

# **RETHINKING USER AGENCY IN SUSTAINABILITY TRANSITIONS**

Analysing the roles of informal settlement dwellers in a splintered sanitation regime



**Pauline Chepchirchir Cherunya**



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splintered sanitation regime

**Pauline Chepchirchir Cheruny**

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**RETHINKING USER AGENCY IN SUSTAINABILITY  
TRANSITIONS**

**Analysing the roles of informal settlement dwellers in a  
splintered sanitation regime**

**Een nieuwe kijk op gebruikers in duurzaamheidstransities**  
**Analyse van de rollen van bewoners van informele nederzettingen**  
**in een versplinterd sanitatie-regime**

(met een samenvatting in het Nederlands)

**Eine neue Sicht auf private Nutzer in Nachhaltigkeitstransitionen**  
**Analyse der Rolle von Bewohnern informeller Siedlungen in einem**  
**zersplitterten Sanitär-regime**

(mit einer Zusammenfassung in deutscher Sprache)

**Proefschrift**

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# **Chapter 1: Introduction**

## **1.1 Daily life struggles of informal settlement dwellers in the access to sanitation**

It is predicted that by the middle of this century, all regions of the world will be predominantly urban. Projections show that rural to urban migration, combined with the overall growth of the world's population, could add another 2.5 billion people to urban areas by 2050 leading to a shift in population from 55% to 68% (UN-DESA, 2018). "While this global trend of urbanization holds much promise for a better life for future generations, it also stimulates transitional conflicts and at various times and places exacerbates inequities" (Müller and Lüthi, 2007).

In African cities, the pace of urban growth has not been able to cope with the development of infrastructure, facilities and regulatory institutions that would ensure decent living standards for all. One consequence is the growth of informal settlements (Slums)<sup>1</sup> (Nhapi, 2015). These are residential areas which have been characterized as: lacking security of tenure by the inhabitants for the land or dwellings; the areas usually lack basic services; the housing may not comply with planning and building regulations; a lack of formal recognition of the settlement and its residents by local governments, and the settlements are often situated in geographically and environmentally unsafe areas which leave residents vulnerable to natural and man-made disasters (UN-Habitat, 2015; Corburn and Sverdlik, 2019). It is projected that Africa could have as many as 1.2 billion urban dwellers by 2050 and 4.5 million new residents in informal settlements each year (World-Bank, 2015).

Informal settlements have intolerable conditions of urban living and thereby requiring increased attention among policy makers, practitioners, as well as scholars. Attention to the conditions of living is still largely focussed on rural areas

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<sup>1</sup> 'Slum' is broadly used in research and practice as an alternative term but usually has derogatory connotations. For more discussion on this see Bartlett S and Satterthwaite D. (1989) Introduction: Beyond the Stereotype of Slums. *Environment and Urbanization* 1: 2-5.

while for the urban informal settlements, an assumption was maintained that economic growth would solve its livelihoods challenges (Marcus and Asmorowati, 2006). Therefore in over several decades, many governments refused to acknowledge the existence of informal settlements or to proactively tackle its challenges (Gulyani and Bassett, 2007; Marcus and Asmorowati, 2006). The limited focus on urban and on informal settlements is also observed within the development scholarship where similar assumptions had been maintained – that economic growth would solve the problems (Marcus and Asmorowati, 2006). Two World Bank reports have suggested that the “urbanization of poverty” – where city dwellers are increasingly unable to cope with maintaining decent livelihoods – is a global trend that requires increased attention (Ravallion, 2002; Ravallion et al., 2007). Informal settlement dwellers lack access to safe and adequate urban services like water, sanitation, energy, electricity, solid waste management, housing, public education, health facilities, credit facilities, law enforcement, and security (UN-Habitat, 2016a; UN-Habitat, 2003). These challenges that limit daily livelihood activities amount to a rather unacceptable contemporary reality for inhabitants whose numbers are continuously swelling (UN-Habitat, 2003; Corburn and Sverdlik, 2019; UN-Habitat, 2016a). Having the highest spatial concentration of people deprived of safe, healthy and dignified conditions for urban living, informal settlements remain critical areas to study.

In this thesis, I would like to analyse the roles and agency informal settlement dwellers, themselves, can have in the transformation of sanitation provision and access conditions in informal settlements, and particularly in relation to successful introduction and embedding of innovations.

Sanitation refers to the provision and access to facilities and services which ensure the safe management of human excreta (WHO, 2018), and it represents one of the greatest global transformation challenges. For example, the sanitation goals in the Millennium Development Goals were not met by great margins (UNSD, 2015).

The priority to addressing sanitation challenges is reflected in the Sustainable Development Goals, Goal 6, which calls on countries to engage more in fulfilling this basic human need (WHO/UNICEF, 2017). In 2015, 4.5 billion people lacked access to safely managed sanitation services (i.e. with adequately disposed or treated excreta) and among them 2.3 billion lacked even basic sanitation – meaning they lacked safety and privacy in the use of services (WHO/UNICEF, 2017; WHO, 2018).

The lack of adequate sanitation results in a broad range of socio-economic consequences. For example, the World Health Organization has reported that 88% of diarrhoeal cases are attributed to poor environmental factors essentially originating from poor excreta management (Wolf et al., 2014; Pruss-Ustun, 2008). It is suggested that meeting sanitation needs can provide propagating effects on a broad domain of daily lives. Adequate sanitation contributes to good health, gender equity and equality, dignified lives, increased primary school attendance, improved economic capacities, and environmental sustainability (Brakarz and Jaitman, 2013; Turley et al., 2013; Hutton, 2007; WSP, March 2012). This thesis therefore takes a specific focus on sanitation as a potential inroad for holistic informal settlements improvement in the long-term and can even make core contributions towards the eradication of poverty.

In the provision of sanitation in Global South<sup>2</sup> cities, public utilities cover only a fraction of inhabitants and cater primarily to rich neighbourhoods resulting in a

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<sup>2</sup> The terms ‘Global South’ and ‘Global North’ in this paper are used to replace the more conventional terms ‘developing’ and ‘developed’ countries for the sake of emphasizing the need for a shift from the modernist perspectives on development as being a predictable and linear process unaffected by political and economic relations between countries. See, Edelman M and Haugerud A. (2005) Introduction: the anthropology of development and globalization. *Edelman, Marc; Haugerud, Angelique. The anthropology of development and globalization: from classical political economy to contemporary neoliberalism. Malden, MA: Blackwell.* The terms are not direct reference to the Northern and 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 > \$3956), while Global

highly uneven spatial differentiation (Nyanchaga and Ombongi, 2007; Fernández-Maldonado, 2008). This differentiation is largely associated with residential segregation from colonial periods and later exacerbated during the period of neoliberalism where market-based principles to service provision were introduced – which emphasized profit over the human rights to access (Nyanchaga and Ombongi, 2007). More recently, public utilities are attempting to extend sanitation services into informal settlements as a result of pressure from civil society organizations and from international conventions and treaties (Lines and Makau, 2018; Gulyani and Bassett, 2007). However, the government-led interventions have largely been frustrated by insufficient economic, technical and institutional capabilities (O'Keefe et al., 2015; van Welie et al., 2019a; Adams et al., 2018). Governments have also lost motivation due to the challenges they face when they attempt to apply conventional planning approaches. These approaches often fail because historical and current processes in Global South cities create complex interlinkages between the economic, political, infrastructural, demographic and social factors of provision and access, thus creating a situation that is difficult to understand and tackle (Jaglin, 2016; Beall et al., 2010; Andersson et al., 2016). The lack in understanding of the complex interplay of these broad and multi-faceted factors creates barriers for actors when they attempt to implement sustainable solutions. While public utilities are struggling, other types of providers have emerged in informal settlements, with varying levels of performance. They include local providers (e.g. local private entrepreneurs), and external (e.g. an international NGOs). The community members also organize and manage sanitation services at

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South are lower-income nations (GNI per capita < \$3.955). See Pagel H, Ranke K, Hempel F, et al. (2014) The use of the concept „global south“ in social science & humanities. *Globaler Süden / Global South: Kritische Perspektiven*. The Institute for Asian and African Studies, Humboldt-Universität Berlin.

In the different chapters of this thesis, the term “Global North” may be interchanged with “Western countries”, “Northern countries”, “Industrialized countries” or specified further to “OECD Countries”

personal, family, or at community levels in groups. They altogether form a patchwork of overlapping, fragmented and poorly aligned service systems which inadequately serve the local dwellers (Jaglin, 2014; Szántó et al., 2012; Letema et al., 2012). For the users, they have to rely on a wide variety of alternative options which require different skills and resources. They especially have to micro-manage the coordination of access in the course of a day across the misaligned service options (i.e. when a preferred access option is not functioning and are forced to look for an alternative).

## **1.2 The value of an “innovation” lens in sanitation improvements**

A variety of the actors who provide services in informal settlements are interested in finding solutions which can accelerate the transition of the sector towards sustainability. These actors include city governments, (social) entrepreneurs, and NGOs, among others. These actors are increasingly taking an “innovation” lens to devising sustainable solutions that can be socially and technologically appropriate, affordable, scalable, ecological, and those that are able to circumnavigate political and other barriers. Innovation in this regard carries the notions of tackling the sanitation challenges from a “systemic” perspective and placing emphasis on accelerating the speed of change towards sector transformations (Hekkert et al., 2007: 414; Bento and Wilson, 2016). In the recent decades, informal settlements have increasingly become a target and breeding ground for “innovation” activities related to sanitation (Kalan, 2011).

I define innovation based on insights from the innovation field of study, as the search and discovery of softwares (e.g. knowledge, policy incentives, behaviour change strategies), hardwares (e.g. technical devices), and/or orgwares (e.g. organizational, business models, financial instruments) which can solve societal challenges (Hekkert et al., 2007; Kiparsky et al., 2013; Dosi and Nelson, 1994). Other scholars suggest that innovation can involve significant improvements in the

ways systems function or introducing an old approach to a new sector – and are therefore not necessarily confined to radical technological novelty (Baskaran and Mehta, 2016; Martin, 2016; Ghosh and Schot, 2019).

For successful implementation of innovative modes of provision and access, first a systemic understanding about the kinds of hardwares, softwares and orgwares that actually exist is a pre-requisite. This is because the underlying innovation processes typically depend on the co-development of socio-technical configurations, market structures, actors and practices (Carlsson and Stankiewicz, 1991; Markard and Truffer, 2008). Therefore, a systemic view of innovation activities can be able to explain how and when specific innovation or service offerings succeed or fail to embed, i.e. to fit into the existing socio-technical configurations and related practices in particular contexts. In this thesis, I consider a systemic perspective to the analysis of innovation and transition processes in such a way that the roles (i.e. efforts) and agency (i.e. influences) of the diverse co-existing actors are incorporated. In the course of a transition, new products, services, user and provider practices, business models, and organizations emerge, which complement, substitute or replace the existing ones. Therefore, a transition entails processes that lead to a fundamental shift in the basic configuration of socio-technical systems (Markard et al., 2012). Additionally, for a sustainable transition, the innovators will need to ensure that their activities contribute to meeting the needs of the currently underserved populations and being able to offer new possibilities to envision trajectories to meeting future needs.

### **1.3 Rethinking the role and agency of the urban “poor”**

It is suggested that for Global South cities, there is need to rethink social, innovation and technological theories and how they can be translated into policies that advance the lives of ordinary people (Ammann and Förster, 2018; Jaglin, 2014; Baker, 2012). For African cities, Ammann and Förster (2018) have suggested the

need for more empirical research and theoretical reflections in order to avoid addressing only symptoms and ignoring the real problems to its development challenges. In particular, it is suggested that the highly heterogeneous and dynamic nature of service provision and access in informal settlements call for alternative modes of organizing services beyond the over-reliance on public utilities and on the limited modes of technologies, business models and practices they maintain (Jaglin, 2014; Reymond et al., 2016; Larsen et al., 2016). Therefore, there is need to also envision more diverse transition trajectories (or pathways) beyond the “modern infrastructural ideal” characterized by large-scale, centralized, and standardized urban services with monopolistic management arrangements by public utilities (Coutard, 2008). This ideal is still largely taken as a basis for sector developments by policy actors in Global South cities (Kooy and Bakker, 2008). However, it is observed that public utilities of African cities are struggling to extend their services because of the lack of resources and capabilities (Adams et al., 2018; van Welie et al., 2019a). Additionally, sewer-based systems continue to raise concern about their environmental sustainability because of large amounts of water and energy resources they require in their operation and maintenance (Larsen et al., 2016; Reymond et al., 2016).

In this thesis, I take an actor-focussed study to the heterogeneity in service provision and access in Global South cities to explore potential contributions of other actors – beyond the public utilities – towards a sustainable sector. I specifically focus on the roles and agency of “the user” in innovation processes and in the transition of sanitation in informal settlements. The core argument here is that the users become a significant actor in highly heterogeneous contexts and therefore their roles and agency have to be considered more. Users have largely been relegated to the role of passive consumers. In this thesis, I argue that there is more to the user in innovation and transition processes beyond being just consumers. They may have more proactive roles in determining fundamental socio-

technological changes in basic service configurations. To explore the proactivity of users and their agency, this thesis takes two perspectives to the analyses: (i) in service provision, and (ii) in daily activities, which includes the use of services. In the following paragraphs, these two perspectives are explained in more detail.

First, in the provision of services, this thesis analyses the role dwellers play within a broader set of service providers in informal settlements. Generally, if at all ideas have been raised by policy actors and scholars about how heterogeneous socio-technical systems should be developed towards sustainable service provision, the local community members (i.e. the users) have been overlooked. This largely results from a Western-inspired perspective of the “modern infrastructural ideal” where service provision is expected to be hi-tech (Coutard, 2008; Kooy and Bakker, 2008). Therefore in this regard heterogeneous service systems are expected to incorporate “professional”<sup>3</sup> actors, for example private companies. The frugal, informal and less technical service provision activities by the dwellers are often taken by policy actors to be short-term and temporary solutions (Sima and Elimelech, 2013; Cherunyu et al., 2015; Joshi and Moore, 2004; Baker, 2012). Informal settlements provide doubtlessly the most vivid illustration of the situation where the users have organized their own services in over several decades through self-provision and in community organized groups (UN-Habitat, 2003; Hailey, 1999). In addition to potential resources and capacities informal settlement dwellers could have in service provision, it is also necessary that aspects related to competition and conflicts are explored. This is required taking into consideration the establishment of community/grassroots groups in over several decades as the main service providers in many informal settlements, and the more-recent interest by professional actors – particularly public utilities and (social) enterprises – to extend their services to these areas. In this thesis, I endeavour to analyse user roles

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<sup>3</sup> In this thesis, I define ‘professionals’ as the actors who are formally licenced to provide services or to engage in innovation activities and have formal proofs of professional qualifications

and agency at the same level as how other “more professional” actors would be analysed (e.g. in terms of their activities, resources, creativity, competence, conflicts, competition, etc.). My aim therefore is to conceptually position the user at the core of analysing innovation and transition processes towards sustainable service provision and access.

The second focus on user roles and agency is in daily activities which includes the use of services. The view that more capable and knowledgeable outsiders need to provide sanitation services is often complemented with the perception that the settlement dwellers need to be educated in order for the novelties presented to them to successfully embed. The users are therefore largely perceived as passive consumers forced to make rational choices in a clearly defined market (Dreibelbis et al., 2013: 1015; Letema et al., 2014; Ostrom, 1996; Schramm and Wright-Conterras, 2017; Shove, 2010a). Ramani et al. (2012: 680) and Rogers (2010: 92-103) have additionally argued that there continues to be undue focus on the supply-side in analysing innovation processes. How innovations become appropriated and reshaped in the contingencies of everyday activities by users remains understudied – especially in informal settlement settings. It is suggested that very few professionals working on urban problems have a good understanding about the realities of daily life for the urban poor (Satterthwaite, 2001: 135; De Geest, 2016; Rigon, 2014). Therefore, this thesis focuses on this important research gap by exploring the roles and agency of people when they engage in mundane daily domestic activities. The focus on user daily activities is also motivated by growing evidence that innovations by the professional actors have been largely unsuccessful, with many failing to embed and to scale beyond pilot projects (Bhagwan et al., 2008; Lüthi et al., 2010; Sijbesma, 2006). Such failures have become a conundrum as they often occur even when the innovations are assumed to maintain economic and technical merits. For example, Howe and Koundouri (2009) report about how, when “transplant” of technologies from “developed world” to the “developing

“world” became a popular approach during post-World War II period, embedding and adoption rates were very low. *Improve International*, an NGO, has compiled a statistical database showing very high rates of poor functionality and failures in water and sanitation systems after decades of development work (Davis, August 2012). The source provides statistics on a dramatic 92% slippage rate from ‘open defecation free’ status by 5000 households across Ethiopia, Kenya, Sierra Leone and Uganda. Today, sanitation in informal settlements continues to face the same fate where seemingly superior service offerings by more professional and resourceful actors fail to successfully embed and to be implemented at scale (Bhagwan et al., 2008; Lüthi et al., 2010; Sijbesma, 2006).

To summarize, the overall aim of this study is to analyse the roles and agency of informal settlement dwellers in innovation processes and in the transition towards sustainable modes of sanitation provision and access in informal settlements. The study is motivated by a conceptual gap in understanding user roles and agency in a sector where the users have generally been assumed to be passive consumers and adopters of innovations. An additional motivation is the conundrum faced by professional actors whereby seemingly superior service offerings fail to embed. This thesis takes a systemic consideration of actors and their activities, and particularly analysing “the user” as an equally important actor in comparison to the professional ones. A user-focused study may open up possibilities for broader range of policy options – beyond monolithic public utility provision – that can be considered for sustainability transitions in service provision and access in informal settlements.

#### **1.4 Theoretical anchor: Sustainability transitions field of study**

This thesis anchors the study of user roles and agency on the “sustainability transitions” field of study. Sustainability transitions has developed in the last two decades as a major research field that is concerned with long-term and fundamental

shifts deemed necessary to adapt societies and economies to sustainable modes of production and consumption (Coenen et al., 2012; Markard et al., 2012). A core concept in the field is the “socio-technical system” which refers to a broad, but tightly interrelated, variety of institutional elements (societal and technical norms, regulations, standards of good practice, public opinions, and user practices), material artefacts and infrastructures, as well as agency in networks of actors dependent on each other (Fünschilling, 2014; Geels, 2011; Markard et al., 2012). The “socio-technical systems thinking” is useful in understanding highly complex, multi-scale and persistent societal problems. I see the value of anchoring my study on user roles and agency within the sustainability transition field based on three key aspects: (i) the socio-technical regime concept provides a basis to conceptualize the heterogeneous service offerings in informal settlements, (ii) it has a focus on innovation processes, and (iii) transition frameworks can be used to analyse transformation potential of actors, e.g. interrelations between actors. These are explained below.

First, in the conceptualization of the heterogeneous service offerings in informal settlements, the “socio-technical regime” concept in sustainability transition becomes valuable. A socio-technical regime is described as the institutionalized set of rules in an organizational field related to actors, artefacts, and markets that governs the presence of basic services and which determines the pace and direction of transition processes (Geels, 2004; Fünschilling, 2014). Socio-technical regimes are broadly understood in transition literature to be coherent, uniform and homogenous – in this sense relating to the situation in many sectors in Western countries. For a socio-technical regime analysis in informal settlements, I take consideration of the experiences by sustainability transition scholars who have started to engage with innovation and transition processes in informal settlements, i.e. Silvestri et al. (2018) and van Welie and Romijn (2018). They and other scholars working in Global South contexts have voiced concerns that a one-to-one

application of the original analytical framework showed only limited explanatory power to address the blatant heterogeneities that exist in basic service sectors in the Global South (see also Ahlborg (2017), Ghosh and Schot (2019), Letema et al. (2012), Murphy (2015) and Wieczorek (2018)). This is because the original frameworks were developed based on studies in a few Western countries that are quite unique when compared with other countries across the globe. Wieczorek (2018: 208) has stated that “key concepts in transition research need to be better unpacked in order to usefully describe and suggest ways to go about radical changes in non-Western contexts”.

