying a new capability, No – not using a new capability, Middle – partly applying a new capability)

Dimension	New capabilities the utility would have to develop to align to the alternative service regimes	PP _{unit}	Mechanism used by PP _{unit} ⁴	PP _{dep}	Mechanism used by PP _{dep} ⁵
Infrastructure and artefacts	Employ a diversity of other (innovative) technologies	Middle (only PVC sewer)	Transformation	Middle (only PVC sewer and PPDs)	Transformation
Rationale and meaning	Active demand creation for utility services to overcome fear of formalization	Yes	Substitution	Middle (promotion activities instead of information activities about projects)	Evolution
Organizational mode	Establish essential collaboration with actors in alternative service regimes	Yes	Transformation	No	None
	Capacity to consider collaborative daily management services (social interaction)	Yes	Substitution	No	None
	Capacity to collaboratively manage waste (water) (social interaction)	No	None	No	None
	New payment models that allow for flexible payments by user	Yes	Transformation	Yes	Transformation (inherited from the PP _{unit})
	Negotiation skills to deal with illegal connections and to interact with informal water vendors	Yes	Substitution	Middle (skills are still there, but no priority and informal water vendors are seen as competitors of the PPDs)	Evolution
	Flexible administrative procedure to apply for a connection	Middle (offices in settlements, support from sociologists, but only for water connections)	Transformation	Middle (offices in settlements, support from sociologists, but for domestic sewer project land ownership is necessary)	Evolution
	Offices in the informal settlements	Yes	Transformation	Yes	Transformation
	Skills to deal with unsafe situations	Yes	Substitution	Yes	Substitution (inherited from the PP _{unit})

⁴ The reference state is the former capability portfolio of the utility, aligned to the centralized service regime

⁵ The reference state is the former capability portfolio of the utility, aligned to the centralized service regime

Time and space	Increase variety of service models to fit people's daily lives and installation in dense, unplanned neighbourhoods	Yes (public standpipes and ablution blocks)	Substitution	Middle (PPDs, but no public sanitation) (low-income but no informal neighbourhoods)	Evolution
Social interaction	Capacity to interact, build trust and sensitize residents in informal settlements	Yes	Transformation	Middle (much less than PP _{unit})	Evolution
	Utility should consider involving users in service provision	Yes	Substitution	Middle (much less than PP _{unit})	Evolution

5. Discussion: Successes and challenges of different pro-poor innovation strategies

The framework presented enabled a better understanding of the challenges that a utility of an East African city was confronted with while pursuing pro-poor innovation strategies. We will now discuss to what extent the two strategies exemplified by the PP_{unit} and the PP_{dep} can be regarded as more or less effective for extending utility services to informal settlements.

As a first step, the utility set up a PP_{unit} as a separate entity providing it with enough leeway to understand the different dimensions of alternative service regimes and to create appropriate capabilities. The PP_{unit} successfully transformed and substituted many capabilities of the utility's portfolio to be better able to fit to the alternative service regimes (Table 5). The substitution and transformation mechanisms were informed by the PP_{unit}'s collaboration with experienced actors of these service regimes. The PP_{unit} learned which conventional capabilities were obsolete and which new capabilities it needed to acquire. Partner NGOs, for example, helped the PP_{unit} to develop social interaction capabilities and informed them about alternative organizational models. The new capability portfolio helped the PP_{unit} to initiate and support several successful public services like ablution blocks and water kiosks. These created employment opportunities for the local residents (see (Athi, 2013, p. 13; WSUP, 2017)), and therefore created trust and support among the residents.

With the establishment of the PP_{unit} the utility created an ambidextrous organizational structure. The utility needed to balance the explorative strategies to develop new capabilities in the PP_{unit}, and exploitative strategies to continue their conventional business through the other departments. The utility proved, however, unsuccessful at operating this complex organizational model. Tensions built up because the utility was not able to integrate the newly developed capabilities in the portfolio of the rest of its organization. The identified tensions can be used to understand the obdurances that the utility had to overcome when it tried to reconfigure its existing practices. For example, one of the practices that was most difficult to change among "conventional engineering" employees, was to interact with the residents in informal settlements during O&M activities. This would require changes in several interdependent capabilities. For example, related to the organizational mode (developing negotiation skills to deal with illegal connections), as well as social interaction (developing the capacity to build trust in informal settlements).

In order to solve the problems of operating this complex organizational model, the utility reversed the ambidextrous organizational structure and redefined the PP_{unit} to become similar to a conventional regional business unit. As a consequence, the PP_{dep} implemented a much more incremental innovation strategy. It favoured evolutionary mechanisms to only marginally adapt and employ conventional capabilities. The capabilities built up by the PP_{unit} were only partially retained and the department stopped exploring new capabilities (Table 5). For example, the rationale for the PPDs (using sophisticated, modern technologies) and organizational mode (24/7 access) aligned very neatly with the established utility routines. PP_{dep} also operated under the assumption that hierarchical and formal interaction with customers would be appropriate, as in high- or middle-income areas. CBOs and users were rarely involved in managing and securing the PPDs, which led to some of the dispensers being vandalized. The expansion of water and sewer networks focused on low-income areas, but no longer on informal settlements. This enabled the utility to proceed with only slightly modified capabilities: the use of household water taps and flushing toilets, the utility as the sole service provider, hierarchical business relationships between the utility and the customers, facility installation in low-income but relatively planned neighbourhoods, and the independence from users in service provisioning. Lastly, while the separate status of the PP_{unit} created leeway to reach out and work with NGOs and CBOs, the PP_{dep} did not engage in community work anymore, because its employees lacked time under the department's mandate. The department subsequently lost most of the trust acquired via these external partnerships. It could therefore no longer explore or enhance capabilities that were built up in the PP_{unit}.

The establishment of the PP_{dep} lowered tensions with the other departments because of its incremental innovation strategy, the use of well-known performance indicators and its conventional business mandate. The PPDs, for instance, were an important strategy to significantly lower the share of “non-revenue water” (1, 5) (Heymans et al., 2014), which is one of the major indicators of the performance of utilities worldwide (Danilenko et al., 2014). These indicators are, however, based on high-income countries, and several studies have argued that “pro-poor benchmarking” of water utilities in low-income contexts need other indicators (Murungi and Blokland, 2016b; Van Dijk and Blokland, 2016). Furthermore, the focus on a market that was more similar to the conventional centralized service regime (low-income communities instead of complex informal communities) helped to realign with the rest of the organization.

Whereas the tensions between the PP_{dep} and the rest of the utility were lowered, its innovative service models did not effectively fulfil the needs of the urban poor in informal settlements. Because the PP_{dep} used an incremental innovation strategy in the new business context, it was not able to properly fit its service models to the alternative service regimes of the informal settlements. For example, the envisioned benefits of the PPDs – of having 24/7 access to water – is questionable in most informal settlements: As it is usually unsafe to leave homes at night in informal settlements, technical availability is not equal to actual access. Moreover, in some areas the utility disconnected illegal domestic

connections and installed PPDs instead, leading to a lower service level for those residents who lost their illegal domestic connections (17). In the sewer and water pipes expansion project, households were required to hand over ownership certificates, which was problematic because many people occupy the land illegally (9). Another problem was the expansion of the sewer. Despite the use of simplified systems and PVC pipes, this required space that was not available in unplanned and dense settlements. Some also doubted the affordability of the service model for the poorest of the poor despite the subsidized price (9). In some cases, the project resulted in higher rents, which affected the poor (7, 14).