In informal settlements, the existence of diverse service providers, varieties of technologies and user and provider practices can be described as having heterogeneous socio-technical configurations. The heterogeneity has since long been described and conceptualized by development scholars, e.g. Coutard (2008), Jaglin (2014), Kooy and Bakker (2008), and Ranganathan (2014). This is different from the monolithic centralized systems that characterize service provision and access in most Western countries. Therefore, in order to capture the complexities, an extension of the socio-technical regime concept is required. Additionally, an extension of the regime conceptualization can allow for more diverse transition trajectories – pathways – to be envisioned beyond the monolithic assumptions which are inherent in the Western-oriented transition frameworks. Wieczorek (2018) has argued that there are more diverse sources of stability and change of socio-technical regimes beyond that which has been identified by current frameworks. For informal settlements, I make the assumption that aspects related to spatial and economic inequalities, vulnerability and poverty, lack of centralized and standardized infrastructures, precarious access conditions for users, socio-cultural differences, and the presence of informal and non-regulated services need to be considered in the characterization of socio-technical regimes.

The second value of adopting a sustainability transitions approach is because the literature has produced a significant body of work on the progressive adaptation or transformation of socio-technical systems in response to introduction of innovations (Markard et al., 2012). This body of literature is in relation to how innovation processes can be accelerated beyond incremental up-scaling and as well in relation to system-wide changes within the contexts where the innovations have to be anchored (van den Bergh et al., 2011). In sustainability transitions, innovations are understood to emerge in “niches”. Niches are protected spaces in which radical – possibly sustainable – innovations can develop without being subject to the selection pressure of the prevailing regime. Niches would then be nurtured in order to gain dominance over incumbent – often less sustainable – regime (Kemp et al., 1998; Smith and Raven, 2012). I take a critical look at the niche concept and its value in the analysis of sanitation innovations in informal settlements.

The third value of a sustainability transition approach is the possibility to analyse transformation potential of actors, particularly in regard to relations between and complementarities among actors. It is understood that the actors face a multitude of challenges related to technical, political, cultural, and financial aspects when they try to pursue innovations (Wittmayer et al., 2016; Frantzeskaki et al., 2012; Farla et al., 2012; Ahlborg, 2017; Avelino and Wittmayer, 2016). Additionally, actors may enter into conflicts and competition (Wieczorek, 2018). Therefore, the analysis of sector transformations must consider a variegated landscape of alternative and even competing actors that will enter into conflict with each other when transitions are about to happen. For users, Ahlborg (2017) and Shove and Walker (2007) have pointed to the need for theoretical and methodological approaches which pay more attention to user logics, roles, and practices. This would avoid overly technocratic studies which consequently disregard or downplay human needs, micro-political struggles, and conflicts of interest inherent in societal transitions. In the

sustainability transition field, considerably less attention has been directed towards understanding how demand-side actors (including users) are part of transitions to sustainability (Fischer and Newig, 2016; Wittmayer et al., 2016; Avelino et al., 2016; Ahlborg, 2017; Shove and Walker, 2007; Meelen, 2019). However, more recently there has been a renewed interest in the question, i.e. see Schot et al. (2016) who has developed a typology of users in sustainability transitions, and the STRN Agenda (2017) which calls for better integration of user-related approaches in transition studies.

A motivation to explore the transformation potential of informal settlement dwellers in basic service improvements is in relation to the efforts they have to give in order to get access on a daily basis. Different from the “abstract systems” in most parts of Western countries where user engagements is almost non-existent (van Vliet and Spaargaren, 2010), I see the value in exploring the roles and agency of informal settlement dwellers who seem to be engaged more, e.g. pay-per-use of access to domestic toilets or self-management of faecal wastes. In this regard, I make the assumption that users in informal settlements may have great agency in limiting or fostering sustainable transitions in basic services.

In regard to user involvements in service provision, there have been critiques by some development scholars on the risk of “romanticizing” the assumed roles and capacities of citizens. They suggest that such studies often fail to provide limits on citizen engagements and participation and thus giving a misleading rationale that citizen can or should provide services on their own (Adams et al., 2018). It is suggested that such overly focus on users can result in too much responsibility being conveyed to citizens, which may actually end up robbing their valuable time and resources to engage in other productive livelihoods activities (Morinville and Harris, 2014; Bénit-Gbaffou, 2018; Adams et al., 2018; Sally et al., 2013). Adams et al. (2018) has argued that such studies may even lead to what they term as a ‘second wave of neoliberalism’ in which market-based principles continue to emphasize

profit over the human rights to access. In this regard, I endeavour to analyse user roles in relation to other co-existing actors who maintain diverse and potentially complementary resources, power positions and capabilities. Such an analysis would require the focus on interrelations among the diverse technologies, organizational modes and user and provider practices. This way the roles and agency of users in shaping longer-term transition trajectories among multi-regime actors can be identified.

In the study of transformation potential of users, different analytical approaches from the sustainability transitions field have to be proposed. First, practice theory is proposed to specify the position of the user within sociotechnical regimes. Second, practice theory is proposed to specify roles and agency of users when they engage in their mundane daily activities in time and space. Third, Grassroots Innovation and the Technilogical Innovation System (TIS) frameworks are proposed to analyse the roles and agency of users in their activities as service providers. These approaches are presented in the following paragraphs in more detail.

First, insights from practice theory proposed in the specification of user position within sociotechnical regimes (i.e. the work presented in Chapter 2). In advancing the understanding of multiple socio-technical regimes in informal settlements, it becomes evident that the regimes cannot be identified based on formal regulations and standardized infrastructures (Spaargaren, 2011; Shove and Walker, 2010; Hargreaves et al., 2013). Instead, such an analysis requires a methodological strategy that enables the identification of other diverse factors which stabilize regimes. In order to specify the elements that differentiate the multiple socio-technical regimes that co-exist, the practices associated with particular combinations of technologies, user and provider routines, organizational forms, and shared meanings are examined. Practices are taken to be the foundation in understanding the ‘social’ in socio-technical regime (Shove, 2004; Cetina et al., 2005), rather than the focus on structural features or the idea of individual rational

choices. The practice perspective allows for a determination about where the different socio-technical regimes are embedded across geographies – such as across different sections of a city. Practices are defined as spatially and temporally organised ‘ways of doing’ certain activities, with a recognizable conjunction of interlinked elements (Schatzki, 2002; Shove et al., 2012). Practice elements are delineated as: materials—the technical infrastructures and artefacts; meanings—the images, symbols, rationales, and perceptions; and competences—the know-how (Shove et al., 2012; Hargreaves et al., 2013). The bundling of various practice elements is understood to be significant for the maintenance, stabilization and reproduction of a practice (Watson, 2012). Bundling can become routinized and the consequences of the performance of routinized practices can persist in the temporal-spatial fabric of society (Jones and Murphy, 2011; Watson, 2012). The stabilization of arrangement of practice elements and bundles (socio-technical configurations), which scale up and gain momentum over time and in space, at some point become what is understood in sustainability transitions as “socio-technical structures” (Hargreaves et al., 2013: 408) which I understand to represent “socio-technical regimes”.

Second, practice theory is proposed to specify user roles and agency when they undertake their mundane daily activities in time and space (i.e. the work presented in Chapters 3 and 4). These chapters provide insights for further development of practice theory particularly in the operationalization of the time-space dimension. Despite being considered as important dimensions in understanding social practices (e.g. see Jones and Murphy (2011) and Watson (2012)), the time-space has only been implicitly applied. The analysis of sanitation practices in informal settlements has a significant time-space function and therefore it would be necessary to conceptually and methodologically utilize the time-space dimension. Additionally, the application of practice theory in the two chapters would provide insights about how innovations become appropriated and reshaped in the

contingencies of daily life activities – especially by users with multiple, sometimes conflicting obligations, needs, and priorities.

Third, grassroots innovations and Technological Innovation Systems (TIS) frameworks are proposed to analyse the roles and agency of users – organized within grassroots groups – as providers of services (i.e. the work presented in Chapter 5). In many informal settlements, formal provision of services has been unavailable in over several decades resulting in the establishment of self or community group provision arrangements (UN-Habitat, 2003; Hailey, 1999; Adams et al., 2018; Letema and van Vliet, 2014). This indicates a more pro-active engagement of users in everyday service provision in such a way that they have responsibility for standard setting, supply, maintenance, monitoring and billing. In service provision, successful innovations might rely on specific resources and capabilities that can be leveraged from community members themselves. For the analysis of resources and capabilities by users insights from the Technological Innovation System (TIS) framework are used. TIS is defined by Bergek et al. (2008b) “a set of socio-technical systems focused on the development, diffusion, and the use of innovations”. TIS analyses are concerned with how actors engage in innovation activities, how they interact in manifold formal and informal networks, and how they define or moderate institutions in order to support the generation, diffusion, and utilization of variants of a new technology or service offering (Bergek et al., 2008b; Markard and Truffer, 2008; Tigabu et al., 2015a). This structural approach to understanding innovation has been complemented with a more process-focused approach. The literature has provided several sets of core functions that can be used to gain insights on how TISs provide an enabling environment for an innovation to flourish (i.e. in terms of acceptance, embedding, scaling, market success etc.). The TIS functions revolve about how knowledge is generated, how entrepreneurs experiment with new products, how markets are formed, how resources are mobilized, how search processes are steered and finally

how technologies gain widespread legitimacy. The TIS functions can be translated into capability domains that actors have to develop in order to successfully introduce and embed an innovation. Mobilizing the TIS framework has an additional benefit that I can look for complementarities of resources and capabilities among actors.

The way informal settlement dwellers organize themselves in form of grassroots groups when they engage in service provision can be compared with the conceptualization of grassroots innovations in sustainability transitions. Transitions literature recognizes the pro-active engagement of civil society and social movements in facilitating the transformation of energy, transport, or food systems towards greater sustainability (Leach et al., 2012; Seyfang, 2010; Gernert et al., 2018). Grassroots initiatives are self-organized groups of ordinary people that come together to tackle individual or collective challenges, or to engage in activities of common aspirations. In the sustainability transitions literature, the agency of grassroots groups is broadly discussed with regard to their contribution to niche growth – by challenging the regime in aspects of technologies, practices and values (Hossain, 2016; Seyfang and Smith, 2007).

To summarize, the socio-technical regime, practice theory, Technological Innovation Systems (TIS) and Grassroots Innovation are research approaches within sustainability transitions field which I apply in this thesis to analyse the roles and agency of users. While these approaches are useful to understand the challenges on the ground, they also benefit with new empirical insights from a societal setting which deviates largely from the Northern contexts which informed the original transition frameworks. Therefore, this thesis could provide useful insights for further sustainability transition theorizing.

## 1.5 Research questions

This thesis makes a detailed analysis of the roles and agency of informal settlement dwellers in the innovation and transition processes in sanitation. The main objectives include: First, mapping the socio-technical regimes in informal settlements and to identify the position of users; second, contributing to a better understanding of the contexts of daily lives in informal settlements and how everyday activities influence the acceptance and embedding of novel service offerings; and third, analysing the resources and capabilities that informal settlement dwellers possess, which can more constructively be used in finding long-term sustainable solutions to sanitation challenges. Eventually, I am able to reflect on the conceptual, methodological and practical contributions of this thesis – particularly in relation to how users are studied, conceptualized and understood. To achieve these objectives, I have specified three research questions:

1. What are the characteristics of socio-technical regimes in Global South cities, and how do informal settlement dwellers are constituted into, and stabilize, these regimes?
2. How do informal settlement dwellers in their daily activities shape the process of embedding innovations into their local contexts?
3. What resources and capabilities do informal settlement dwellers possess for transforming socio-technical regimes?

## 1.6 Methodology

### 1.6.1 Empirical context and case motivation

My thesis takes the empirical case of sanitation provision and access in informal settlements in Nairobi, Kenya. The choice of city and sector is motivated by ongoing interest expressed by diverse actors to pilot decentralized small-scale sanitation innovations (Kalan, 2011), and as well increasing interest by the

government towards informal settlement improvements (Government-Of-Kenya, 2007; Anderson and Mwelu, 2013). Additionally, despite a lot of ongoing service improvement activities by diverse actors, the majority of settlement dwellers still lack access to basic sanitation – meaning they lack safety and privacy in the use of services. While 36% of Nairobians live in informal settlements (Mansour et al., 2017), only 10% to 12% of these settlement dwellers are formally connected to sewers<sup>4</sup> (CCN, 2007; Gulyani et al., 2006). Nairobi makes a good case to study also on the basis that the city is positioned as a key innovation and learning hub on urban transformations (Kalan, 2011), thereby it can foster knowledge advancements across regions facing similar challenges.

Nairobi is the capital of Kenya and the country's largest city by population. The last demographic census was conducted in 2009 and at the time the population was 3,375,000 (Statistics, 2010). With a projected annual growth rate of 4.1% in urban population between 2012 and 2030 (UNICEF, 2016), the current population could be around five million. The city dates back to 1899 when it was established as the headquarters for the Kenya-Uganda railway construction by the British. The foundational physical planning of the city in the early 20<sup>th</sup> century was influenced by rapid spatial expansions and colonial segregation that led to unbalanced developments resulting in the establishment of informal settlements. While the British colonials occupied a section of the city where planned services were provided, the Kenyans who worked as labourers in the railway construction settled in the fringes of the growing town where formal services were not provided. Nairobi continued to grow as a trading and administrative hub and in the second part of the 20<sup>th</sup> century after independence, many rural migrants moved into the city for employment opportunities. The few rich Kenyans settled in the former planned sections while the majority poor immigrants from rural areas found refuge

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<sup>4</sup> These estimates do not only include domestic connections, but also sewer connections to public and shared toilets. The exact percentage of households that have a domestic sewer connection is thus unknown, but I estimate it to be lower than these numbers.

in the informal settlements. Currently, one-third of Nairobians live in informal settlements where service provision is one of the city's key transformation challenges.

### **1.6.2 Research design and data collection**

This thesis study is based on primary qualitative data. Data was collected during three field visits — with cumulative field-stay duration of six months between 2016 and 2018. In order to gain a comprehensive picture of Nairobi's sanitation sector, multiple types of data was needed.

The first data-set is derived from interviews at the neighbourhood level. In-depth interviews were carried out with 46 informal settlement dwellers, to assess their everyday activities, their interactions with novel service offerings, and their daily experiences in a settlement upgrading initiative. More women were purposively selected to be interviewed as living in informal settlements disproportionately affects them. Women face significantly higher barriers in accessing basic services and livelihoods opportunities (Tilley et al., 2013; Chant, 2013; Amnesty-International, 2010). For instance, a report on insecurity and indignity faced by women in Nairobi's informal settlements notes that women are at greater risk of sexual violence when they have to walk to public toilets at night – which is the main domestic option available to them (Amnesty-International, 2010). Furthermore, these toilet facilities do not adequately cater for menstrual management needs leading to anxiety for women and girls (Amnesty-International, 2010). Chant (2013) additionally found that women in informal settlements spend more time and resources in accessing basic services than the men living in the same areas, thereby limiting their ability and time to earn through paid employment. Seen through the lens of women, analysing the living conditions in informal settlements unveils a more comprehensive picture of daily life struggles.

The interviews were complemented with observations and six focus group discussions. Members and leaders of grassroots groups, which provide sanitation services locally, were asked additional questions about their activities, challenges, and opportunities in service provision.

Semi-structured interview guidelines are the main form of inquiry for the interviews at the neighbourhood level. The interview schedule was predefined but the interactions were less structured sometimes allowing breaks, changing the order of questions or incorporating transect walks with the respondents. This allowed them to freely share as much as they wished in a form they were comfortable with. As sanitation is sometimes perceived as a shameful topic to openly discuss, creating a flexible interviewing environment enabled respondents to open up and to give more personal views.

The neighbourhood was used as a logical analytical scale since sanitation innovations in Nairobi are often introduced and tested at this level. The neighbourhood level has similar administrative structures – a village – and therefore it could enable for comparisons to be made in terms of socio-political and governance issues. Five neighbourhoods within informal settlements in Nairobi were selected as case studies because of the presence of ongoing or previous innovative initiatives (Table 1). These neighbourhoods are: Mathare-Bondeni in Mathare, Kahawa-Soweto in Kahawa, Mukuru-Rorie in Mukuru, Decanting Site in Kibera and Canaan Village in Kibera. Different cases were applied for the different chapters in this study.

**Table 1: Profile of the neighbourhoods studied in Nairobi**

<b>Neighbourhood</b>	<b>Population</b>	<b>Initiatives/innovations</b>
<b>Mathare-Bondeni</b>	Population of 2,500 families, and part of the larger Mathare informal settlement of 188,183 inhabitants containing 13 neighbourhoods. Established, 1920s (Karanja and Makau, 2012)	<i>Fresh Life</i> public container-based toilet: introduced but not scaled. <i>Banza</i> in-house container-based toilet: introduced but not scaled. <i>Muunagno Wa Bondeni</i> grassroots initiative (selected from 8 grassroots from across Nairobi which were analysed in an initial exploratory study)
<b>Kahawa-Soweto</b>	Population of 3,000 families. Established, 1980s (Karanja and Makau, 2012)	<i>Shared Water-Closet toilets</i> : five of the seven toilets not in use
<b>Mukuru-Rorie</b>	Population of 5,832 individuals, and part of the larger Mukuru informal settlement of 100,000 inhabitants containing 11 neighbourhoods. Established, 1998 (Karanja and Makau, 2012)	<i>Jitegemee</i> in-house container-based toilet: initial acceptance but very low levels of embedding. <i>Fresh Life</i> public container-based toilet: introduced and was successfully scaling
<b>Kibera Soweto – Zone A</b>	Before upgrading: 6,377 families. After upgrading: Population of approximately 822 families. Established, 2016 (KNCHR, 2018). Part of larger Kibera informal settlement of whose actual population is unclear (UN-Habitat, 2014). Established, 1904	<i>Integrated settlement upgrading</i> initiative
<b>Kibera - Decanting site</b>	Population of 1,200 families. Temporary upgraded housing units of the beneficiaries of KENSUP government project. Established, 2009 (KNCHR, 2018)	<i>Integrated settlement upgrading</i> initiative

The second set of qualitative data was from various sector actors. Sixty interviews were conducted with government officials, workers in international organisations, private (social) enterprises, and local informants such as community health extension officers to get professional opinions on how informal dwellers manage their everyday lives, how sanitation innovations and settlement improvement

initiatives were introduced, the interactions between different actors and their perception on the future of sanitation in informal settlements. The specific list of interviews used is presented in each of the chapters. For the study presented in Chapter 2, which mainly answers the first research question – to map the heterogeneity of the sanitation sector at the city level in a such a way that user activities and practices are brought to the core – additional primary data was sourced. This thesis is part of a broader research project titled “Sustainability Transitions of Sanitation Regimes in Urban Africa: Assessing the prospects for disruptive innovations”, which includes the work of another PhD student, Mara van Welie. Both PhD theses are about sanitation in Nairobi. While Mara van Welie focused mainly on the roles of providers and the development at the scale of the city, my work takes the users’ perspective as the starting point for analysing sanitation situations within the informal settlements. For the work presented in Chapter 2, half of the data used was from my dataset and the other half from the dataset of Mara van Welie. The first step in this project was the creation of a common conceptual understanding of the sanitation sector in Nairobi, which is reflected in the co-authored paper in Chapter 2.

The recorded interviews were transcribed. Those in local *Kiswahili* language were translated, in verbatim, to English. All the interview transcripts were then coded using MaxQDA software, and finally analysed. Inter-coder reliability exercises were conducted together with co-authors of the different papers to assist in developing comprehensive list of codes and themes. Inter-coder reliability refers to “the extent to which two or more independent coders agree on the coding of the content of interest with an application of the same coding scheme. It is an important component in the content analysis (especially for open-ended qualitative data), without which the interpretation of the content cannot be considered objective and valid” (Lavrakas, 2008: 344).

During my research, I utilized both inductive and deductive analytical approaches in parallel. This was necessary as the data collection was conducted based on preliminary assumptions which were derived from a literature review on potential analytical approaches (Gabriel, 2013). I developed an analytical scheme with themes and codes before going to the field. These themes and codes guided the development of interview guidelines which were mostly open ended to provide space for additional insights during the data collection process. Glaser and Strauss (2017) suggest that new theories can be generated from a systematic process of analysing data with the guidance of concepts and frameworks from other sources than the data. This way, the new discoveries from the data can be applied to make the original concepts and frameworks more robust.

Towards the end of the project, a one-day dissemination workshop was organized in Nairobi (6<sup>th</sup> July 2018) where I presented the preliminary findings of my research to 56 sanitation sector stakeholders. The preliminary findings were discussed with sector experts who validated most findings and giving additional insights while suggesting small adjustments or corrections with regard to other results. Importantly, however, this was also an opportunity to share the results from my research, following requests by many of the interview respondents.

### **1.6.3 Ethics in fieldwork and the use of data**

Clark (2008) and Sukarieh and Tannock (2013) suggest that ethical issues in respect to a wide range of issues including power, identities, trust and representations require reflection by every researcher before going to the field – particularly when interviewing communities that are poor, marginalized, indigenous, a minority and those experiencing some form of crisis.

What I identified as a significant ethical issue in my study areas was the perception by informal settlement dwellers that they have become over-exposed to many studies over the years yet their local conditions never seem to improve. This leads

to scepticism among settlement dwellers about how the information they share is actually used. Some are fearful that the data is probably sold to business people or the government and is never intended to help them (Interview respondent, Mathare Bondeni). This becomes a challenge in sourcing for primary data but more importantly indicates a need for researchers to take into account such unintended impacts of their activities.

“Research fatigue” by settlement dwellers has become a big challenge in Nairobi and can present limitations in finding the right respondents and in collecting reliable data. It occurs when a community or potential respondents become tired of being requested for interviews over and over again by many researchers. This is not a new phenomenon and has been repeatedly documented in literature. Research fatigue is explained to lead to apathy, indifference and resistance by the respondents resulting in reduced quality of data collected or in difficult research processes (Clark, 2008).

To deal with the challenge of scepticism, I endeavoured to set the right expectation by providing adequate and accurate information about why I am collecting the data and what the data will be used for. I indicated that I did not foresee any immediate benefit for the respondents and their community and that the data would be used for research purposes only. Prior to beginning the interview, I also informed the potential respondent about the kind of information I required and the duration of the interview. This way, they have a choice to refuse to participate from the on-set. The potential respondent was also asked to confirm that they consent to the interview. Only few respondents refused to participate mainly because they lacked time.

My ability to get many willing respondents, despite the conditions of research fatigue in the informal settlements, was facilitated by the use of a local inhabitant in requesting fellow community members for an interview. Engaging a local contact

person helped in trust building. However, the use of a local contact person may risk that the people chosen are only those within close social circles – therefore potentially limiting social diversity. My observation on this was that some of the interviewed persons have become “experienced respondents” and have, over time, developed generic responses to questions. This becomes a problem as the responses can lack authenticity. To deal with this challenge, I informed the contact person about the importance of enabling a variety of respondents in my research in regard to ethnicity, location, economic activities, among others.

Lastly, some of the responses given during the interview were perceived by the respondents to be socio-politically and socio-culturally sensitive. For example, some people who were interviewed about the government-led integrated settlement upgrading initiative perceived some of their responses to be socio-politically sensitive. Some respondents also shared their views on ethnic differences in relation to sanitation practices, which was perceived to be a socio-culturally sensitive topic. Therefore in the presentation of data, all the names are anonymised in order to ensure privacy and confidentiality.

## **1.7 Thesis structure**

This thesis is based on four journal articles (one published, one accepted, one resubmitted and one submitted). Each of these articles constitutes a chapter (Chapters 2 until 5). This is followed by a conclusion, Chapter 6, which reflects on the general lessons learnt and the main contributions of this doctoral thesis.

In Chapter 2, the mapping of socio-technical regimes required an extension of the original concept in order to make it applicable to Global South cities, where service provision and access conditions are highly heterogeneous. We specified two analytical levels: “service” and “sectoral” regimes. Service regimes are stable combinations of technologies, user routines and organizational forms of providing

and accessing a service. The service regimes are identified based on user and provider practices. At a second level, alignments between the existing service regimes are used to specify the forms of “sectoral regime” of cities. Adopting this distinction enabled the characterizing of Nairobi as a “splintered regime”. A key characteristic of splintered regimes is the proactive role of users: in mending the splinters in order to gain access, and by being service providers in organized grassroots groups. The splintered regime is compared with “monolithic”, “polycentric”, and “fragmented” sectoral regimes which can be found in other geographical settings globally. The four sectoral regimes also represent more diverse “transition pathways”.

The active user roles in Nairobi’s splintered regime called for an extension of the analysis to the daily practices of users in order to understand the processes of embedding innovations. In Chapter 3, I describe how the mending of splinters occurs. It entails complex daily activities across time and in space, which I conceptualize as “Oscillating Domestic Spaces”. The concept is specified based on insights from practice theory and the socio-technical regime. The concept reflects the need for people to develop a multiplicity of alternative options and partial solutions to be able to manage access under difficult and uncertain context conditions for practices. The Oscillating Domestic Space in informal settlements is then taken as a context for application of an innovative container-based toilet in Nairobi’s informal settlements. The study showed that lack of understanding of the contextual preconditions for practices resulted in failure of the innovation to embed in line with the expectations of the providers. The innovation anchored only to a small part of the Oscillating Domestic Space and was in disarray with the broader needs and norms of users most of the time. The analysis showed that, when innovations are introduced without a systemic perspective in a context with oscillations, they can potentially result in further splintering – when users take up the innovation as an add-on rather than as a replacement to a non-desirable service

option. Therefore, the concept shows how regime stability can emanate from contexts with unmet needs, fragmented services and negative outcomes and feedbacks in basically all aspects of daily life.

In Chapter 4, the value of paying attention to oscillations in domestic spaces is demonstrated when I use the Oscillating Domestic Space concept to analyse livelihoods reconstruction in a settlement upgrading initiative – where relocations disrupted these “spaces”. The disruptions resulted in multitude of negative feedbacks on the physical integrity of the upgrading initiative and as well in the legitimacy by beneficiaries in the entire process. The settlement dwellers now need to spend significant efforts to rebuild their livelihoods.

In Chapter 5, I conduct an analysis on the transformative potential by informal settlement dwellers for a transition from a splintered to a polycentric regime. The technological innovation system and grassroots innovation concepts are applied in the analysis. The study finds that community members, in their organization into grassroots groups, have resources and capabilities which “professional” actors lack, which can be leveraged. However, these grassroots can also hinder further transitions when they defend their local monopolies against new (and potentially complementary) actors. I discuss new actor arrangements that build on the strengths of the grassroots but can evade potential lock-in that hampers longer-term sustainability transitions.

In the conclusion of this thesis, Chapter 6, I present the key findings and reflect on them for a broadened view of what it takes to apply transition approaches in heterogeneous contexts – particularly in relation to the roles and agency of users. Additionally, I discuss practical implications for user-oriented sustainability transitions for Nairobi’s sanitation sector. I eventually highlight inroads for future transition studies.





## **Chapter 2: Splintered sanitation regimes**

The findings presented in this Chapter have been published:

Van Welie, M. J., Cheruny, 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<sup>5</sup>.

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<sup>5</sup> Author contributions in the Appendix section

## Abstract

Today's rapid global urbanization highlights the need for long-term transformations of basic service sectors in developing cities in order to improve the livelihoods of the urban poor. Sustainability transitions frameworks have proven fruitful for addressing these sorts of challenges. However, they have been at pains so far in accounting for the heterogeneity and complexities that typically characterize informal settlements in the Global South. We therefore propose a conceptual framework that extends the conventional analysis of socio-technical regimes by distinguishing the two levels of sectoral regime and service regime. Challenges for sustainability transitions may then be identified by missing alignments within and among the two regime levels. The framework is applied to the sanitation sector of Nairobi, Kenya, a city experiencing rapid population growth and a highly uneven provision of basic services. Drawing on a set of 152 in-depth interviews, observations, and five focus group discussions, the paper reconstructs the prevailing service regimes and shows how they suffer from misalignments and dysfunctions creating all sorts of problems at a sectoral level. We conclude that Nairobi's sanitation sector can best be characterized as representing a splintered regime. The paper concludes with a discussion of how the new conceptualization of socio-technical regimes suggests some new sustainable transition pathways and how this framework might also be instructive for transition challenges in cities of the Global North.

**Keywords:** socio-technical regime; service regime; sectoral regime; transition pathways; Global South; sanitation

## 2.1 Introduction

We are currently witnessing urbanization at a scale like never before. Fifty-four percent of the world's population is living in cities and the urban growth rates are particularly high in the developing parts of the world, especially in Africa (UN-Habitat, 2016b). Rapid urbanization creates huge challenges for city planners who are not able to keep pace with the number of people moving into developing cities in search for work and life opportunities.<sup>6</sup> New city dwellers often end up impoverished, living in informal settlements without access to proper basic services and infrastructure, such as housing, safe drinking water, and sanitation, solid waste management, reliable electricity and access to healthcare (UN-Habitat, 2003). Such circumstances demand long-term transformations to basic services and infrastructure such that the urban poor are able to improve the quality and resilience of their livelihood strategies.

In order to identify ways to improve service delivery to the urban poor, we propose that a socio-technical system perspective offers a promising approach, one able to account for the socioeconomic complexities of basic service provisioning in developing cities while providing a means to analyse the dynamics of transition processes with respect to these (Markard et al., 2012). Particularly useful is the concept of a 'socio-technical regime'— the institutionalized set of rules in an organizational field related to actors, artefacts, and markets that governs the presence of basic services and which determines the pace and direction of transition processes (Geels, 2004; Fünfschilling, 2014)

Regimes related to urban basic services are key determinants of their quality, accessibility, affordability, sustainability, and resilience in the face of rapid

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<sup>6</sup> With "developing city" we mean a city in a low-income (GNI per capita < \$1.005) or lower-middle-income economy (GNI per capita \$1.006 to \$3.955). Kenya is a lower-middle-income economy (<http://data.worldbank.org/about/country-and-lending-groups>; accessed 5 February 2018).

urbanization. As such, they provide a critical object of analysis through which one can understand the challenges to and possibilities for improvements to service delivery systems.

Much of the literature related to socio-technical regimes and their evolution is based on analyses in advanced industrialized countries and regions. In these contexts, basic service regimes are often uniform spatially, characterized by a dominant governing authority, and marked by consistent levels of quality throughout (De Haan et al., 2015; Fuenfschilling and Binz, 2018). This is not the case in developing cities of the Global South, however, as recent applications of socio-technical transition frameworks have demonstrated (Ramos-Mejía et al., 2018). In such contexts, conventional interpretations of socio-technical regimes are too simplistic given the complexity of basic service sectors and the highly uneven distribution of infrastructure in these cities (Fernández-Maldonado, 2008). For example, in urban East Africa multiple arrangements of actors, artefacts, and spaces coexist to meet the sanitation needs of residents (Letema et al., 2014).

Given the limitations, a reconceptualization of socio-technical system analysis is needed in order to enable the analysis of multiple co-existing regimes (Konrad et al., 2008; Raven and Verbong, 2007). Such a reframing would take into account the heterogeneity that exists in the basic service sectors of developing cities – such as the modernized mixtures approach (Letema et al., 2014; Van Vliet et al., 2014a) and recent scholarship on the “splintering” of infrastructure services along socioeconomic, racial, gender, and other lines of difference (Graham and Marvin, 2001; Jaglin, 2008; Swilling, 2014). These perspectives acknowledge that large, centralized, and homogenous infrastructures may fail to account for the present-day realities facing urban residents, and thus fail to offer realistic visions for sustainability transitions. Instead, service differentiation, spatial heterogeneity, and pro-poor distributions of services may be crucial strategies to achieve decent living conditions for the city dwellers (Botton and Gouvello, 2008). All told, sustainability

transitions frameworks need to better account for the heterogeneity and unevenness of actually existing socio-technical regimes in developing cities so that planners, policymakers, and donors might better develop alternative pathways to sustainability.

The goal of this paper is to make a conceptual contribution to the literature on socio-technical transitions. We propose a conceptual framework that seeks to overcome the limitations on extant regime conceptualizations, particularly related to highly heterogeneous contexts such as those in developing cities. We do so by re-conceptualizing socio-technical regimes at two levels: the level of service provision and the level of the sector. “Service regimes” form around specific institutionalized combinations of technologies, user routines, and organizational forms for providing the service. An example would be the automobile regime as a means to provide personal mobility services. “Sectoral regimes” refer to the provision of broad societal functions like transport, food, safe urban water, electricity, and so forth. In making this distinction, the goal is to provide conceptual space wherein the configurations of service options as well as the alignments between them are more clearly visible. Alignments, as in the complementarities of various services and smooth inter-operability between the different service regimes, increase the strength of the sectoral regime while making it more accessible to a diverse range of residents. As such, the mixtures of service options and their alignments might help to better understand prospective pathways towards future sustainable regime structures in developing cities and beyond.

We further argue that analysing the multiple service regimes constituting sectoral regimes in developing cities requires a grounded approach, one able to inductively identify these differentiations and their characteristics. To do so, we draw on insights from practice theory (Shove, 2004; Jones and Murphy, 2011; Shove and Walker, 2010), in order to reveal the agencies, structural features, spaces, times, social interactions, and material factors that constitute differentiated service

regimes and which make them more or less aligned within the context of sectoral regimes. We deploy the conceptual framework through an analysis of sanitation supply, demand, and use practices in a developing city (Nairobi, Kenya). Our analysis reveals the differentiated service regimes that constitute the city's sanitation (sectoral) regime, the strength of their alignments both internally and with respect to other service regimes, and the obstacles that service providers and consumers/users face in making transitions towards sanitation regimes that provide higher quality, sustainable, and more justly distributed services.

The case of Nairobi's sanitation sector is well suited to demonstrate the value of this approach. The city is facing significant infrastructure challenges as it rapidly grows and the gap between the rich and the poor has become increasingly extreme in recent years. Adequate provision of sanitation services is a fundamental challenge to the city's inhabitants, and a major task for city officials, especially in the informal settlements where 36% of Nairobi's population lives (Mansour et al., 2017). The highly uneven spatial differentiation of sanitation configurations was initiated during the colonial period of residential segregation and it has become more pronounced and complicated during the era of neoliberalism where market-based principles continued to emphasize profit over the human rights to access (Nyanchaga and Ombongi, 2007). The sanitation sector today is characterized by a high variety of access options and conditions, multiple providers, different institutional arrangements, different spatial structures, and user practices, and complex formal and informal governance structures (Juuti et al., 2007; van Vliet et al., 2014b). Complicating matters further is the fact that different sanitation configurations are operated within single geographical areas and residents typically use more than one configuration in the course of their day. To describe these complexities our analysis draws on semi-structured interviews with experts from the sanitation sector, direct observations and focus group discussions with residents collected by two of the co-authors over a five month period in 2016.

The paper is structured as follows. In the next section, the literature on transition studies of infrastructures and basic services in developing cities is reviewed followed by a discussion of the relevance of practice theory for socio-technical regime analysis. We then introduce a conceptual approach to identify regime structures in developing cities' basic service sectors. The framework is then applied to the case of Nairobi's sanitation sector. The results identify the variety of service regimes which coexist in the sanitation sector in Nairobi. The final sections discuss the implications of these findings for sustainability transitions in Nairobi and highlight the broader relevance of the conceptual approach for transition studies in general.

## **2.2 Sustainability transitions in developing cities**

Basic service sectors can be understood as socio-technical systems consisting of (networks of) actors and institutions, as well as material artefacts and knowledge (Markard et al., 2012). In order to understand the dynamics of socio-technical systems, the concept of socio-technical regimes is used to analyse the logic and direction for incremental socio-technical change along established pathways of development (Markard et al., 2012). An adequate understanding of a socio-technical regime in a developing city is an important starting point to identify potential future transition pathways of a basic service sector. However, sustainability transitions research has only recently started to focus on the Global South, while the origins of transitions research are based on empirical cases in industrialized countries. The recent increase of empirical applications in the Global South is challenging the conventional notions of transitions frameworks (Ahlborg, 2015; Byrne, 2011; Murphy, 2015; Ramos-Mejía et al., 2018).

Some previous transition studies recognize the complexity of regimes in the Global South. Sengers and Raven (2014) note that diverse (informal) services characterize the urban transport regime in Bangkok and van Eijck and Romijn (2008) state that

the energy regime in Tanzania consists several sub-systems that can be separate regimes on their own. However, these studies lack an explicit analysis of how these diverse socio-technical structures constitute a regime. Other studies do not specifically mention the diversity of regimes in their cases in the Global South, but apply a rather highly aggregated understanding of what a regime could be: the “energy/power regime” in India (Verbong et al., 2010) or the “energy regime” in Malaysia (Hansen and Nygaard, 2013) to just name a few. Lastly, several studies have pre-dominantly focused on niche growth and diffusion of new technologies in the Global South without elaborating how the regime looks like towards which these developments could contribute (Blum et al., 2015; Tigabu et al., 2015b; Kamp and Vanheule, 2015)

### **2.2.1 Heterogeneity of basic services in developing cities**

Although sustainability transitions research has not extensively dealt with urban contexts in the Global South, much can be learned from other literature on basic services and infrastructures in developing cities (Kooy and Bakker, 2008; McFarlane and Rutherford, 2008; Ranganathan, 2014; Rutherford and Coutard, 2014). These works reveal the material and political challenges associated with potential transition pathways, and highlight the inadequacy of extant transition frameworks for understanding the complexity and heterogeneity of basic service regimes and for identifying potential transition pathways in the short-to-medium term. Negative or unsustainable urbanization pathways are often associated with the “splintering” of urban infra-structures and basic services along class, gender, or ethnic lines which can create extreme inequalities with respect to public utility access and social services (Amin and Graham, 1997; Graham and Marvin, 2001; Jaglin, 2008; Swilling, 2014). Such intra-city differentiations occur when there is insufficient redistribution or investment in infrastructure and social services such that the poorest urbanites and recent migrants are forced to rely on informal, ad hoc, inefficient, and/or low-quality alternatives in order to meet their basic needs.