The case study shows that the PP_{dep} removed certain newly acquired capabilities from its portfolio and was not able to maintain its partnerships as part of the conventional organizational structure, which prevented its success in aligning with alternative service regime dimensions and resulted in a reduced impact in terms of the pro-poor performance. For example, the PP_{dep} did not focus on public service models because such models demand transformation of the conventional organizational mode. It instead focused on centralized, domestic service models well known in the centralized service regime. The utility's neglect of complex public service models was not a novelty. In the past the major financiers of the City Council (the utility's predecessor) also shifted away from financing public models such as water kiosks and instead financed individual connections (Katko et al., 2013, p. 176).

The conceptual lens helped to understand that the setup of a normal business department (PP_{dep}) might have been the right move to deal with the problems that the utility encountered with an ambidextrous organizational structure, having a separate organizational unit. The tensions between the PP_{unit} and the rest of the organization are in line with the ambidexterity literature that has extensively reported on the challenges that organizations may face when balancing exploration and exploitation (e.g. (Gibson and Birkinshaw, 2004; Lavie et al., 2011)). After reducing the organizational tensions, the utility should however have paid attention to maintaining and further developing the new capabilities that had been built up through interaction with the alternative service regimes. Furthermore, our study suggests that a department focusing on the urban poor needs other types of performance indicators and success criteria than conventional business departments so as to provide sufficient leeway to establish external partnerships. This might enable a successful management of newly developed capabilities in the organization (Jansen et al. (2009)). The findings are in line with management literature suggestion that partnerships might be important means to achieve a balance between exploration and exploitation activities in an organisation (Kauppila, 2010; Lavie et al., 2011).

6. Conclusions

We set out to analyse the challenges a utility is confronted with when trying to expand services into informal settlements in the Global South. We developed a framework to show why organizational capabilities are difficult to establish if they do not conform to the primary service regime contexts that a utility is mostly operating in. This limits the expansion strategies of utilities and therefore hampers the ability to provide services to a majority of the local population in these cities. The case study of a water

and sewerage utility in a large city in East Africa illustrated how the utility's capabilities are aligned with the centralized service regime and how this limited the ability to operate in alternative service regimes. The utility reported in this paper largely failed to achieve effective pro-poor service provision by reverting back to its established capability portfolio.

Based on this analysis, we claim that a more explicit understanding of the interrelationship of capability portfolios and service regimes would have enabled the utility to be more successful in its pro poor strategies. Utilities that aim to expand into in the business context of informal settlements therefore need to gain a systemic and thorough understanding of the various interrelated dimensions of the new service regimes in which they want to operate. Different types of social interaction, rationales, use of infrastructures at different locations, and organizational modes need a coherent approach to changing the capability portfolio. Utilities do need to develop capabilities entering these new business environments, while still being able to run their conventional business. An ambidextrous organizational structure enables utilities to be successful in this situation. However, when a separate organizational structure causes too many tensions, utilities can also embrace contextual ambidexterity instead to carry out both explorative and exploitative strategies. This would entail that the mandate leaves sufficient room to divide time between conventional tasks and developing new capabilities, for example through establishing external partnerships.

In more conceptual terms, we showed how the combined analysis of capability and regime structures helps to better understand actor's challenges in transition processes. The framework proposed in this paper therefore provides a tentative inroad to elaborate on the linkage between the micro level of actors and the meso-level of social structures (Farla et al., 2012). However, the present paper only provided some first illustrations of this research field, and suggests a much broader agenda of future research.

First, the socio-technical regime concept might provide an opportunity for management scholars to analyse the interrelationships among technical, institutional and capability related dimensions that define a new business context. This might provide a more systematic understanding of how to approach capability transformations and assess the need for ambidextrous organizational structures. The operationalization of socio-technical regime concept in business contexts however needs further elaboration compared to what could be achieved in the present paper.

Second, the capability perspective may inform transition studies about the challenges that actors are confronted with in transition processes. The findings of this research may in particular lead to a better understanding of the role of incumbent actors in regimes, in line with previous work done (Wesseling et al., 2015; van Mossel et al., 2018)). The three capability reconfiguration mechanisms and insights from ambidexterity literature can be used to assess how incumbent actors respond to potential regime change. For example, what learning sources and mechanisms do they use to modify their capability portfolios, and if this is sufficient to align their portfolio to the envisioned future regime. This indicates if

incumbent actors are able to solve their capability deficits in transition processes, or are actually even pro-actively contributing to it.