Splintering processes undermine the “modern infrastructural ideal” of ubiquitous, monopolistic, integrated, and standardized networks of service provisioning, which was common until the 1960s; serving as a regressive development dynamic that have driven the withdrawal of the State from urban planning decision-making processes.

Perhaps most significantly, the splintered urbanism literature highlights the heterogeneity, spatial unevenness, and complexity of basic services in most cities, regardless of whether they are developed or developing. While Coutard (2008) argues that there has never been a modern infrastructure ideal in many contexts, this is especially true in developing cities (Kooy and Bakker, 2008). Rather than there being a short-term potential for a universalized ideal of service provision, there will be a persistent pattern of differentiation of services. As such, one should be wary to view such a city with a “Northern lens”, and to instead be sensitive to coexisting systems of basic services (Bakker et al., 2008; Kooy and Bakker, 2008; Furlong, 2014).

Beyond the splintered urbanisms literature, the modernized mixtures approach also acknowledges the diverse governance structures in service provision and links them with the institutional and technological diversities, thereby moving away from the binary about technology and management as either being centralized or decentralized. Building on socio-technical approaches for sustainable provision of services, the approach conceptualizes urban infrastructures and services as an interplay of spatial, social, and technical dimensions, capturing the various possible combinations of actors and technologies other than only large centralized networks (Van Vliet et al., 2014a). It argues that multiple regimes can operate in a single geographical area (Letema et al., 2014), such as a city, where they are embedded in the different socio-spatial contexts found in close proximity.

In sum, the literature highlights intra-urban differentiations of basic services and infrastructures in developing cities, demonstrating the ways in which these are spatially constituted and geographically embedded despite being co-located in a single city. We argue that this heterogeneity should be taken seriously as a means to advance a more geographically sensitive transition approach; one that deploys a place-sensitive analysis of the everyday practices through which people from different neighbourhoods, genders, classes, and ethnic groups access and provide infrastructures and services. An alternative framework for a socio-technical regime analysis of a basic service sector in a developing city should be able to identify multiple co-existing regime structures and detail the contextual diversities they are embedded in, resulting from spatial unevenness (Murphy, 2015; Truffer and Coenen, 2012). Doing so will require extensions to the conventional understanding of socio-technical regimes and their evolution. We follow Fuenfschilling and Truffer (2014) and recognize that the co-existing regimes may have different strengths based on their degree of institutionalization. Additionally, we draw on insights from practice theory (Shove, 2004; Jones and Murphy, 2011; Shove and Walker, 2010), to use the everyday practices of users and providers of basic services to create a coherent, grounded, and spatially sensitive framework to analyse transition pathways of the regimes.

### **2.3 Conceptualizing and analysing heterogeneous regimes**

A framework for a transition analysis of basic services in developing cities needs to embrace the diversity of social and technical structures present, in order to identify potential transition pathways towards more sustainable socio-technical systems. It should also be open for a variety of potential end-points of transitions, and identify what systemic problems hinder these processes. Besides highlighting structural conditions, the framework should account for agency, and be sensitive to the specificities of the broad variety of geographical contexts that are typical for many developing cities.

We propose that such a framework can be developed by building on the concept of socio-technical regimes, but we have to differentiate the extant interpretation by explicitly distinguishing two levels: “service regimes” and “sectoral regimes”. Service regimes form around specific institutionalized combinations of technologies, user routines and organizational forms for providing the service. An example would be the automobile regime as a means to provide personal mobility services. Sectoral regimes refer to broader economic and societal realms (or organizational fields) that cover a societal function like transport, food, safe urban water, electricity, and so forth.

Our concept of service regimes is very similar to the term socio-technical regimes as applied in most of the transitions literature. We prefer the term service regime because our concept highlights the specific aspects of everyday life that are often overlooked in socio-technical regimes research. The concept of sectoral regimes has been less consistently addressed in the extant literature. Many studies merely refer to the broader “sector” or “domain” where specific socio-technical regimes are embedded (e.g. the transport sector, when the analysis deals with the automobile regime or the “electricity sector” in studies about wind power). In some studies the sectoral context was claimed to constitute the broader socio-technical system in which the regime is embedded (Geels, 2004). In sectors that are dominated by specific socio-technical configurations, scholars have claimed that the two levels are identical, for example in the transport domain, the automobile regime is used as the dominant regime in an assessment of the transition to low-carbon transport systems (Geels, 2012). Others proposed that delimiting different hierarchical levels would be a pure question of the specific analytical interest of the researcher (Geels and Schot, 2007). Only very few scholars have endeavoured to elaborate regime structures at and between different levels of abstraction (Konrad et al., 2008; Raven and Verbong, 2007).

In most cases, a hierarchical relationship exists between service regimes and a specific sectoral regime. The latter will typically consist of various service regimes. E.g. the personal mobility regime (sectoral level) typically consists of more or less aligned service regimes related to i) the automobile, ii) busses and trams, iii) bicycling, iv) trains and v) pedestrian mobility forms. Each one of these service regimes consists of coherent and institutionalized arrangements of technologies, infrastructures, regulations, symbolic meanings, user routines, and public discourses. And all of them interact with each other at the sectoral level to provide the specific services in a more or less seamless way. In the following, we first describe our approach for studying regimes based on practice theory. We then specify the different components that constitute service and sectoral regimes, and describe how we assess the strength of these regimes.

### **2.3.1 Analysing regimes: a practice-oriented approach**

Before unpacking service and sectoral regimes conceptually, it is important to highlight the epistemological/methodological strategy that we apply to their analysis. Our approach focuses on the everyday practices that users and providers employ in the access, provisioning, maintenance, etc. of basic services.<sup>7</sup> Practice theory has been applied to socio-technical transitions research but the

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<sup>7</sup> We build upon early works of the following and others using practice theoretical approaches who strive to navigate between individualist and structuralist explanations for how institutions, organizational fields, firms, and other socioeconomic phenomena function, reproduce themselves, become embedded in particular contexts, and change over time: Giddens A. (1979) Agency, structure. Central problems in social theory. Springer, 49-95, Giddens A. (1984) The constitution of society: Outline of the theory of structuration: Univ of California Press., Bourdieu P. (1980) Le sens pratique, France: Ed. de minuit., Wenger E. (1998) Communities of practice: Learning, meaning, and identity: Cambridge university press., Reckwitz A. (2002) Toward a theory of social practices a development in culturalist theorizing. European journal of social theory 5: 243-263., and Schatzki TR. (2002) *The site of the social: A philosophical account of the constitution of social life and change*: Penn State Press.

conceptualization and delineation of practices and their constitutive elements is sometimes underspecified (Cohen and Ilieva, 2015; McMeekin and Southerton, 2012; Shove, 2010b; Shove and Walker, 2010). The contributions of these studies are significant and helpful, but we think that practice theory can be deployed more productively, specifically to identify key features that stabilize regimes and/or offer points of intervention not otherwise visible through a focus on technological artefacts or individualized behaviours.

Following Jones and Murphy (2011: 367), we define practices as the 'stabilized, routinized, or improvised social actions that constitute and reproduce economic space, and through and within which socio-economic actors and communities embed knowledge, organize production activities, and interpret and derive meaning from the world'. Practices are constituted, enabled, and shaped by behaviour patterns, performances, perceptions, power relations, materials, and the time-space contexts where they are normally carried out. While the precise details of each of these elements may vary by individual, there are generalizable trends that mark and differentiate service regimes. In order to discern these elements and their differentiations, our approach examines the practices associated with particular combinations of technologies, user/provider routines, organizational forms, and shared meanings in order to construct generalized heuristics or models of service regimes. The focus on practices allows us to identify service regimes such that we can then determine how, why, and where, and how strongly they are embedded in the city.

### **2.3.2 Service regimes**

We consider a specific configuration of technologies and their associated user and provider practices as a service regime. A stabilized service regime is marked by routinized practices that may be difficult to change once established. This stability is caused by various processes and patterns, like the reproduction of professional

routines such as shared protocols about how to install water pipes or connect households to the electricity grid, or when there is a clear division of roles and responsibilities among service providers in a well-established value chain. Additionally, service regimes may be stabilized through shared understandings about how, when, and where to provide and use a basic service. An example is the structured habit of households putting their old paper waste at the street in countries like Switzerland on a weekly basis, for regularized waste collection. Providers and users know when, where, and how to arrange this service of picking up old waste paper. In more specific terms, we conceptualize the processes and patterns associated with service regimes along five basic dimensions that we reveal through an analysis of sanitation servicing practices: infrastructure and artefacts; organizational mode; time and space; rationale/meaning; and social interaction. When these dimensions are aligned with one another, a stabilized service regime comes into being. These dimensions are:

(1) *Infrastructure & artefacts*: artefacts are physical material entities (Shove et al., 2012) such as toilets and water taps. Infrastructures are physical structures that enable the functioning of collections of artefacts (Shove et al., 2015), for example water pipelines, or electricity lines.

(2) *Organizational mode*: an organizational mode is a group of actors with complementary strategies and a particular set of capabilities and procedures to fulfil the provisioning of basic services. Within a certain organizational mode a group of actors typically have a shared understanding about the hardware and services they provide. A core practice in the organizational mode concerns operating and maintaining the artefacts and infrastructures, i.e. all the activities that are required for the day-to-day running of a basic service facility and its long-term regular maintenance. Specific forms of expertise and “competence” (Shove et al., 2015) are important preconditions for operations to be carried out successfully.

(3) *Time and space* are the “when? why then?” and the “where? why there?” of accessing basic services (Jones and Murphy, 2011). Operations and services of providers, as well as everyday operational activities of users, are performed within or in relation to particular times and spaces. Basic services are operated in specific spatial locations and the timing for access is regulated.

(4) *Rationale/meaning*: the mental activities, emotions, and motivational knowledge, which represent social and symbolic significance of participation, or doing something, at any one moment (Shove et al., 2012). They enable for an understanding of an actor's role and expectations, and the rules, both formal and informal, that govern the provision and access to a basic service.

(5) *Social interaction*: the contact and exchanges between people as they are enabled/scripted by specific artefacts. Through social performances, one can identify the social roles, rules, power asymmetries and intentions (Jones and Murphy, 2011). Social interactions form an important enabling or hindering factor for users' access to basic services and for providers to maintain regular practices, because they can lead to mutual understanding, trust building, social capital and help to identify roles and identities.

These five dimensions of a service regime may be (mis)aligned with each other to a higher and lesser degree, and by this determining the strength of the regime. Alignments at the service regime level are determined by the complementarities between different service regime dimensions. Alignments between rationale/meanings and time and space dimensions of a service regime would, for example, result from a shared understanding among the users and providers about their roles and the timing and location of a provided service/artefact. Such alignments create mutual trust among users and providers and stabilize the service regime. Another example would be when artefacts are aligned with users'

preferences such that the service is more accessible given resource, mobility, and capability constraints.

In contrast, misalignments occur when there is a lack of complementarity among the dimensions. For example the provision of a service that does not fit the expectations and wishes of the users, because of the type of infrastructures that are used. Another misalignment can be an inconvenient location to access the service, or a complex organizational mode that leads to misunderstandings or conflicts about the expected roles of users and providers. Typically in the course of service regime maturation, socio-technical configurations will become increasingly aligned internally. This is the process that is commonly described in manifold niche maturation accounts and the historical reconstructions of regime emergence (Geels, 2005; Raven and Gregersen, 2007).

In addition to the alignments between the dimensions, the strength of a regime and its degree of institutionalization depends on how widely diffused and taken for granted certain characteristics of the regime are, how long it has been in place, and to what degree it is contested by different societal actors (e.g. because of being exposed to conflicting institutional logics) (Fuenfschilling and Truffer, 2014: 777). A service regime is stronger when there is a shared consensus about the technical design, while a service regime that inhabits various heterogeneous designs will be less persistent and less strong. A service regime is strong when large populations of providers and users take it for granted.

Importantly, the service regime needs to fit with the manifold external structures and local contexts where it is situated, which also determines its strength (Bergek et al., 2015; Fuenfschilling and Truffer, 2014). A strong service regime will in general be in congruence with the major social, geographical, and technological requirements that often coincide with so-called landscape forces (Geels and Schot, 2007). The better this fit, the more stable a service regime will be. Beyond

landscape fit, an effective service regime also has to fit in with or be embedded in sometimes complex local contexts (Bergek et al., 2015). Because local conditions may vary quite substantially within close spatial distances, generic service regimes need to be adapted and modified such that they can function effectively in a wide range of contexts. To do so, a regime has to fit the heterogeneous practices, competences, beliefs and routines, and the physical conditions that mark a particular location.

All said, service regimes may be ranked regarding their strengths. On the one extreme we may witness very well established internal alignments, a good fit with contextual requirements (local or landscape factors) and a low level of contestation by different actors. However, service regimes may also show deficiencies in one or several of these dimensions and thus appear as being only semi-coherent (Geels, 2004; Fünfschilling, 2014). They may exhibit only partial alignments, be it in contradiction with rapidly changing and/or locally specific external conditions or being contested by powerful actors. At the other extreme we may witness very weak service regime structures, where several of the dimensions are not well established yet and alignments are poorly developed or even creating tensions. We therefore propose to conceive regime strength as a gradient that varies from uncontested dominant regimes towards weakly structured, newly emerging regimes (which may under certain conditions equal emerging niches). By this we aim to overcome a binary depiction of the relationship between regime and niches and to capture, conceptually, the heterogeneity of service regimes in developing cities (Fuenfschilling and Truffer, 2014; Geels, 2011; Smith et al., 2005).

This conceptualization immediately begs the question of how the strength of particular regimes relates to negative outcomes or externalities. Negative outcomes can affect society as a whole or hamper the functioning of other sectors (environmental pollution or high costs for accessing or providing a basic service), and can also lead to local conflicts and frictions with prevailing social or economic

structures (low acceptance of a technology or shame when using a basic service without privacy). Weak service regimes can generate negative outcomes mainly through poor quality of service delivery or misalignments with other services and infrastructures. But also strong service regimes, can cause substantial social, economic, or environmental problems (e.g., fossil fuelled power plants contributing to global warming). While positive externalities can help to further stabilize a service regime, negative outcomes do not inevitably destabilize them as long as internal alignments and connections with other contextual factors remain strong (e.g. fossil fuel prices remain affordable through subsidies).

### **2.3.3 Sectoral regimes**

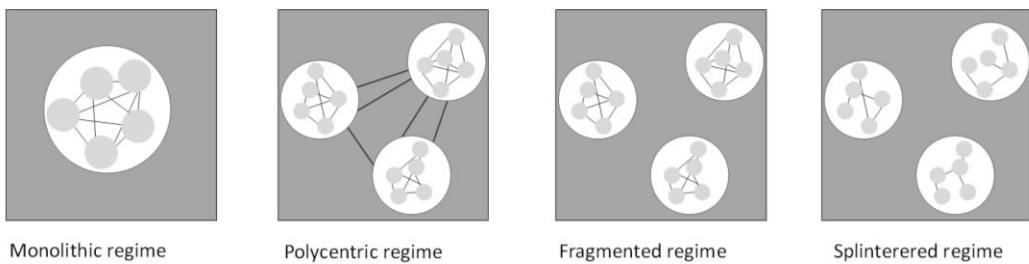
Sectoral regimes typically encompass several service regimes. A sectoral regime is characterized by alignments or misalignments between the different service regimes. Alignments at the sectoral level are a function of the complementarities between various services and inter-operability between the different service regimes. Well-aligned sectoral regimes typically ensure that: (1) users have access to a combination of different complementary and matching service regimes; (2) infrastructures which are used in the different service regimes complement each other and are connected by appropriate interfaces; (3) providers in different service regimes complement each other's competences and offerings; and (4) sectoral regulations are in place to warrant the smooth inter-operability between the different service regimes. Misaligned sectoral regimes instead may correspondingly suffer from one or several problems: (1) inefficiency in service provisioning in the different service regimes (e.g. basic service providers are not complementing each other in order to improve their services); (2) physical infrastructures that could align the different service regimes are absent; (3) the differentiated needs of users can only be met through the users' own efforts to actively find a way to meet their daily basic needs; and (4) regulations or policy actors do not recognize all the

service regimes that exist (e.g., marginalizing certain practices) and/or are not supportive of novel service regimes.

This leads us to propose four basic configurations of sectoral regimes (Figure 1):

- *Monolithic regime*: a sectoral regime consisting of one dominant service regime.  
For example: urban water management in countries like the Netherlands and Switzerland, where the dominant service regime takes up about 95% of the service structures in the sector.
- *Polycentric regime*: a sectoral regime that consists of several service regimes. At the sectoral level, the different service regimes are well-aligned with each other.  
For example: transport in the Netherlands, where the service regimes of automobile, biking and public transport exist in parallel and are well-aligned because physical infrastructures for bicycles exist, and both formal and informal rules of using the physical road infrastructures for biking and driving a car are in place.
- *Fragmented regime*: a sectoral regime that consists of several service regimes; however at the sectoral level the service regimes are misaligned.  
For example: transport in most parts of the US, where the regimes of automobile and biking exist in parallel but where physical infrastructures for bicycles and sector standards for managing bicycles on the roads are often missing or unevenly distributed.
- *Splintered regime*: a sectoral regime that consists of several service regimes that are partially aligned internally. At the sectoral level the service regimes are misaligned.  
For example: many basic service sectors in developing cities.

**Figure 1: Four typologies of sectoral regimes - sectoral regime (grey square), service regimes (white circles), dimensions of service regimes (grey circles), alignments (lines)**



### 2.3.4 Transitions in sectoral regimes

In dynamic terms, the sectoral regime typology enables the identification of alternative future configurations towards which a sectoral regime could transition. Transitions have been defined as “changes from one socio-technical regime to another” (Geels and Schot, 2007: 399). However much of the literature has focused on transitions from one dominant regime to an alternative one. According to our framework, we may identify a variety of endpoints that a transition could lead to. For example, transition processes can be characterized by improvements of the alignments between the service regimes in the sectoral regime. Service regimes can become better aligned, whereby a sectoral regime transitions from a splintered to a fragmented or polycentric regime. Obviously, all sorts of partial trajectories, or different transition pathways (Geels and Schot, 2007) are possible as well and these can lead to various different endpoints of a transition.

The different transition endpoints cannot be ranked *a priori* in terms of their sustainability performance. A splintered regime for instance is typically associated with many negative outcomes in a developing city such as limited access to basic services for users, or non-organized and unproductive competition between alternative service providers. A fragmented regime may equally show negative

outcomes due to misalignments between the different service regimes. However, polycentric and monolithic sectoral regimes may also be riddled with negative environmental, economic, or social externalities. A centralized approach to urban water management may for instance lead to excessive waste, pollution, and costs when compared to a polycentric regime which allows decentralized service regimes to coexist and serve specific user segments. The analysis of sectoral regime typologies can help to identify a broader range of future endpoints of transition process compared to the monolithic endpoint that is envisioned in most transition studies.

To summarize, the framework provides a conceptual approach for mapping diverse basic service structures present in a developing city and to specify alternative transition pathways. This approach can be instructive for researchers, policy makers, and practitioners for systemically identifying barriers to sustainability transitions in a specific sector. The framework differentiates between problems of misalignments within service regimes, such as too high costs for accessing or providing a basic service, and misalignments between service regimes at sectoral level, which for example lead to coordination problems between basic services.