Third, these results challenge the traditional notion of a priori distinguishing “niche” and “regime” actors in conditions of heterogeneous regime structures. An actor that moves in a splintered sectoral regime from one service regime to another one (e.g. from the centralized to alternative service regimes in our case), has to be considered as an incumbent in one, but also as a new entrant in all other service regimes. Consequently, a much broader set of potential transition pathways has to be considered under these conditions.

Acknowledgments: We would like to express our appreciation to all interviewees for their engagement in this study. Furthermore, we would like to thank Claude Menard and Henny Romijn for useful comments on earlier versions of this paper. This research presented in this paper was supported by the Swiss National Science Foundation (grant number 10001A_159300).

Annex

Final coding scheme:

- Pro-poor unit/department
 - Activities pro-poor unit
 - Activities pro-poor department
 - Shortcomings pro-poor unit
 - Shortcomings pro-poor department
 - Changes over time
 - *Code for each year from 2004 onwards*
 - Reasons for the need for a pro-poor unit
 - Reasons for the need for a pro-poor department
- Differences pro-poor unit vs. pro-poor department
- Other departments utility
- Innovations/projects
 - Ablution blocks
 - Bio-centers
 - Connection of water pipes
 - Self-metering
 - Pit emptying CBO
 - Social connection policy
 - PPDs
 - Water kiosks
- Specific characteristics of centralized service regime
 - Infrastructures and artefacts
 - Organizational mode
 - Rationale & meaning
 - Social interaction
 - Time and space
- Specific characteristics of alternative service regimes
 - Infrastructures and artefacts
 - Organizational mode
 - Rationale & meaning
 - Social interaction
 - Time and space
- Differences between low vs. high-income neighbourhoods
- Challenges of embedding of innovations in alternative service regimes
 - Reasons for failure of projects
 - Infrastructures and artefacts
 - Organizational mode
 - Rationale & meaning
 - Social interaction
 - Time and space
- Other actors / partners utility
 - *Codes for each specific actor mentioned as well as for each partner of the utility*
 - Collaboration with other service providers
 - Sharing/developing knowledge together
 - Funding & resources

References

- Aoki, K., & Wilhelm, M. (2017). The Role of Ambidexterity in Managing Buyer–Supplier Relationships: The Toyota Case. *Organization Science*, 28(6), 1080-1097.
- Athi. (2013). *Water and Sanitation Service Improvement Project (WaSSIP). Environmental and Social Impact Assessment Project Report* Retrieved from Nairobi, Athi Water Services Board: <http://awsboard.go.ke/wp-content/uploads/2015/10/Environmental-and-Social-Impact-assessment-for-Nairobi-WASSIP-SLUM-PROJECT-Final2.pdf>
- Blomkvist, P., & Nilsson, D. (2017). On the Need for System Alignment in Large Water Infrastructure: Understanding Infrastructure Dynamics in Nairobi, Kenya. *Water Alternatives*, 10(2), 283-302.
- Bolton, R., & Hannon, M. (2016). Governing sustainability transitions through business model innovation: Towards a systems understanding. *Research Policy*, 45(9), 1731-1742.
- Bousquet, A. (2010). Water and the poor in Nairobi: from water apartheid to urban fragmentation, the case of Kibera. In H. C. Charton-Bigot & D. Rodriguez-Torres (Eds.), *Nairobi Today: The Paradox of a Fragmented City*. Dar es Salam: Mkuki na Nyota Publishers.
- Canzler, W., & Knie, A. (2016). Mobility in the age of digital modernity: why the private car is losing its significance, intermodal transport is winning and why digitalisation is the key. *Applied Mobilities*, 1(1), 56-67.
- Castro, V. (2009). *Setting up pro-poor units to improve service delivery. Lessons from water utilities in Kenya, Tanzania, Uganda and Zambia*. Retrieved from Water and sanitation program-Africa (WSP-AF): https://www.wsp.org/sites/wsp.org/files/publications/service_delivery_field_note.pdf
- Castro, V., & Morel, A. (2008). Can delegated management help water utilities improve services to informal settlements? *Waterlines*, 27(4), 289-306.
- Chan, E. S. (2009). Bringing safe water to Phnom Penh's city. *International Journal of Water Resources Development*, 25(4), 597-609.
- Cherunya, P. C., & Truffer, B. (2017). *The contribution of grassroots groups to sustainability transition of developing cities: the case of sanitation in Nairobi*. Paper presented at the International Sustainability Transitions (IST) Conference 2017, 18-21 June, Gothenburg, Sweden.
- Cherunya, P. C., Truffer, B., & Ahlborg, H. (2018). *Anchoring innovations in oscillating domestic spaces: Why sanitation service offerings fail in informal settlements*. Paper presented at the International Sustainability Transitions (IST) Conference 2018, 12-14 June, Manchester, UK.
- Cresswell, J. W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches*. California: SAGE Publications.
- Creswell, J. W. (2013). *Research Design: qualitative, quantitative, and mixed methods approaches*. California: SAGE Publications.
- Cross, P., & Morel, A. (2005). Pro-poor strategies for urban water supply and sanitation services delivery in Africa. *Water Science and Technology*, 51(8), 51.
- Danilenko, A., van den Berg, C., Macheve, B., & Moffitt, L. J. (2014). *The IBNET Water Supply and Sanitation Blue Book 2014 - The International Benchmarking Network for Water and Sanitation Utilities Databook*. Retrieved from Washington, The World Bank: <https://openknowledge.worldbank.org/bitstream/handle/10986/19811/9781464802768.pdf?sequence=5>
- Darmani, A., Niesten, E. M. M. I., & Hekkert, M. P. (2017). Characteristics of investors in onshore wind power in Sweden. *Environmental Innovation and Societal Transitions*, 24, 67-82.