## 2.4 Methodology

The empirical analysis of this paper is based on qualitative data collected through interviews and observations during two stays in Nairobi: the first one between February and March and the second one between September and December 2016. In the first stay, two of the co-authors conducted a total of 49 semi-structured interviews with a diverse range of actors within the sanitation sector. In the second period, we conducted 103 further interviews that went deeper into aspects of practices. Relevant people in government agencies, the local government, Non-Governmental Organizations (NGOs), international agencies, sanitation enterprises, formalized and non-formalized sanitation service providers, and

individual inhabitants were interviewed (Table 2). We selected the interviewees based on their knowledge about and experience with the sanitation sector, and through snowball sampling. Additionally, we conducted five focus group discussions in informal settlements with women community groups. We combined these focus group discussions with visits to the homes of 32 residents in three informal settlements to discuss and observe their living conditions and their everyday domestic practices. Lastly, we analysed relevant documents such as policies and action plans, as well as available literature on sanitation access and provisioning in Nairobi.

We were interested in developing an understanding of user and provider perspectives and practices in the sanitation sector in Nairobi in order to be able to reconstruct distinct service regimes and to understand and document the alignments and strengths of the city's sanitation sectoral regime. The data collection was guided by the current user, provider, and governance situation of sanitation in Nairobi, and important historical developments which led to this situation; developments and innovations taking place; and the actors' perceptions of the future of the sector. We continued the interviews until no major new information about the sector's situation emerged.

All interviews were recorded, transcribed and, coded using the qualitative data coding software MAXQDA 12. The coding process led to an extensive coding scheme covering the major characteristics, developments, challenges, and future predictions of the sanitation sector in Nairobi. This organized data was used in an iterative process, together with information found in literature, to develop the conceptual framework. Thus, in the development of the framework both inductive and deductive thinking were applied. In the section that follows, we deploy these data and this analysis to reconstruct how Nairobi's sanitation sector can actually be characterized as a splintered sectoral regime.

**Table 2: List of interview respondents**

<b>Interviewees</b>
Governmental agencies (22)
Local government (11)
Non-Governmental Organizations (36)
International agencies (8)
University (1)
Sanitation enterprises (17)
Sanitation waste collectors (7)
Key local informants in informal settlements (18)
Residents of informal settlements (32)
Focus group discussions (5, with 8 to 10 participants in each)

## **2.5 Nairobi's splintered sanitation regime**

### **2.5.1 Identifying the set of service regimes**

Through the analysis of practices and the study of secondary data, we identified five service regimes that operate in Nairobi. We characterized the core dimensions of each of these. The five service regimes vary greatly in one or more of their dimensions: (1) The domestic sewer regime encompasses a flushing toilet used by one household, connected to the sewer system which is provided and operated by the utility. (2) The shared on-site sanitation regime encompasses a shared on-site toilet located either inside a plot or off-plot. It is shared by multiple households and mostly provided and installed by the landlord of the plot or by an NGO. (3) The public sanitation regime consists of toilet services in public places which provide pay-per-use services. They are mostly operated by Community Based Organizations (CBOs) or by private enterprises. (4) The coping sanitation regime denotes practices of people to relieve themselves in their homes using improvised domestic items or defecation in the open. Finally, (5) the container-based regime consists of toilets equipped with containers or biodegradable bags to collect the faeces and the urine. The containers or bags are regularly collected and the waste is normally treated and the resulting sludge is re-used. Container-based services

function as a public pay-per use or as in-home toilets, and are provided by social enterprises. The core dimensions of the five service regimes are summarized and compared in Table 3.

The different service regimes show quite high levels of institutionalization of their core elements and varying degrees of internal alignment. In the following, we will illustrate major examples of how the different alignments play out in each service regime. The domestic sewer regime is characterized by the internationally established dominant design of sewer technologies for domestic use. The service regime is internally well-aligned. The dimensions fit well together, for example the operational aspects are neatly aligned with the shape and position of the artefacts, for example the installed water meters that measure the water consumption (the water that is also required for flushing toilets) are easy to reach for meter reading or repairing:

*“...they (utility staff) are dealing with areas which are well organized. And the issues are clear such that if you would want to disconnect a meter in a formal area, it is easy for you to find that meter.” – utility officer*

The rationale of the utility is to deliver a high quality and modern service, and the users perceive this service as comfortable. The organizational mode and infrastructure thus align well with the users' perceptions and meanings:

*“The good thing about having a sewer option is that they (the toilets) are cemented (thus clean) and have flush water inside the toilet (so you do not have to carry yourself)” – informal dweller 1*

**Table 3: The detailed dimensions of the service regime**

	infrastructure & artefacts	Rationale & meaning	social interaction	organizational mode	time & space
<b>domestic sewer regime</b>	central sewer system + (pour) flush toilet	- users: comfortable, good image, costly, consumes too much water - provider: sanitation using high quality modern technologies	- none	- daily maintenances by households - waste management by utility	- timing users: anytime - location: inside the house or on the plot
<b>shared on-site regime</b>	latrine + pit or septic tank	- users: accessible, convenient, low costs, dirty, conflicts among households - provider: arranging sanitation for tenants	- coordinating access and cleaning among households	- organized by landlords or NGOs - daily maintenance by households - waste management by manual emptiers or private exhauster trucks	- timing users: anytime when on-plot and only during the day-time when off-plot - location: off-plot or on-plot
<b>public sanitation regime</b>	latrine + pit or septic tank, bio- & compost latrines, hanging toilet, central sewer system + pour flush toilet	- users: convenient, costly, dirty, risk of diseases, insecure during the night - provider: business opportunity	- trust building: being a “customer” - everyday interaction between operator and user	- daily commercial operations by CBO, NGO or enterprise - waste management by manual emptiers, private exhauster trucks or utility	- timing users: during the day when user has money - location: commercial areas, public residential, hanging over a river
<b>coping sanitation regime</b>	cleaning bucket, plastic bag	- users: convenient option, no costs, useful in the setting of informal settlements, shameful, indignity, bad smell, done secretly, dirty, risk of diseases, insecure, acceptable for children	coordination within the family, being accompanied by others	- organized by households and individuals - no safe disposal of the waste	- timing users: anytime - location: inside the house, close to the home, around shared toilets, at open defecation hotspots (rivers, bushes)
<b>container based sanitation regime</b>	waterless system with urine diversion, biodegradable bags, containers	<i>As in-house service:</i> - users: convenient, indignity, inappropriate for adults, culturally unfit & uncomfortable for men, useful for children, useful at night  <i>As public service:</i> - users: convenient, costly, risk of diseases - provider: environmental friendly sanitation, creating value from recycling waste	<i>As in-house service</i> coordination within the family  <i>As public service</i> - trusted, being a „customer“, a lot of interaction between operator and user	<i>As in-house service</i> - daily operations by household - enterprise collects the waste and re-uses it as fertilizer, biogas, animal feed  <i>As public service</i> - daily commercial operations by enterprise - waste is collected and re-used as fertilizer, biogas, animal feed	<i>As in-house service</i> - timing users: anytime, especially at night - location: in-house toilet  <i>As public service</i> - timing users: during the day when user has money - location: public locations: commercial areas, public residential

The regime is strongly embedded in certain (mainly higher-end) neighbourhoods of the city, but does not fit well with the material and socio-spatial conditions faced by the majority of residents in the informal settlements.<sup>8</sup> Insecurity of tenure and low economic capabilities in informal areas, for example, lead to limited investments into sewer systems by dwellers:

*“I would have really liked to connect my house with a sewer toilet, but I think to myself – what if I invest and then the government decides to resettle me somewhere else?”* (informal dweller 1)

All-in-all this is a strongly institutionalized and persistent service regime in certain areas of the city, because the dimensions align well among each other. Additionally, it is strengthened through ties to the international networks and actors associated with the global sanitation sector and their preference for large-scale centralized infrastructure (Fuenfschilling and Binz, 2018).

A second common service regime is the shared on-site sanitation regime. This regime is characterized by sanitation options that are not connected to the centralized sewer system, but that are constructed as pit latrines or toilets connected to a septic tank. Landlords typically provide this service to their tenants. Alternatively some community groups install these toilets with the help of NGOs and provide maintenance. Several households typically share such a toilet. Manual pit emptiers and exhauster trucks are hired to periodically remove and manage the waste. This is a well-aligned aspect of the organizational mode in this service regime, as a Water Sanitation and Hygiene (WASH) coordinator of an NGO explains about the situation in the informal settlements:

*“...they (residents) normally opt for the manual pit emptiers to exhaust, because they are affordable and they are easily reachable”.*

Also the social relationships between the landlords and tenants are well-developed and relatively well-aligned with the organizational aspect of hiring exhauster services:

*“When the toilet needs to be exhausted, the landlord is responsible. He pays for the service (...) when the landlord delays we contribute towards the services as tenants, since we have a plot representative. He will inform the landlord and the amount will be deducted from the upcoming rent”* (informal dweller 2)

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<sup>8</sup> Estimates of the percentage of Nairobi's total population that is connected to the sewer vary (48% or 66%), as well as for the percentage of Nairobi's informal settlements population that is formally connected to the sewer (10% or 12%) CCN. (2007) City of Nairobi Environment Outlook. In: City Council of Nairobi UNEP, United Nations centre for Human Settlement (ed) UNEP, UN-Habitat. City Council of Nairobi (CCN), UNEP, UN-Habitat, Gulyani S, Talukdar D and Potter C. (2006) Kenya - Inside informality : poverty, jobs, housing and services in Nairobi's slums World Bank, Washington DC: The World Bank . These estimates do not only include domestic connections, but also sewer connections to public and shared toilets. The exact percentage of households that have a domestic sewer connection is thus unknown, but we estimate it to be lower than these numbers.

Despite the fact that waste management is well organized in practical terms for users, it has a negative effect on the environment, because many manual pit emptiers dump the waste in rivers. Shared on-site toilets are widespread in the informal settlements, because the service is compatible with the lack of space in these areas.<sup>9</sup> As well in low-income residential areas with high-rise buildings, the service regime is widespread. The service is compatible with low-income housing arrangements in plots and in high-rise buildings where shared facilities are cheaper. The timing and location of this service regime are also matching well with the expectations of the informal settlements' residents. A focus group discussion with women living in one of the informal settlements of Nairobi noted that they perceive shared toilets to be ideal as their location within gated areas makes them secure to visit any time of day or night. This service regime is also institutionalized because of the use of simple technologies that are affordable, especially in comparison to sewer connected toilets, as a WASH advisor of an international NGO explains:

*“...it is not easy to have those (sewer) connections, so in a way that was a major reason why they (residents of informal settlements) would go for onsite sanitation solutions.”*

Some misalignments in this service regime derive from the fact that users often perceive the infrastructure as dirty and because conflicts can arise among the households about the maintenance aspect of the organizational mode. In a focus group discussion with women, they noted that cleanliness is sometimes a challenge in shared toilets because it is difficult to agree on a protocol for maintenance among many people. All-in-all, because of several well-aligned and a few misaligned dimensions within the service regime, and the fit with the local context, this is a strong and persistent service regime in the informal settlements and suburban areas of Nairobi.

Another persistent service regime is the public sanitation regime. This service regime is characterized by sanitation services that are offered in public places. Several different artefacts and infrastructures are used to provide public sanitation services in Nairobi, from pit latrines to pour flush toilets that are connected to the sewer. This service regime is historically found in many commercial neighbourhoods and the city centre of Nairobi (Ngugi and Ndegwa, 1992; Njeru, 2014). Additionally, today this service regime is widespread in informal areas where public

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<sup>9</sup> In two of Nairobi's large informal settlements (Mukuru & Kibera) 50% of the households share a latrine with other households O'Keefe M, Lüthi C, Tumwebaze IK, et al. (2015) Opportunities and limits to market-driven sanitation services: evidence from urban informal settlements in East Africa. *Environment and Urbanization* 27: 421-440. We would like to emphasize that informal settlement's residents often use more than one option every day.

services are used by many people as an important daily sanitation option.<sup>10</sup> Despite the important role of this service regime in informal settlements, the timing, location, and cost of these services are often misaligned with the realities facing users, thus forcing them to rely on adaptive and coping strategies (see below) to fulfil their needs. As a founder of a social-enterprise and a resident explain:

*“... most people who are using it have to walk, maybe half a kilometre or something to get there. Maybe it is right around the corner but the majority of the users are going to come from further...”.*

Sometimes the services are perceived as costly:

*“Public toilets are very costly. If you calculate the cost for large family like mine on a monthly or annual basis it's a lot of money (...) this competes with other domestic needs like food so we often opt for coping strategies”* (informal dweller 3)

At the same time, various providers profit from this regime. The public services are run by a diversity of actors, among others, private enterprises, CBOs and NGOs. As such public sanitation services provide a business opportunity for community members in informal settlements that form CBOs that operate public toilets.

*“Public toilet groups give opportunities for jobless youths to earn an income (...) they saw the opportunity to provide better management of the toilets and the users were happy because the toilets became cleaner”* (informal dweller 4)

Also some community members consider public toilets ideal because many users lack land tenure rights and hence would not want to invest in private toilets. There is a risk that they are relocated because of insecure land tenure.

*“I am fine with the public toilet. What if I build a private one then eventually I am relocated? I will waste a lot of money”* (informal dweller 1)

All told, despite several misalignments in the public sanitation regime, it remains relatively highly institutionalized because the services are widespread, match the context conditions for majority of city dwellers without tenure rights, and are perceived a business opportunity by community groups.

In the absence of public, domestic or shared sanitation services in certain areas of Nairobi, mainly in the informal settlements, people have developed coping strategies to relieve

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<sup>10</sup> In two of Nairobi's large informal settlements (Mukuru & Kibera) 45% of the households use pay-per-use facilities *ibid*. We would like to emphasize that informal settlement's residents often use more than one option every day.

themselves.<sup>11</sup> These services constitute the coping sanitation regime. Different coping strategies are practiced, for example, using a bucket or a plastic bag inside the house or open defecation. These services are organized by individuals themselves, in order to have a low-cost and safe sanitation solution. This service regime is highly institutionalized, because of several well-aligned dimensions. For example people in the informal settlements perceive these practices as normal strategy to manoeuvre the lack of other alternatives, despite the fact that they think that it is undignified and unhygienic. A WASH advisor of an international NGO explains:

*“...If you look at the social norms perspective, it's accepted. However, people would not dare to defecate in a nice park, as nobody is doing it. That's the kind of perception, like I cannot do it here. But, if you go to the urban areas you go to this corner that corner, there is so much of dirt (open defecation) here and there. So people feel like everyone is doing it, well they can do it themselves as well”*

Practices associated with coping strategies, like having specific hotspots for defecation or a popularly adapted practice known as “flying toilets”<sup>12</sup> become commonplace - as coping is compatible in regard to timing – used at night when other public toilets are closed and people do not dare to go out because of insecurities. All-in-all these alignments and fit with the local context result in a relatively strong coping sanitation regime.

The fifth regime observed in Nairobi the container-based regime is based on (urine-diverting) dry toilets. This regime has gained legitimacy among international development donors in recent years as an attempt to break with the stagnant situation of the failure of existing options to serve all the millions of people in informal settlements during the last several decades. In Nairobi, this service regime is initiated by international enterprises that provide dry sanitation services such as urine diversion toilets using containers or biodegradable bags that are collected on a regular basis. These services are clean and environmental friendly, because waste management is in place and the waste is treated and re-used. These services are only found in the informal settlements and their embedding is not so extensive because several dimensions of the service regime still need to be aligned. For example the placing of the container toilet inside the house misaligns with the perceptions of the users on privacy and dignity:

*“...the men refused to use it. They perceive it as a “potty” for children (...) men would not want to sit on it and the rest of the family is in the small one or two roomed house.”* (informal dweller 5)

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<sup>11</sup> Six percent (6%) of Nairobi's informal settlements residents have no toilet facility and use “flying toilets” Gulyani S, Talukdar D and Potter C. (2006) Kenya - Inside informality : poverty, jobs, housing and services in Nairobi's slums World Bank, Washington DC: The World Bank .

<sup>12</sup> Flying toilet is when a plastic bag is used for defecation, then secretly thrown away in ditches and on rooftops.

Also, the perception among users of this service does not align with social norms and interactions, it is by some perceived as strange:

*"When this (a container-based option) was introduced we (the women) were not shy to use it. We didn't have other options, toilets were very far away. Now that we have more public options we question and laugh at ourselves really what this is that we used"* (informal dweller 6).

The providers in this service regime are also struggling to find a well-functioning efficient organizational mode concerning the waste collection and transport in the informal settlements, as one of the employees of a social enterprise explains about the amount of container-based toilets somebody can collect per day:

*"...in some other areas where we don't have a dense network then someone will have to move long distances then you will be able to collect maybe ten toilets per day in that area. So depending on things like those and also the topography of that area, it varies between maybe ten to twenty toilets".*

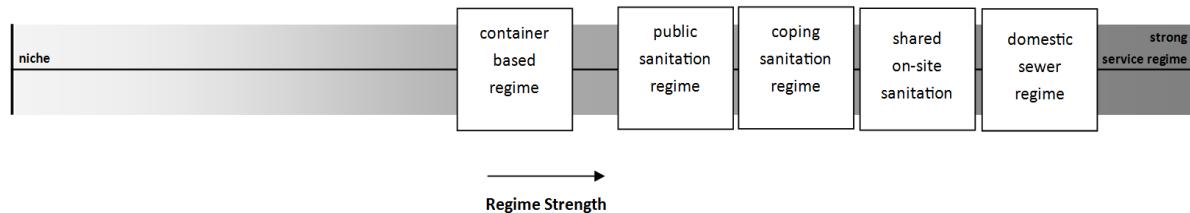
And then there is the challenge of accurately timing when to collect waste from inside people's homes:

*"... accessing the toilet faeces (toilet containers) inside somebody's house could be a bit challenging for us, so we have to learn the behaviours of the users, or rather of the owners (of the houses)...".*

Providers in this service regime struggle with aligning their organizational mode; the timing of accessing the houses in which container-based toilets are used, and the location where the users can leave them efficiently for collection. They are also still improving the frequency of waste collections. Despite these misalignments, the service regime is scaling-up<sup>13</sup> in certain informal settlements thanks to the support of international actors such as donors, who support safe management and treatment of wastes through this service regime. The providers in this regime work on the legitimization of their services among (potential) users, and try to improve the alignments of the service to the times and spaces that match with the daily practices of potential users. All-in-all this service regime is not strongly institutionalized but it is maturing quickly as internal alignments are being strengthened.

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<sup>13</sup> One of the large providers in this regime started its operations in 2011 and currently franchises more than 1100 container-based toilets, which serve over 53,000 people per day in Nairobi's informal settlements Sanergy. (2018) *Our impact by the Numbers*. Available at: <http://saner.gy/our-impact/by-the-numbers>.

**Figure 2: Regime strength of the five service regimes**

Overall, all the five service regimes have different degrees of internal alignments and all show relatively strong degrees of institutionalization of certain elements. The five service regimes all have a different fit with the local context and are each more or less contested. We used this section's analysis of the (mis)alignments, the fit to the local context, and the contestation of the various service regimes to create Fig. 2 which illustrates the differing strengths of the service regimes in Nairobi. Regime strength is rather high for all service regimes. This is at odds with some of the preconceived views on sanitation in informal settlements, which see non-sewered options as provisional or informal and easy to replace, once a “better” solution would be available. It also illustrates that we cannot clearly oppose between regimes and niches in such complex environments. For example container-based options, which are still very much under-development, but have already a number of highly institutionalized elements and local embedding. Other options like public or shared toilets or open defecation show quite high degrees of institutionalization while creating many externalities to its residents. Sewered systems are expanded into informal settlements as rather provisional and experimental simplified sewer projects, which have a number of characteristics of niche processes. With our framework, we can therefore replace the rather dichotomous niche-regime distinction which has been prevalent in the literature so far, by a gradient of alternative service regimes exhibiting different degrees of regime strengths and local embeddedness.