- Dominguez, D., Worch, H., Markard, J., Truffer, B., & Gujer, W. (2009). Closing the Capability Gap: Strategic Planning for the Infrastructure Sector. *California Management Review*, 51(2), 30-50.
- Duncan, R. B. (1976). The ambidextrous organization: Designing dual structures for innovation. In R. H. Kilmann, L. R. Pondy, & D. Slevin (Eds.), *The management of organization* (Vol. 1, pp. 167-188). New York North-Holland.
- Eisenhardt, K. M., & Martin, J. A. (2000). Dynamic capabilities: what are they? *Strategic Management Journal*, 21(10-11), 1105-1121.
- Farla, J., Markard, J., Raven, R., & Coenen, L. (2012). Sustainability transitions in the making: A closer look at actors, strategies and resources. *Technological Forecasting and Social Change*, 79(6), 991-998.
- Fourchard, L. (2011). Between World History and State Formation: New Perspectives on Africa's Cities. *The Journal of African History*, 52, 223-248.
- Fuenfschilling, L., & Binz, C. (2018). Global socio-technical regimes. *Research Policy*, 47(4), 735-749.
- Fuenfschilling, L., & Truffer, B. (2014). The structuration of socio-technical regimes - Conceptual foundations from institutional theory. *Research Policy*, 43(4), 772-791.
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy*, 31, 1257-1274.
- Gibson, C. B., & Birkinshaw, J. (2004). The Antecedents, Consequences, and Mediating role of Organizational Ambidexterity. *Academy of Management Journal*, 47(2), 209-226.
- Gray, D. E. (2004). *Doing research in the real world* London: SAGE Publications.
- Gulyani, S., Talukdar, D., & Potter, C. (2006). *Kenya - Inside informality : poverty, jobs, housing and services in Nairobi's slums* Retrieved from World Bank, Washington DC: <http://documents.worldbank.org/curated/en/450081468047364801/Kenya-Inside-informality-poverty-jobs-housing-and-services-in-Nairobis-slums>
- Hartman, P., Gliedt, T., Widener, J., & Loraamm, R. W. (2017). Dynamic capabilities for water system transitions in Oklahoma. *Environmental Innovation and Societal Transitions*, 25, 64-81.
- Heymans, C., Eales, K., & Franceys, R. (2014). *The Limits and Possibilities of Prepaid Water in Urban Africa: Lessons from the Field*. Retrieved from Washington, The World Bank: <https://wsp.org/sites/wsp.org/files/publications/WSP-Prepaid-Water-Africa.pdf>
- Hoffmann, W. H. (2007). Strategies for managing a portfolio of alliances. *Strategic Management Journal*, 28(8), 827-856.
- Jansen, J., Tempelaar, M., van den Bosch, F., & Volberda, H. (2009). Structural differentiation and ambidexterity: The mediating role of integration mechanisms. *Organization Science*, 20(4), 797-811.
- Jones, A., & Murphy, J. T. (2011). Theorizing practice in economic geography: Foundations, challenges, and possibilities. *Progress in Human Geography*, 32(3), 366-392.
- Katko, T., Juuti, P. S., & Schwartz, K. (2013). *Water Services Management and Governance. Lessons for a Sustainable Future*. London: IWA Publishing.
- Kauppila, O.-P. (2010). Creating ambidexterity by integrating and balancing structurally separate interorganizational partnerships. *Strategic Organization*, 8(4), 283-312.
- Kiparsky, M., Sedlak, D., Thompson, B. H., & Truffer, B. (2013). The innovation deficit in urban water: the need for an integrated perspective on institutions, organizations, and technology. *Environmental Engineering Science*, 30(8), 395-408.
- Lavie, D. (2006). Capability reconfiguration: An analysis of incumbent responses to technological change. *Academy of Management Review*, 31(1), 153-174.
- Lavie, D., Kang, J., & Rosenkopf, L. (2011). Balance Within and Across Domains: The Performance Implications of Exploration and Exploitation in Alliances. *Organization Science*, 22(6), 1517-1538.