Taken together, these five service regimes constitute the city's splintered sanitation regime at the sectoral level. However, not every service regime is present everywhere as some neighbourhoods are characterized by a single service regime (e.g. high-end areas have only the domestic sewer regime) or a mixture of two-to-three (e.g. certain low-income residential areas have shared on-site sanitation regime and public sanitation regime). Because all five service regimes are institutionalized to a certain degree, it is unlikely that one of the service regimes will suddenly replace another or disappear on a city-scale in the near future.

### 2.5.2 Mapping out the splintered sectoral regime

The five services regimes identified in Nairobi have different strengths, not one of them is dominant, and they are weakly aligned to one another thus meaning that the city's sectoral regime has to be characterized as splintered. One indicator for weak sectoral alignments is the lack of adequate sanitation planning as expressed by the program manager of an international NGO working on sanitation issues:

*“... when they (the utility) are doing their masterplan they must consider different technologies in terms of a mix of technologies, but they won't do that. They will only do a masterplan for sewerage, if they do that. So, that's where you have the big gap”*

The absence of effective planning is part and parcel of more general lack of effective governance structures, translating in unilateral legislation<sup>14</sup> favouring sewer systems and not providing standards for different types of service regimes:

*“Nairobi city bylaw does not recognize pit latrines and does not recognize any other sanitation option except the sewer connection”* (WASH program officer, international NGO)

*“I can assure you that there is no day an on-site system can meet the conventional treatment standards. It is not possible. So we need some kind of a flexible standard”* (lecturer, Kenyan University)

Misalignments are also visible in the coordination deficits between the different sanitation providers, for example between NGOs and public utilities:

*“The problem with all these interventions is there is disconnectedness (...) so everybody just kind of puts up their own intervention”* (executive director, Kenyan NGO)

*“They (NGOs) don't consult when they are trying to provide solutions (...) we are unable to provide services there because one of the risks and again because of the vandalism so the community tends to feel that it is our company that is refusing to offer the services, but you see right from the word go, we are not involved”* (community development officer, utility).

Lastly, physical infrastructures that could align different service regimes are absent:

*“...in the areas where we work there are no sewer trunks. That is where you find there is the biggest issue of faecal sludge management. So currently what we are doing is talking with them (the utility) on how to handle this. If nearby there is a sewer place, how can we be able to support the communities (to use it)? Because you find that they will not be able, actually when the pit fills up, to dig another one (pit latrine), because there is not that space”* (WASH coordinator, international NGO)

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<sup>14</sup> In May 2016 a new “Environmental Sanitation and Hygiene Policy 2016–2030” was launched by the Kenyan Ministry of Health which might improve this situation in future.

All told, the splintered sectoral regime results in a situation in which the differentiated needs of users can only be met through the users' own efforts to actively find a way to meet their daily basic needs, often resulting in negative outcomes. For example, the lack of access to public toilets at night leaves many users with coping mechanisms at home:

*"You have to go like three hundred meters to get access to the toilet and there you are passing through alleys and there is no lighting."* (project officer, Kenyan NGO)

*"The toilet is closed for the day at 10pm in the night. We have to persevere until morning or we just decide to use a small container (coping strategy) in the bathroom, and then very early in the morning before others wake up we dump the faeces into the drainage outside."* (informal dweller 6)

And children, in particular, suffer from a lack of complementary/accessible services:

*"The performance, (...) the attentiveness of the kids during the classes. It's impaired, because this kid needs to go and help him or herself but they don't have anywhere to go. So they are waiting to go home in the evening to relieve themselves."* (country program manager, international NGO)

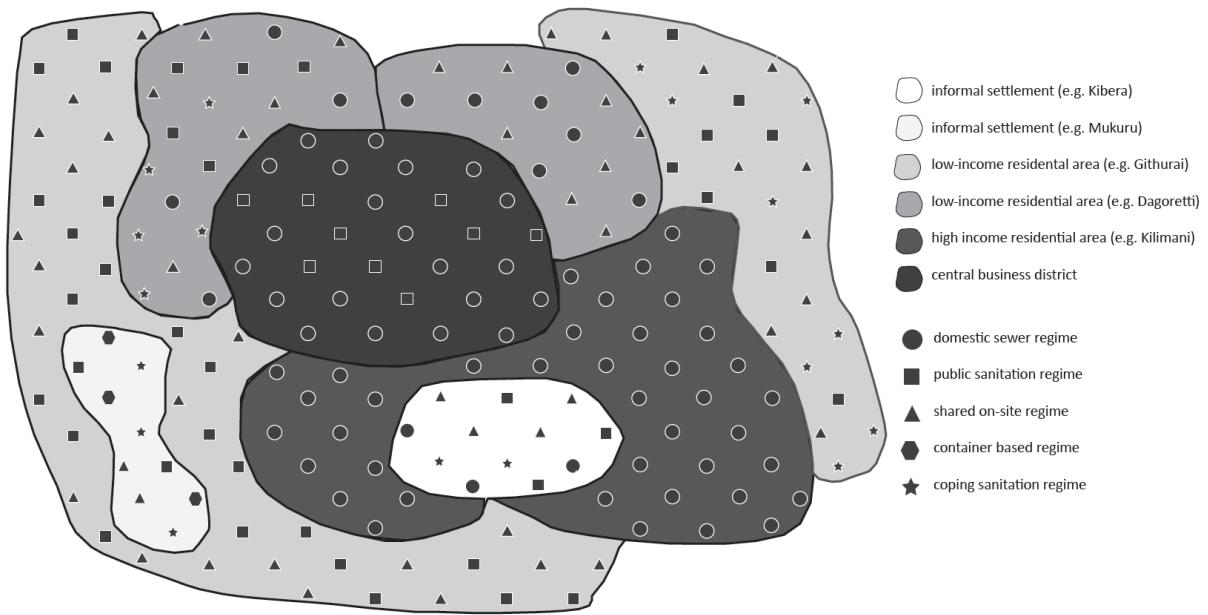
These circumstances mean that the user has to put much more effort into serving her/his needs, and this has a knock-on negative effect on productivity, security, and, in the case of education, the development of human capital.

In order to visualize the splintered nature of the sanitation sector, we constructed a stylized map of Nairobi's sanitation provision depicting the mixtures of service regimes that prevail in several parts of the city (see Fig. 2.3). The most complex constellations are found particularly in informal settlements and low-income residential areas. Wealthy neighbourhoods and the central business district have sectoral regimes that are more homogenous.

How could a future more sustainable sanitation map look like? Most of the city planners assume that, over time, the heterogeneity will disappear in parallel with economic development. As a consequence the domestic sewer service regime will become dominant and the sectoral regime will change from splintered to monolithic. Based on our analysis, we argue however that other developments could be much more realistic. The sectoral regime in low-income and informal settlements will probably not see a strong diffusion of the domestic sewer service regime for still some time into the future. Therefore other service regimes (i.e., the container-based, public sanitation, and shared on-site regimes) should still be improved and alignments among them at the sectoral level could have a strong effect on service quality for the residents. The sectoral regime would transition from a splintered state to a perhaps fragmented or even a polycentric typology. If this can be achieved, a replacement of the still widespread coping regime and the

negative externalities related to it are likely to disappear. The discussion that follows outlines a few inroads for potential pathways for such a transition.

**Figure 3: Conceptual representation of Nairobi showing the splintering in the sanitation sector of Nairobi projected in space**



## 2.6 Discussion: potential transition pathways in Nairobi's sanitation sector

The thorough identification and mapping of the socio-technical structures that create the service regimes and sectoral regime of sanitation in Nairobi gives pointers for how the transition from the current splintered regime towards a well-aligned polycentric regime could happen. This would lead towards a sanitation sector that provides higher quality, more sustainable, and justly distributed services. Potential transitions will depend on how the five service regimes develop individually and whether developments will lead to better alignments among one another. The primary goal is to assure that basic needs can be met twenty-four hours a day without having residents resort to coping regimes, and faecal waste is safely managed.

The systemic analysis of the splintered regime presented in this paper helps to identify possible strategies to overcome misalignments at the sectoral regime level. This is useful because actors usually work and innovate mostly within their service regimes. For example, providers improve the design of container-based toilets or the waste collection carts, improve the payment systems for public toilets, or improve the conversion of waste into biogas or fertilizer. As these examples show, these innovations are rather incremental changes within service regimes, while misalignments at the sectoral regime are not recognized. Actors within the different service

regimes have their specific independent views on the future of Nairobi's sanitation sector, and work on specific projects to achieve this goal.

For example, the future pathway that is envisioned by the actors in the domestic sewer regime is mostly focused on the “Nairobi as a modern city” perspective: a complete sewerage system covering the whole city. Achieving this in medium term (next 10–20 years) is unrealistic and contested given the costs, pace, and complexities associated with the installation of sewerage infrastructure. Regardless, Nairobi City Water and Sewerage Company remains mainly focused on this pathway (NCWSC, 2014). The domestic sewer regime is politically expedient, supported by large international donors, and is well-aligned with a business-as-usual approach. More diverse service models and technologies would require new forms of knowledge, skills and experiences that are currently unavailable.

In order for the utility to be able to serve more people in the different neighbourhoods, other capabilities and service models are needed. Possible alignment building processes could stem from the development of sanitation policies that address the needs of all five service regimes. The capabilities to manage and further develop the other service regimes are typically available with other actors (i.e. NGOs, CBOs, etc.). The public utility would therefore have to collaborate more closely with non-state actors, like private enterprises, NGOs, and CBOs, in order to provide reliable services.

*“For now I think we are still stuck up to our old system where we improve the sewer line, but for the future we are very open to such innovations (i.e. dry sanitation) (...) but I don't think we have the capacity now to start doing this”* (project officer at the utility)

Other scenarios might call for improved alignments between the public sanitation regime and the shared on-site sanitation regime. In both service regimes, NGOs, CBOs and self-help groups are actively involving the residents in the informal settlements in service provisioning. Consequently, these non-state actors envision delegated service provision as the ideal future. A local NGO representative noted:

*“Neighbourhood associations are new opportunities that have come with devolution in the government (constitution of Kenya of 2010) (...) the so called illegal illicit supply of water, electricity, sanitation and waste services (...) communities can negotiate to be delegated some service provision functions by the local government (...) this will enable better revenue collection.”*

Currently, the public and shared service regimes are not well-aligned. The (international) NGOs and CBOs in both service regimes are not purposely referring to each other. The organizational modes of CBOs and NGOs could be improved by learning from each other's service

approaches. For example, the timing and location of the services could be improved regarding the manual pit emptier services. These are used in both service regimes, but are not officially recognized, and thus not regulated and coordinated:

*“We need to have guidelines on issues of faecal sludge management, they (the authorities) need to recognize the manual pit emptiers. As much as they are saying they are illegal they are playing an important role in the sanitation value chain so they need to be recognized.”* (program coordinator, international NGO)

Another scenario relates to entrepreneurial strategies in the container-based regime. These actors typically imagine a future in which private enterprises play a key role and would collaborate with actors in the domestic sewer regime. Such public-private partnerships could support their preferred transition pathway.

Furthermore, there is some potential for collaborations in the field of waste treatment between actors of the container-based regime, the public sanitation regime, and the shared on-site sanitation regime. The first is focused on treating and reusing sanitation waste but does not always collect enough waste from its containers, while in the shared and public sanitation regime a lot of waste is collected from pit latrines without it being properly treated or disposed. Collaborations would lead to positive environmental outcomes.

Through the systemic perspective on splintered regimes that we developed, an overview of a broader set of possible transition pathways could be identified. Disregarding the issue of inter-service alignments will likely lead to the prolonging the state of splinteredness for a long time into the future.

## 2.7 Conclusion

Sustainability transitions frameworks are increasingly called to account for the heterogeneity and unevenness of socio-technical systems in developing cities. In this paper, we developed a conceptual framework that extends conventional regime analyses by differentiating two levels: sectoral regime and service regime. The use of a practice-oriented perspective leads to a coherent, grounded, and spatially sensitive framework to analyse transition pathways of heterogeneous regimes in various complex contexts, not only in developing cities.

In a wider sense, the hope is that this paper's contributions will find applications beyond developing city contexts such that socio-technical transitions research moves beyond its often overly homogeneous interpretation of regimes and towards recognition of the diversity of service regimes that mark sectors like transport, food, water, electricity etc. in all cities. In doing so, it

will be possible to more systematically distinguish between, for example, the transport regime in Dutch cities in which several service regimes (automobile, busses and trams, bicycling, trains, pedestrian mobility forms) are well-aligned, compared to US cities where the regime is often more fragmented (e.g., the bicycling service regime is not well aligned to the other service regimes). Through such comparisons the framework enables the identification of a broader set of alternative transition pathways and ultimately more fine grained policy advice may be derived from a regime based analysis. In particular, the approach overcomes the niche-regime binary which is implicitly oriented at the overthrowing of a monolithic sectoral regime. This paper opens up for much more heterogeneous and uneven sector constellations and therefore provides new perspectives for planners, service providers, and policy makers. The framework finally also provides a useful starting point to gain a more spatially-sensitive understanding of regime configurations. The practice inspired interpretation in particular enables to emphasize the importance of local contexts for successful transition processes.



## **Chapter 3: Anchoring innovations in Oscillating Domestic Spaces**

The findings presented in this Chapter are accepted for publication in Research Policy journal, subject to minor corrections.

Paper title: *Anchoring innovations in oscillating domestic spaces: Why sanitation service offerings fail in informal settlements*. Authors: Pauline C. Cheruny, Helene Ahlborg and Bernhard Truffer.<sup>15</sup>

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<sup>15</sup> Author contributions in the Appendix section

## **Abstract**

A persistent conundrum for practitioners and researchers in the development context is that, often, newly provided and improved basic services are not maintained by users despite seemingly superior functionality and user convenience. We argue that one major reason for this is an insufficient understanding of the context in which users have to manage their daily lives. We therefore propose an approach to analysing the embedding of basic services that focuses on the users' daily practices. We do so by borrowing insights from 'socio-technical transitions' and 'practice theory' in developing our concept of *Oscillating Domestic Spaces*. The concept reflects the need for people to constantly respond to quickly changing and precarious circumstances by rearranging their daily practices in time and space and developing a multiplicity of alternative options and partial solutions. We illustrate the analytical approach in a case study of sanitation access in informal settlements of Nairobi, Kenya. The analysis shows how the introduction of a container-based toilet resulted in partial embedding. The innovation anchored to only a part of the Oscillating Domestic Spaces and was in disarray with the needs of users most of the time. The conceptual approach contributes to the understanding about how users take part in sustainability transitions as well as the added value of the time-space dimension in analysing practices in highly complex contexts. We conclude by reflecting on the potential applicability of the analytical approach to transition cases in the Global North.

## **Keywords**

Practice Theory; Socio-technical transitions; Oscillating domestic spaces; Sanitation; Global South

### 3.1 Introduction

Around the world, actors are engaged in processes of improving basic service access and well-being for the one billion people living in informal settlements (slums) (UN-Habitat, 2016b; Sheuya, 2008; Ezeh et al., 2017). Informal settlements in quickly growing cities provide fertile ground for innovation by presenting numerous challenging problems requiring solutions. However, the high level of complexity and multi-dimensional poverty defeats many hopeful attempts at rolling out novel solutions for hygienic, safe, affordable, and consistent access to water, sanitation, energy, housing or waste management. In this article, the starting point is the question: why do so many innovations introduced to informal settlements fail to embed and replace the existing practices that innovators see as undesirable? Attempting to understand this failure<sup>16</sup> and what it takes for innovations to embed, we develop a conceptual approach that enables us to understand service provision and use from the perspective of users and their daily realities.

In Sub-Saharan Africa, the persistence of unequally distributed and unsustainable basic service systems result from a combination of historical and current processes, with institutional, economic, political, infrastructural, demographic and social factors creating a complex situation that is difficult to understand and tackle (Jaglin, 2016; Beall et al., 2010). Public utility actors often lack technical, institutional and financial capacities, sometimes also the motivation, to extend services into informal settlements (van Welie et al., 2019a; O'Keefe et al., 2015). These areas are often characterised by overcrowding, tenure legality problems, insecurity and high rates of unplanned expansions (Andersson et al., 2016; O'Keefe et al., 2015). Large-scale public service provision, such as utilities delivering electricity, drinking water and sewage systems, often reach only higher-income urban neighbourhoods, and there exists a patchwork of overlapping but fragmented and poorly aligned service systems that inadequately serve informal settlement dwellers.

Sanitation, in particular, faces some of the greatest transformation challenges for Global South cities and, so far, there has been little progress. For example, the Millennium Development Goals for sanitation were not met by great margins (UNSD, 2015). Increasingly, public and private sector actors are engaging in the sanitation sector, attempting to provide alternative service provision models. Compared to large-scale centralized models, decentralized and small-scale sanitation systems are suggested to offer possibilities for rapid installations, cost reductions, local

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<sup>16</sup> We define 'failure' from the perspective of many innovators as the inability of a new service offering to gain prominence and quickly replace existing less desirable options and practices (i.e. container-based toilets replacing open defecation) which contribute to inability of innovations to quickly scale up.

adaptation to available spaces and to preferences, and possibilities for local experimentation and learning (Katukiza et al., 2012; Larsen et al., 2016; O’Keefe et al., 2015). However, while the potential merits of small-scale systems are many, the successes are few, with many not being maintained by users, failing to replace non-desirable artefacts and practices and failing to scale up beyond pilot projects (Lüthi et al., 2010; Bhagwan et al., 2008; Sijbesma, 2006).

We argue that these failures result, to a large degree, from insufficient understanding of the context in which these innovations are introduced and from a lack of adequate engagement with users throughout the innovation process. Whereas conventional approaches to introducing new service options in engineering, economics and psychology are technology and product-oriented (Ockwell et al., 2018; Ramani et al., 2012), it is an established insight in development studies and socio-technical transition studies that innovation aiming at user embedding should be needs-driven and context-sensitive (Korten, 1980; Satterthwaite et al., 2015; Hansen and Coenen, 2015). In development practice, however, users are too often treated as either passive adopters in innovation processes, with their agency and role as co-innovators overlooked, or are perceived as free-floating individuals making rational choices on a market (Dreibelbis et al., 2013: 1015; Letema et al., 2014; Ostrom, 1996; Schramm and Wright-Contreras, 2017). Furthermore, Ramani et al. (2012: 680) and Rogers (2010: 92-103) argue that there continues to be undue focus on the supply-side. The process of how new service offerings become appropriated and reshaped in the contingencies of everyday activities and by users with multiple, sometimes conflicting obligations, needs, and priorities, is overlooked and remains understudied. A combination of the shallow understanding of context and limited engagement with imagined ‘beneficiaries’ not only prevent well-tailored service offerings, but also lead supply-side actors to entertain somewhat unrealistic assumptions about the successful embedding of their solutions.