- Lieberherr, E., & Truffer, B. (2015). The impact of privatization on sustainability transitions: A comparative analysis of dynamic capabilities in three water utilities. *Environmental Innovation and Societal Transitions*, 15, 101-122.
- Mansour, G., Oyaya, C., & Owor, M. (2017). *Situation analysis of the urban sanitation sector in Kenya*. Retrieved from Water & Sanitation for the Urban Poor (WSUP): <https://www.wsup.com/insights/situation-analysis-of-the-urban-sanitation-sector-in-kenya/>
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2(1), 71-87.
- Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: an emerging field of research and its prospects. *Research Policy*, 41, 955-967.
- McGranahan, G. (2015). Realizing the Right to Sanitation in Deprived Urban Communities: Meeting the Challenges of Collective Action, Coproduction, Affordability, and Housing Tenure. *World Development*, 68, 242-253.
- Miles, M. B., Huberman, A. M., & Saldana, J. (2013). *Qualitative Data Analysis* (Vol. 3). Los Angeles: Sage Publications.
- Monstadt, J., & Schramm, S. (2017). Toward The Networked City? Translating Technological ideals and Planning Models in Water and Sanitation Systems in Dar es Salaam. *International Journal of Urban and Regional Research*, 41(1), 104-125.
- Murungi, C., & Blokland, M. W. (2016a). Assessment of tools in use by the National Water and Sewerage Corporation to improve water and sanitation services to the slums of Kampala, Uganda. *International Journal of Water*, 10(2/3), 192-212.
- Murungi, C., & Blokland, M. W. (2016b). Benchmarking for the provision of water supply and sanitation services to the urban poor: an assessment framework *International Journal Water*, 10(2/3), 155-174.
- NAWASCO. (2018). *Demonstrating and upscaling an innovative sanitation value chain for the (peri) urban low income areas in Nakuru County, Kenya*. Retrieved from http://www.snv.org/public/cms/sites/default/files/explore/download/21.02.2018_factsheet_nakuru_county_sanitation_programme_1.pdf
- Nilsson, D. (2017). The Unseeing State: How Ideals of Modernity Have Undermined Innovation in Africa's Urban Water Systems. *NTM Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin*, 24(4), 481-510.
- Njiru, C., Smout, I. K., & Sansom, K. (2001). Managing water services through service differentiation and pricing in an African City. *Journal of the Chartered Institution of Water and Environmental Management*, 15(4), 277-281.
- Njoroge, M. (2004). Athi Water Services Board Comes of Age. (Accessed 29 May 2017), Retrieved from Africa Water, Sanitation & Hygiene: <https://afriwater.org/articles/123-athi-water-services-board>
- Nyarko, K. B., Oduro-Kwarteng, S., Dwumfour-Asare, B., & Boakye, K. O. (2016). Incentives for water supply to the urban poor and the role of the regulator in Ghana. *International Journal of Water*, 10(2-3), 267-280.
- Pagel, H., Ranke, K., Hempel, F., & Köhler, J. (2014, 11 July). *The Use of the Concept „Global South“ in Social Science & Humanities*. Paper presented at the Globaler Süden / Global South: Kritische Perspektiven, The Institute for Asian and African Studies, Humboldt-Universität Berlin.
- Ravet, S. (2016). A stepwise approach to achieve sustainable services to low income areas, the experience of a private operator. *International Journal of Water*, 10(2-3), 228-245.
- Ruhiu, J., Ogendo, M., Kamundi, E., Kaseve, C., Owuocha, K., & Mbachia, S. N. (2009). *Strategic Guidelines for Improving Water and Sanitation Services in Nairobi's Informal Settlements*. Retrieved from Nairobi, Nairobi City Water and Sewerage Company (NCWSC), Athi Water Services Board (AWSB), Water and Sanitation Program –

- Africa (WSP-AF):
http://www.wsp.org/sites/wsp.org/files/publications/Af_Nairobi_Strategic_Guidelines.pdf
- Sarasini, S., & Linder, M. (2018). Integrating a business model perspective into transition theory: The example of new mobility services. *Environmental Innovation and Societal Transitions*, 27, 16-31.
- Schwartz, K., & Sanga, A. (2010). Partnerships between utilities and small-scale providers: Delegated management in Kisumu, Kenya. *Physics and Chemistry of the Earth*, 35(13-14), 765-771.
- Schwartz, K., Tutusaus, M., & Savelli, E. (2017). Water for the urban poor: Balancing financial and social objectives through service differentiation in the Kenyan water sector. *Utilities Policy*, 48(Supplement C), 22-31.
- Shove, E. (2010). Social theory and climate change: questions often, sometimes and not yet asked. *Theory, Culture and Society*, 27(2-3), 277-288.
- Shove, E., & Walker, G. (2010). Governing transitions in the sustainability of everyday life. *Research Policy*, 39(4), 471-476.
- Teece, D., & Pisano, G. (1994). The Dynamic Capabilities of Firms: an Introduction. *Industrial and Corporate Change*, 3(3), 537-556.
- Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7), 509-533.
- Tinsely, E., & Navarette, C. (2017). *Formalizing the Electricity Grid Connection*. Retrieved from World Bank Group:
https://www.innovationpolicyplatform.org/system/files/04_Energy%20BMI_BOP%20Grid%20Connection_Jun19.pdf
- Truffer, B. (2003). User-led Innovation Processes: the Development of Professional Car Sharing by Environmentally Concerned Citizens. *Innovation* 16(2), 139-154.
- Truffer, B., Schippl, J., & Fleischer, T. (2017). Decentering technology in technology assessment: prospects for socio-technical transitions in electric mobility in Germany. *Technological Forecasting and Social Change*, 122, 34-48.
- UN-Habitat. (2016). *Slum Almanac 2015/2016. Tracking Improvement in the Lives of Slum Dwellers*. Retrieved from UN-Habitat: https://unhabitat.org/wp-content/uploads/2016/02-old/Slum%20Almanac%202015-2016_EN.pdf
- UN. (1997). *Glossary of Environment Statistics, Studies in Methods, Series F, No. 67*. Retrieved from New York, United Nations:
https://unstats.un.org/unsd/publication/SeriesF/SeriesF_67E.pdf
- UN. (2014). *The Human Right to Water and Sanitation - Milestones*. Retrieved from United Nations:
http://www.un.org/waterforlifedecade/pdf/human_right_to_water_and_sanitation_milestones.pdf
- Van Dijk, M. P., & Blokland, M. W. (2016). Introduction and reflection on benchmarking for the delivery of water and sanitation services to the urban poor. *International Journal of Water*, 10(2-3), 109-121.
- van Mossel, A., van Rijnsoever, F. J., & Hekkert, M. P. (2018). Navigators through the storm: A review of organization theories and the behavior of incumbent firms during transitions. *Environmental Innovation and Societal Transitions*, 26, 44-63.
- van Waes, A., Farla, J., Frenken, K., de Jong, J. P. J., & Raven, R. (2018). Business model innovation and socio-technical transitions. A new prospective framework with an application to bike sharing. *Journal of Cleaner Production*, 195, 1300-1312.
- van Welie, M. J., Cherunya, P. C., Truffer, B., & Murphy, J. T. (2018). Analysing transition pathways in developing cities: The case of Nairobi's splintered sanitation regime. *Technological Forecasting and Social Change*, 137, 259-271.

- Wakiru, J. K., & Kayaga, S. M. (2013). *Analysis of trends in the performance of urban water utilities: A case study of Embu Water and Sanitation Company*. Paper presented at the 36th WEDC International Conference: Delivering Water, Sanitation and Hygiene Services in an Uncertain Environment.
- Wamuchiru, E., & Moulaert, F. (2017). Thinking through ALMOLIN: the community bio-centre approach in water and sewerage service provision in Nairobi's informal settlements. *Journal of Environmental Planning and Management*, 1-20.
- Weerawardena, J., & O'Cass, A. (2004). Exploring the characteristics of the market-driven firms and antecedents to sustained competitive advantage. *Industrial Marketing Management*, 33(5), 419-428.
- Wesseling, J. H., Farla, J. C. M., & Hekkert, M. P. (2015). Exploring car manufacturers' responses to technology-forcing regulation: The case of California's ZEV mandate. *Environmental Innovation and Societal Transitions*, 16, 87-105.
- WHO. (2015). *Progress on sanitation and drinking water - 2015 update and MDG assessment* Retrieved from World Health Organization (WHO) and the United Nations Children's Fund (UNICEF): <https://washdata.org/report/jmp-2015-report>
- WorldBank. (2012). *Nairobi - Sanitation Output-Based Aid (OBA) Project* Retrieved from Washington, D.C., World Bank Group: <http://documents.worldbank.org/curated/en/755991477895754505/Nairobi-Sanitation-Output-Based-Aid-OBA-Project>
- WSP. (1997). *The Water Kiosks of Kibera*. Retrieved from Nairobi, The World Bank, Water and Sanitation Program (WSP): https://www.wsp.org/sites/wsp.org/files/publications/94200710038_WaterKiosksOfKibera.pdf
- WSUP. (2017). Where we work - Kenya. (Accessed 31 July 2017), Retrieved from Water & Sanitation for the Urban Poor (WSUP): <http://www.wsup.com/programme/where-we-work/kenya/>
- Yin, R. K. (2014). *Case study research: design and methods* (Vol. Fifth edition): SAGE Publications.