When Satterthwaite et al. (2015) analysed the progress framework for the Sustainable Development Goals (SDGs), they found that it is still standard development practice to ignore contextual dimensions and basic realities on the ground when setting objectives or undertaking interventions. They found that the entire statistical base for assessing progress within the United Nations’ targets on sanitation defines improved provision the same way for all areas, without concern for space and density, occupations, whether rural or urban, housing designs etc. Based on our own review on how the ‘sanitation ladder’ is specified in the SDGs, we find that it maintains a rather linear and mechanist categorization by specifying the following access levels: open defecation, unimproved, limited, basic and safely managed (WHO/UNICEF, March 2018). Further, these levels are reached without sufficiently accounting for everyday precarities in service

provision and access (i.e. if there is consistent provision of and access to sanitation). We therefore suggest that context is overlooked not only by practitioners but also by policy actors.

The aim of this paper is to contribute to a context-sensitive and actor-centred perspective on innovation processes by considering conditions for the successful introduction, acceptance, and embedding of new service offerings in informal settlements. We position ourselves in the literature on sustainability transitions. Our specific vantage point is a ‘socio-technical system’ which refers to a broad, but tightly interrelated, variety of institutional elements (societal and technical norms, regulations, standards of good practice, public opinions, and user practices), material artefacts and infrastructures, as well as agency in networks of actors dependent on each other (Fünschilling, 2014; Geels, 2011; Markard et al., 2012). Transitions entail processes that lead to a fundamental shift in the basic configuration of a socio-technical system (Markard et al., 2012). In particular, we build on ‘socio-technical transitions’ and ‘practice theory’ to develop a novel conceptual approach to studying transitions in contexts characterized by high complexity, fragmentation and uncertainty as compared to the ‘usual focus’ in this field—the centralised, stable and relatively homogenous sectors of basic service provision in OECD contexts.

The main contribution of this paper is elaborating the concept of the *Oscillating Domestic Spaces*, which makes visible how people are faced with constant fluctuations—expected and unexpected—in the conditions that enable service access. As people go about their daily tasks, they are forced to respond to precarious situations by adopting a multiplicity of complementary and partial solutions. This manoeuvring manifests itself in ongoing adjustments—i.e. oscillating daily space-time patterns—in how, when, and where practices are carried out. This has consequences for the potential acceptance and embedding of new innovations. We illustrate the virtues of this analytical approach in an empirical case study of sanitation in the informal settlements of Nairobi, in Kenya.

For scholars and practitioners involved in basic service delivery in poor urban communities, the approach helps improve the understanding about the processes of embedding and inspires context-sensitive and needs-driven solutions. The approach suggests that there is a need to align expectations around success with the reality of users in the informal settlements. We argue that a careful consideration of the context in which people go about their daily lives leads to a more modest understanding of what constitutes a ‘successful’ innovation—reflecting the need for multiple and partial solutions rather than a silver-bullet approach.

Importantly, we think that the approach has significance beyond the empirical field of sanitation in informal settlements in African cities. There are two conceptual contributions to the literature

on ‘sustainability transitions’ emerging from the analysis. First, research on transitions has often focused on purposeful interactions between state and market actors in their attempts to achieve certain goals. Considerably less attention has been directed towards understanding how demand-side actors in their everyday lives and activities are part of transitions to sustainability (Fischer and Newig, 2016; Wittmayer et al., 2016; Avelino et al., 2016). The approach taken here, to place the daily practices of users at the core of the analysis, shows how relevant it is to understand their agency in order to identify the conditions for systemic change. In particular, we follow Ahlborg (2017) and Shove and Walker (2007), who have pointed to the risk that socio-technical system approaches that do not theoretically and methodologically pay attention to demand-side actors’ logics, roles, and practices could become overly technocratic and consequently disregarding or downplaying human needs, political struggles, and conflicts of interest inherent in societal transitions. The use of practice theory—which has already been operationalized within socio-technical transitions by several researchers—is helpful for counteracting this shortcoming (Shove and Walker, 2007).

Second, the literature on transitions has been developed based largely on empirical experiences in a few OECD countries and industrial sectors, and only recently have other geographical and sectorial contexts been explored (Wieczorek, 2018). Our second contribution is thus to operationalize a practice-oriented approach to studying transitions in contexts riddled with uncertainty, heterogeneity, and fragmentation with regard to service provision arrangements. Our conceptual framework builds on the ‘time-space’ dimension of practices, which becomes more critical analytically in highly complex contexts. This is typical for informal settlements in Global South cities but may also be relevant for other contexts with similar characteristics.

The paper is structured as follows: The next section reviews literature on practice theory and its integration with socio-technical transitions literature, and also elaborates on the analytical approach we propose. Section 3.3 introduces the empirical case study of sanitation in Nairobi’s informal settlements and describes the research methodology. The results section summarizes the case evidence and illustrates the complexities that informal settlement dwellers are confronted with daily when taking care of their domestic and sanitation needs. We highlight an attempt at introducing a new service offering, a container-based toilet, which had been envisioned by innovators as an in-house family toilet and would also solve the problem of ‘open defecation’ and ‘flying toilets’<sup>17</sup>. Our analysis explains why the innovation became only partially embedded and

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<sup>17</sup> Open defecation is when people defecate in the open environment rather than into a toilet (I.e. in fields, bushes, forests, ditches, canals or other open spaces). Flying toilet is a local term in informal settlements in Kenya and refers to the strategy of defecating into a plastic bag while inside the home and throwing the

why it didn't replace these inferior sanitation practices. Section 3.5 discusses the implication of the findings for research and practice. We conclude by commenting on the usefulness of the analytical approach for socio-technical transitions in other sectors and geographies.

## 3.2 Theory

### 3.2.1 A practice-theoretical understanding of socio-technical transitions and limitations

Socio-technical transitions are processes that lead to a fundamental shift in socio-technical systems and involve far-reaching changes along technological, material, organizational, institutional, political, economic and socio-cultural dimensions as well as in terms of everyday user practices (Markard et al., 2012). In analysing the systemic changes that are triggered by innovations, practice theory is increasingly used as an approach that takes practices, rather than structural features or individual rational choices, to be the foundation in understanding the 'social' in socio-technical transitions (Shove, 2004; Cetina et al., 2005). Practices are considered 'sites' of the social that can reveal key insights into the ways and means through which organizations and socio-technical regimes operate and change over time (Schatzki, 2002). Practice theory is strongly associated with, and builds upon, early works of Giddens (1979; Giddens, 1984), Bourdieu (1980), Wenger (1998), Reckwitz (2002), and Schatzki (2002). For Giddens (1979), practices are understood as foundational building blocks of society that reflect the relationships between actions in everyday life worlds and the long-standing structures that govern and mediate these. In this understanding, a focus on practices can overcome the structure-actor dualism, a problem encountered and discussed in many fields, including earlier formulations of transition frameworks (Spaargaren et al., 2013: 10).

A number of more recent studies have involved themselves in bridging practice thinking and transition studies. They include studies on food systems (Cohen and Ilieva, 2015; Hargreaves et al., 2013; Spaargaren et al., 2013), energy (Boamah and Rothfuß, 2018; Ulsrud et al., 2018; Gram-Hanssen, 2011; Greene, 2018), transport and mobility (Shove and Walker, 2010; Watson, 2012), showering (Shove and Walker, 2010), sanitation (van Welie et al., 2018)<sup>18</sup>, and several conceptual discussions (Shove and Walker, 2007; McMeekin and Southerton, 2012; Shove et al., 2012; Stengers, 2010). For Hargreaves et al. (2013), they understand humans as skilled agents who actively negotiate and perform a wide range of practices in the normal course of everyday life. People perform practices while embedded in webs of relations between human actors and non-

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waste, unnoticed, into the open environment. These strategies are performed because of a lack of toilet access.

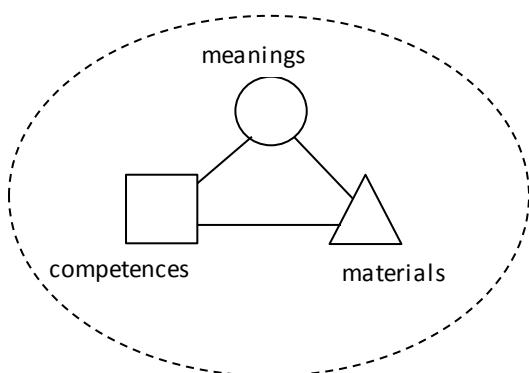
<sup>18</sup> This is in reference to the already published work based on Chapter 2 of this thesis.

human elements (Stengers, 2010), and such practices are shaped by and reshape the context of which they are part.

Shove and Walker (2007: 2) indicate that practice-oriented approaches make studies of systems in transition less retrospective and distanced, and in this way are better able to make propositions about how individuals and organisations can act to steer transitions. The added advantages of a practice theory approach also include giving attention to the agency of the demand-side, that is, to the role of citizens as part of a transition (Shove and Walker, 2007), and, as well, being able to give equal attention between a novel service offering and the other inconspicuous artefacts and activities that the new offering competes with, replaces or becomes an embedded part of (Shove and Walker, 2007; Hargreaves et al., 2013).

Practices are defined as spatially and temporally organised ‘ways of doing’ certain activities, with a recognizable conjunction of interlinked elements (Schatzki, 2002; Shove et al., 2012). Practice elements are delineated as: *materials*—the technical infrastructures and artefacts; *meanings*—the images, symbols, rationales, and perceptions; and *competences*—the know-how (Shove et al., 2012; Hargreaves et al., 2013).

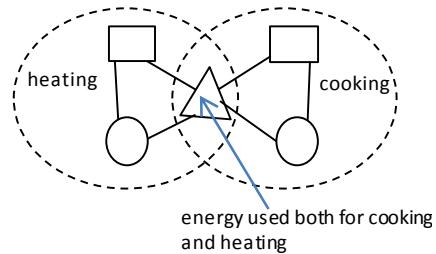
**Figure 4: The interlinked elements that make up a practice**



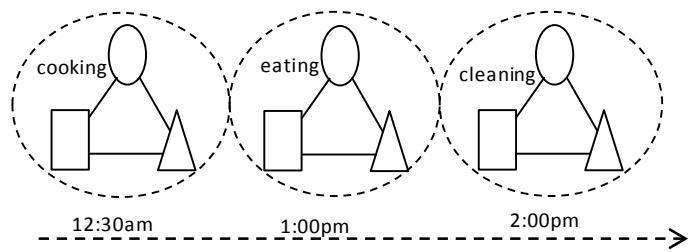
In the domains of everyday life, practices co-exist and elements may overlap across practices. Consider, for example, cooking, which combines materials (ingredients; gas-cooker), meanings (diet choices; assumed responsible; preferred cooking times), and competences (know-how of using the stove; skills of cooking certain dishes). Cooking is also linked to other, analytically distinguishable, practices of acquiring the ingredients, eating and cleaning the kitchen. The co-existence of practices is conceptualized as ‘ecologies’ and ‘bundles’ of practices respectively by Stengers (2013) and Shove et al. (2012). The bundling can occur by overlap of elements (Shove et

al., 2012), such as when both practices of room-heating and cooking require the same material element – energy (Figure 5); or in the form of sequencing of different practices in time and space (Shove et al., 2009), i.e. establishing a daily schedule of cooking-eating-cleaning (Figure 6). Users develop routines across different activity-domains for plural reasons—reflecting meanings, taste, comfort, and resource maximization (Shove et al., 2012), as well as necessity, constraint, or obligation.

**Figure 5: Bundling by overlap of elements**



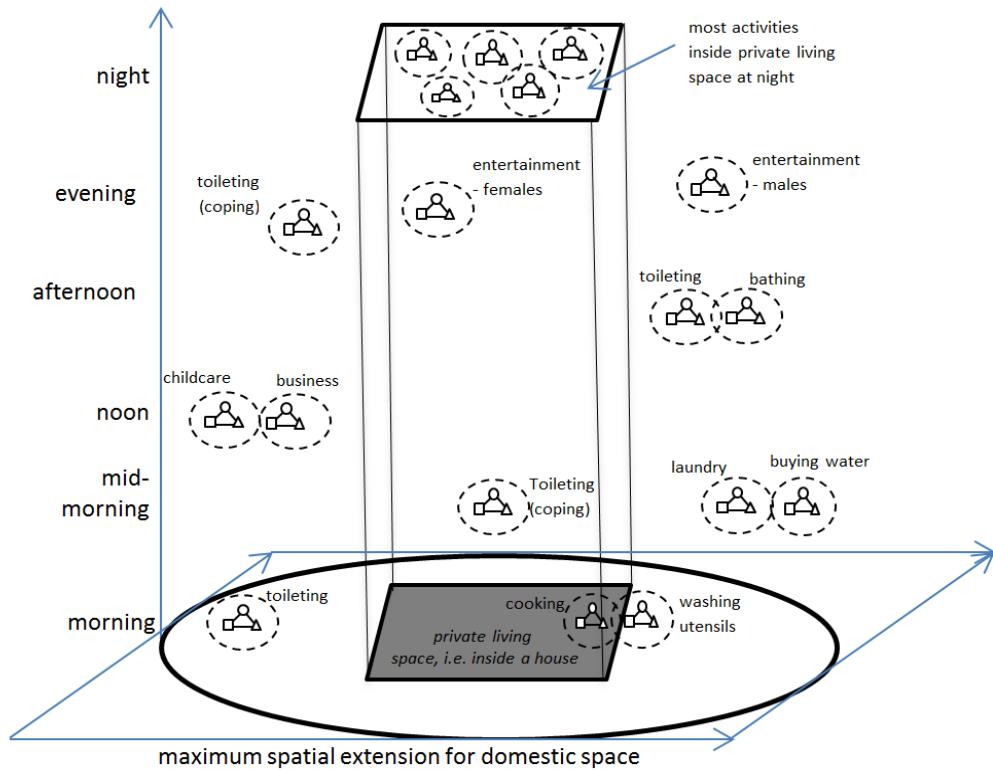
**Figure 6: Bundling by sequencing different practices over time**



The bundling of practices is significant for the maintenance, stabilization and reproduction of a practice (Watson, 2012). Bundling can become routinized and the consequences of the performance of routinized practices can persist in the temporal-spatial fabric of society (Jones and Murphy, 2011; Watson, 2012). The stabilization of arrangement of practice elements and bundles (socio-technical configurations), which scale up and gain momentum over time and in space, at some point become what they understand as ‘structures’ (Hargreaves et al., 2013: 408), or socio-technical ‘regimes’ in our perspective. Hence it is suggested that the disentanglement of the space-time provides a useful analytical approach to understanding the interplay of individual and structural constituents of social phenomena (Watson, 2012; Shove et al., 2012; Jones and Murphy, 2011). Though acknowledged as an important function, application of the time-space dimension has often been implicit or simplified in the analysis of practices. Operationalization of the time-space has largely focused on optimisation of time-resources as practices become “overall more demanding and hungrier of time” (Shove et al., 2012: 96). What we can see in the literature is that the main focus in analysing the everyday practice dynamics has been on structuring the temporal rhythms of daily life or on re-scheduling activities over time, (i.e. studies by Shove et al. (2009) and Watson (2012)). Less attention has been given to the space dimension. We suggest that the time-space, together, becomes a more critical element analytically in situations where practice elements—required to perform a specific practice—are diverse, often spatially dispersed, and their availability is precarious, as is the situation in basic service access in cities in the Global South, and more prominently in informal settlements.

How practice theory has been integrated into transition studies has been largely informed by empirical case studies from the Global North. Only three studies from the Global South are known to the authors, these being: Boamah and Rothfuß (2018) and Ulsrud et al. (2018) on solar PV in Ghana and Kenya and van Welie et al. (2018) on sanitation in Nairobi. In our view, the current application of practice theory to study sustainability transitions is not well suited for understanding practices in cities in the Global South because the contexts are fundamentally different: Basic service access in informal settlements is characterized by inadequate and inconsistent provision, there is high levels of poverty among users, and varieties of formal and informal service options co-exist. These aspects present a lot of difficulties and uncertainties for users. In contrast, in cities in the Global North, there is more certainty about how, where and when to undertake a task because conditions for performance of practices are rather stable. This is by virtue of reliable and adequate infrastructures, efficient monitoring of basic service systems, and much more stable financial conditions of most individuals with regard to accessing basic necessities (such as domestic water supply, solid waste management, and public transport). We could also argue that less socio-cultural diversity is a contributing factor. Contextual differences may require adaptation of analytical concepts. For example, in the analysis of sanitation provision practices in Global South cities, van Welie et al. (2018) had to specify five (instead of three) practice dimensions in order to adequately differentiate sanitation service regimes. Boamah and Rothfuß (2018) and Ulsrud et al. (2018), took a rather simplified application of a practice analysis by focusing on the interactions between beneficiaries and the novel solar lighting technologies. They paid less attention to the bundling of practices and everyday contingencies in space and time – aspects this present paper attempts to contribute.

For our empirical context, we find it necessary to bring out more explicitly the time-space aspects of practices in the analysis in order to deal with the uncertainties, fragmentation and the complex bundling of practices. From this perspective, we suggest that the introduction of an innovation leads to an intricate reconfiguration of the other normal inconspicuous activities and practices that the innovation competes with, replaces or becomes an embedded part of. Figure 7 uses the space-time path concept (Hägerstrand, 1970) to illustrate the bundling of practices over time and in space, yielding a typical representation of domestic activities in an informal settlement.

**Figure 7: Bundling of practices in time-space in an informal settlement**

### 3.2.2 Oscillating Domestic Spaces

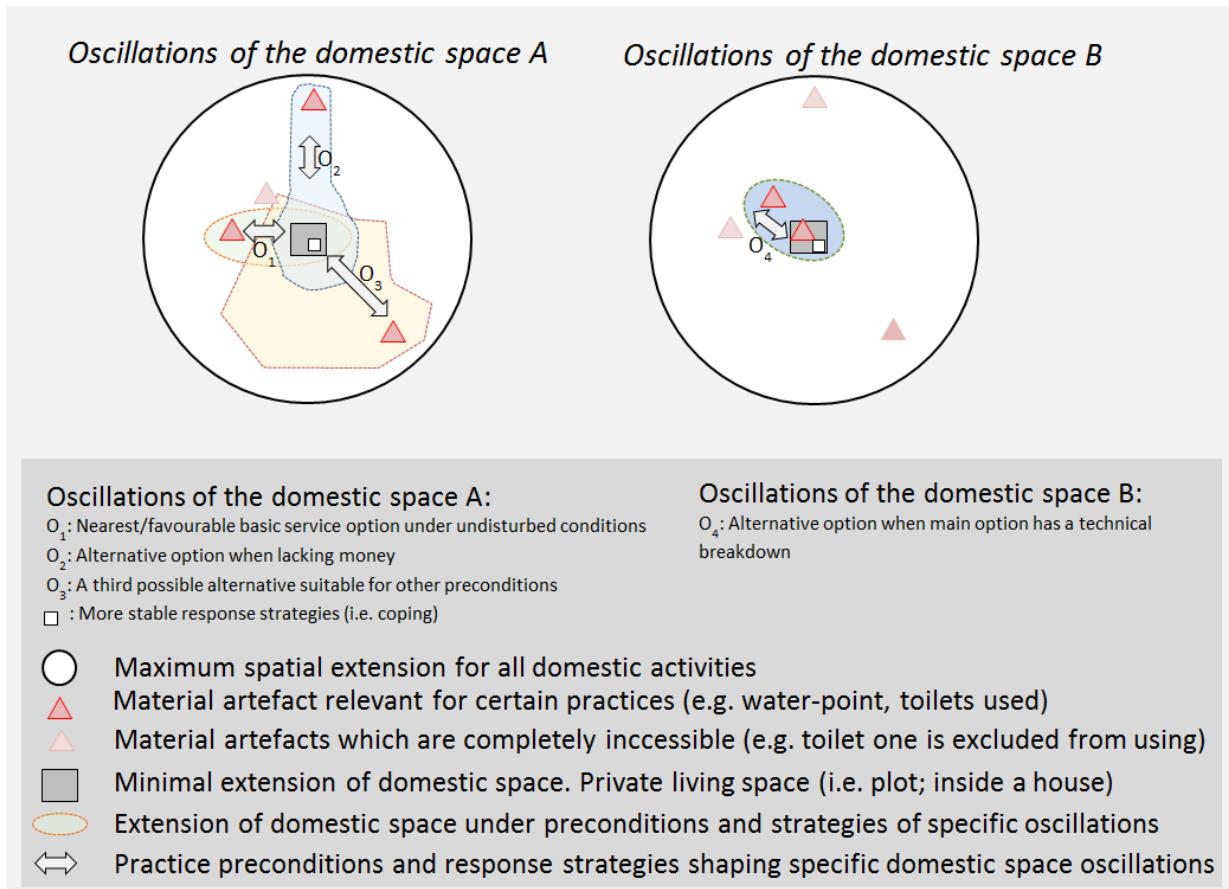
The analytical approach we propose enables an intricate and grounded analysis of practices. Domestic activities performed by inhabitants of informal settlements are constituted by elements and practice bundles arranged in time-space (Figure 7). We centre our analysis on a phenomenon we call the *Oscillating Domestic Space*.

We define *domestic space* as the social and material expanse related to making a ‘home’ in which people engage in daily, which is manifested in interactions with other people and the material world in time and space. It can be analysed within the spatial extension for all domestic activities (Figure 7). The domestic space *oscillates* because there are continuous fluctuations in the *practice preconditions*, those being the immediate contextual factors that enable performance of the practice of interest. This means that we cannot assume that people have the effective opportunity—the capability—to perform desired practices. As we will show empirically, people may have the know-how involved in a practice, without having the means and freedom to make use of it. This lack of effective opportunity to engage in activities that contribute to people’s well-being has been thoroughly discussed in the literature on ‘capabilities’ that builds primarily on the work by Amartya Sen (1993). We find that Sen’s ‘capability approach’ provides valuable insight on how to conceptually understand the uncertain and unstable opportunities for performing practices in

more precarious living, a consideration that we lack in current applications of practice theory. As we discuss later in this section, the fluctuations in preconditions result in daily changes in the actual possibilities for accessing the fragmented and unreliable service options. The attention to time-space enables us to identify the fluctuations: we see daily and seasonal, regular and irregular, predictable and unpredictable, individual and structurally-caused changes in the practice preconditions.

In response to the way the preconditions are unreliable and unstable, inhabitants in informal settlements have to develop and maintain multiple practice arrangements in order to successfully perform a domestic task. Hence, the Oscillating Domestic Space is our concept to capture these instabilities and to illustrate how individuals and groups rely on multiple but fragmented and unreliable service options to enable the performance of a practice. When the preferred option cannot be used due to a breakdown of linkages between practice preconditions (e.g. when a toilet cannot be used because of lack of water or electricity supply), people respond strategically by rearranging the possible linkages in time and space (e.g. by going to buy water elsewhere and bringing it to the toilet, therefore being allowed access). The person may also decide to use another toilet located farther away or even open defecation. Deciding among several uncertain service options can expend considerable time and effort. We thus see how people develop strategies for different situations to manage every domestic activity. These *response strategies* are dynamic and contingent upon creativity and innovativeness, and explain why people develop a portfolio of alternative options across space and time. Response strategy as a concept does not signify the practices in themselves, but explains how the multiplicities of more or less appreciated practices are developed and become stabilised.

Figure 8 shows how the domestic spaces are extended (the shaded shapes) under specific preconditions for practice and the response strategies applied (double-pointed arrows). Hence, if the practice of ‘going to the toilet’ is composed of material elements such as a public toilet (the triangles), the know-how for using a facility, and the willingness to use it because it is not too far and it’s clean enough, then the precondition for use is how all these factors shape the capability to access the toilet, such as: the toilet being open, the road being passable, the person having money to pay for access, and the service provider having water for flushing and hand washing. If the person lacks money on this occasion (a precondition), then the response strategy would be to go to another farther, and perhaps dirtier, option ( $O_2$  instead of  $O_1$  in Figure 8) where access is possible on credit. The shift leads to an aligning of a different set of practice elements in time and space.

**Figure 8: Visualization of Oscillating Domestic Space**

The fluctuations in preconditions can originate either locally or at other scales and organisational levels, including processes and events that cannot be managed or controlled by local actors (users, service providers) and may even be difficult to manage by higher-level actors (utilities, governments). But they affect practice preconditions locally in important ways. These external factors include weather-seasonality, activities of Non-Governmental Organizations (NGOs), political tensions, social instabilities, economic meltdowns, practices of (informal) service providers, land tenure situations, norms and legislation shaping gender roles and women's access to resources, ethnicity, religion, and governments' activities and mandates in informal settlements. For example the lightly shaded triangles in Figure 8 represent material artefacts that are inaccessible by certain groups (i.e. because of social isolation based on ethnicity). We will highlight these external factors only to the extent that they are relevant for understanding oscillations in the domestic space of our empirical examples.

### Practice preconditions in informal settlements

In line with Shove et al. (2012) we conceptualise practices as composed of three kinds of elements: materials, meanings, and competences, and suggest that the preconditions can be

identified as reflecting these. The actual practice preconditions we specify are: (i) functionality of service infrastructures and artefacts (materiality), (ii) the individual and shared socio-cultural norms and values, and local institutions (meanings), and (iii) people's competences, personal characteristics and contingent abilities. The three preconditions together shape the situated capabilities of individuals to perform practices. Here we align with Sen who highlights three 'conversion factors' (environmental, social and personal factors) that together shape capabilities (Sen, 1993). These correspond well with practice elements as defined by practice theorists. However 'capability approaches' bring additional valuable insights on how to conceptually understand the uncertain and unstable opportunities for performing practices in more precarious living, a consideration that we lack in current applications of practice theory. We share Sen's critique about insufficiency of approaches that focus narrowly on real incomes and commodity-bundles in assessing capabilities, such as in welfare economics (Sen, 1993). We align with Sen in our attention to the multiplicity of factors that shape the kinds of practices that are possible based on both personal and contextual factors in the immediate living environment as well as the wider economic, social, political and institutional context. However, we do not adopt the full Capability Approach because our analytical objectives are more modest. We are aiming to understand preconditions for safe, affordable and reliable toileting practices rather than evaluating the capability of bodily health (i.e. see Robeyns (2005)). We are looking at a specific link in a bundle of practices related to one aspect of health and wellbeing. Second, practice theory as it has been developed in conjunction with sustainability transitions has a 'socio-technical perspective' which is missing in Capability Approaches. We specify further three practice preconditions for informal settlements:

First, the *material functioning of basic service facilities is unreliable*, thus access is often uncertain. There are a number of reasons for this including sub-standard constructions (i.e., small piping systems), very high numbers of users per water-point, bathroom or toilet, and insufficient supply of water and electricity (Kariuki and Schwartz, 2005; Satterthwaite et al., 2015). These factors lead to frequent non-functioning of basic services and ongoing infrastructural challenges facing providers (Thieme, 2017; Otsuki, 2016). Furthermore, basic service offerings that are located in public areas are open only during regular business hours and remain closed at night (Amnesty-International, 2010; O'Reilly, 2016). Important to note is the lack of formally regulated provision protocols so that services are made available only at the convenience of the service provider (Kariuki and Schwartz, 2005). These conditions mean users cannot predict availability, forcing them to look for alternative options every other time (Lawhon et al., 2017; Schwartz et al., 2015).

Moreover, seasonal rainy conditions lead to deteriorated road infrastructure limiting movements of people and hence access.

Second, we acknowledge the *significance of individual and shared socio-cultural norms and values, and local institutions* in shaping practices. We therefore support the argument that introduction of new service offerings ought to be sensitive to formal and informal institutions ascribed to gender, age, class, ethnicity, religion etc. (Desai et al., 2015; Kulkarni, O'Reilly, & Bhat, 2017; Lawhon et al., 2014; Truelove, 2011). However, we would like to highlight that in the contingencies of everyday life in poor communities where people struggle to maintain their well-being, the link between social norms and practices is not very stable. Inhabitants often engage in activities and practices that are risky or which they find unacceptable, shameful, and not in accordance with what is socio-culturally expected of them. So far, this aspect has not been adequately explored in connection with the introduction of innovations. For example, the innovations may be accepted despite being perceived as culturally unfit. We understand the socio-cultural preconditions for practices to be full of tensions between plural and diverging meanings and obligations in everyday life, resulting in *hesitations between conforming with and bending the norms*. We find support for this argument in the work of Stengers (2010: 18), who emphasizes that “practices are not free from norms, but conformity is not the most important and does not determine the practice”. We see that in our context, practices are thoughtful ‘ways of doing’ that form in response to challenging conditions that prevent the development of easy, comfortable routines and, instead, force people to stop, hesitate, and reflect on meanings, options and outcomes (Stengers, 2010). Norms still matter greatly, but we suggest that they play a more ambiguous role than previous discussions on practices characterized by routine and conformity have lead us to believe. This calls for more intricate approaches in understanding how individuals dynamically position their practices in relation to norms.

The third precondition is that individuals have to possess the competence, personal characteristics and contingent abilities that are necessary for accessing services or engaging in specific practices. Competence or know-how is important (as prescribed by practice theorists), but there are additional factors such as mental, bodily and physical characteristics and abilities as well as economic realities that facilitate or hinder access (based on insights from Capability Approaches). We see physiological needs as salient capability aspects for access to material resources and services. These include sickness, old age, menstrual days and pregnancy. They may reduce people's physical strength and mobility and thus reduce the extension of domestic spaces for performing domestic tasks. They may also influence demand for services, i.e. menstruation may increase the need of water, cleanliness, comfort and old age may require close distance. Lack

of security, especially for women and girls who are vulnerable to sexual abuse, limit people's mobility and access to resources and services (Tilley et al., 2013). In the face of reduced mobility, greater need and security concerns, assistance from family and friends becomes important to enable access. Toileting is often an individual practice, but can also become a collective one under such circumstances. To gain access therefore, social relations become important. Further, we acknowledge that cities and informal settlements are generally very heterogeneous socially and culturally, creating a larger (compared to many rural settings) diversity of norms, values, beliefs, and perceived belongings (Gilbert, 2007). This creates diverse social spaces with variations of networks and overlapping hierarchies that influence possibilities for access. Additionally, informal settlements are typically inhabited by low-income communities that depend on irregular incomes. The majority hold a variety of casual employments, use savings and borrowings simultaneously, and save money using a mixture of formal and informal instruments (Collins et al., 2009). The irregular cash flow influences daily practices as most informal dwellers access water, bathrooms, and toilets based on pay-per-use offerings (WSUP, 2011; Corburn and Hildebrand, 2015). The intermittent incomes imply that people's financial abilities to manage daily domestic tasks are precarious and competing needs mean changing prioritizations. The third precondition therefore entails (in)capabilities in terms of *know-how, physiological needs, security, social relations and economic abilities*.

To summarize, we see oscillation of domestic spaces to mean that informal dwellers have to manage domestic tasks in a complex entanglement of constantly changing states between: functioning and non-functioning services, socio-cultural norms and pressures to break these rules, and thirdly, changing capabilities in terms of know-how, physiological needs, security, social relations and economic abilities. These preconditions interplay to shape the effective opportunities for performing particular practices. As a result, domestic spaces are constantly changing, partly in foreseeable oscillating rhythms, but more importantly in rather unpredictable ways.

### **Response strategies to precarious practice arrangements**

We identify four generic *response strategies* based on their institutional meaning and locus for action (Table 4). These are the strategic and innovative actions for rearranging the possible linkages between diverse practice preconditions in time and space to enable alternative access. Such actions highlight what people do when the preconditions for preferred options cannot align. Our categorization of response strategies by institutional meaning is inspired by our earlier argument that conformity does not determine practices. Rule breaking needs to be seen as important

dimension to understanding practices. Categorizing based on ‘locus for action’ enables us to explain how socially undesirable practices could still remain prevalent in society.

**Table 4: Response strategies are categorized based on institutional meanings and locus for action**

		<b>Institutional meaning</b>	
		Rule following	Rule breaking
<b>Locus for action</b>	Social sphere	<i>Negotiating</i> : actions to leverage social relations in the construction of and access to alternative options	<i>Contravening</i> : actions where individuals break rules to force access or to exploit an opportunity
	Personal sphere	<i>Navigating</i> : searching for alternative access options that require, in general, more effort on the side of the user	<i>Coping</i> : socially less intrusive actions that go against morally held beliefs and often result in feelings of shame

There are two proactive and socially congruent strategies that try to accommodate daily needs by finding alternative options to the preferred ones. We distinguish between those that can be adopted within personal spheres, that is navigating, and strategies for which social interactions become crucial, which we term negotiating. *Navigating* entails searching for alternative options to performing a practice and generally requires more effort on the part of the user. Examples include: only using facilities when at work or school or walking farther to find cheaper options. *Negotiating* encompasses actions to leverage social relations in the construction of and access to alternative options. An example is bargaining the terms of access in order to get cheaper access or to use on credit terms.

The other two strategies go against established rules and involve a higher risk of social sanctioning. *Contravening* encompasses those options where individuals break rules to force access or to exploit an opportunity. An example is when individuals break a water piping-system to access free-of-charge water, or when they trespass to access a public toilet. *Coping* represents a socially less intrusive set of options which entail practices that go against morally-held (public) beliefs and, if exposed, often result in feelings of shame. Coping is mostly done privately or secretly. Despite negative cultural connotations, coping is prevalent, i.e. everyone is doing it but few people acknowledge it publicly.

### 3.3 Methodology

We illustrate our analytical approach in the case study of access to sanitation in informal settlements in Nairobi, Kenya. Nairobi is a popular site for innovative interventions in the basic

service sectors. A growing interest by the private sector to complement the struggling public utilities has led to several novel sanitation innovations being piloted in the city (Kalan, 2011; O'Keefe et al., 2015; van Welie et al., 2019a), making sanitation in Nairobi an interesting case to study. We selected three villages<sup>19</sup> in three informal settlements for a detailed study: 'Mathare-Bondeni', 'Kahawa-Soweto' and 'Mukuru-Rorie'. The villages are selected based on the presence of small-scale sanitation innovations and new service offerings (Table 5).

**Table 5: Data on historical and demographic profiles and on sanitation innovations and new services**

Settlement	Year established	Population*	Innovation** As of December 2016
Mathare-Bondeni	1920s	A village of 2,500 people (part of the larger Mathare informal settlement of 188,183 inhabitants containing 13 villages)	<i>Fresh Life</i> public container-based toilet: introduced but not scaled <i>Banza</i> in-house container-based toilet: introduced but not scaled
Kahawa-Soweto	1980s	3,000 people (made up of the one village)	Shared Water-Closet toilets: five of the seven toilets not in use in over 5 years
Mukuru-Rorie	1998	A village of 5,832 people (part of the larger Mukuru informal settlement of 100,000 inhabitants containing 11 villages)	<i>Jitegemee</i> in-house container-based toilet: initial acceptance but very low levels of embedding 'Fresh Life' public container-based toilet: introduced and scaling slowly, with a lot of challenges

\* Source: Karanja and Makau (2012)

\*\* Only *Jitegemee* will be elaborated in more detail in the results section to exemplify the heuristic value of our analytical approach. Experiences with the other innovations and new offerings will only sporadically be exemplified.

The first author collected data in Nairobi in five-month period: February and March 2016 and October to December 2016. In order to investigate sanitation practices, we needed multiple types of data. The first data-set investigated women's everyday domestic tasks. We focus on the women because they are primarily responsible for domestic tasks in the informal settlements of Nairobi and are considered to be disproportionately affected by sanitation challenges. The respondents are 32 women who were purposively selected with the help of a local contact person in the three villages. Our initial approach was to select respondents to represent use-experiences with specific toilet-types (e.g. public by NGO, public by social enterprises, shared, private-sewered, private-onsite, new offerings or other). However, the categories could not be precisely used as most residents tended to use more than one option in the course of a day. Therefore, we shifted towards getting a complete picture of all possible alternatives used by the interviewed

<sup>19</sup> Our analytical level is based on the conventional practice in Kenya that innovations are often introduced to community groups based on lowest administrative structures in informal settlements—the villages.

respondents and possible within the study areas. Among the interviewed women, five were beneficiaries of a novel container-based toilet known as 'Jitegemee' which is highlighted in the results section. Investigations focused on how they interact with persons and (new) artefacts in order to successfully manage domestic tasks in time and space, and what this means for them personally and for their livelihoods. Domestic tasks include, but are not limited to, cooking, washing clothes, cleaning utensils, childcare, fetching water from a water kiosk, bathing, relaxing after finishing domestic chores, and toileting. For the informal settlements context, we consider toileting a domestic task as it requires time and mobility to reach the toilet artefacts, it competes with other domestic tasks for resources (i.e. time, money), and daily negotiations and navigating are required to gain access. We used semi-structured interview schedules as the main form of inquiry. Interactions with each interview respondent lasted 65 minutes on average. We followed the interview schedule but the interactions were less structured sometimes allowing breaks, changing the order of questions or incorporating transect walks with the respondents. This allowed them to freely share as much as they wished in a form they were comfortable with. As sanitation is sometimes perceived as a shameful topic to openly discuss, creating a flexible interviewing environment enabled respondents to open up and to give more personal views. Interviews were complemented with observations of where, how and when the domestic tasks are carried out. Also complementing the interviews were two initial exploratory Focus Group Discussions (FGDs) with women during the first fieldwork, and three for validation at the end of the second fieldwork. The first author conducted the interviews in the local language, Kiswahili. All these interviews were conducted in the informal settlements, mostly in the homes of the respondents. As such, the first author also spent considerable time in the villages observing and experiencing everyday situations and conditions. The interviews were recorded and later transcribed then translated into English.

A second data-set for additional perspectives of the three villages included inquiries with 22 NGO representatives, 3 community health extension officers, 9 local administrative leaders and 3 male residents. Our primary focus was on women. However, we sought the perspectives of the male inhabitants in order to corroborate some of the gender-related responses that arose during the interviews. The full list of anonymised interview respondents is presented in Appendix A. The respondents are referred in the results section with code names (e.g. MB1 for Mathare-Bondeni respondent 1, FGD1 for Focus Group Discussion 1, ...).

The interviews and notes were coded by means of MaxQDA-12 software. The coding process led to an extensive coding scheme covering domestic activities, sanitation activities, internal and external factors influencing access, practice preconditions, response strategies and experiences

with new service offerings. This data was coded using an iterative process based on the original practice theory dimensions and with additional dimensions we derived from the data that helped to define our concept of Oscillating Domestic Spaces. The second and third authors participated in analysis of data, resulting in joint reflection on and discussion about the interpretation of findings.

Before we go to the results, we explain the choice to present the stories of three women among the 32 interviewed and how we practically applied our analytical framework. Presenting the three stories in a descriptive way is intended to provide the reader with a detailed picture and understanding of the context and preconditions for performing practices. To practically apply our analytical framework, we start by mapping the physical outline of the spatial extension for all domestic activities. We use the family house as the reference point,<sup>20</sup> hence the family house represents the minimum domestic space extension. In Nairobi's informal settlements, however, various domestic tasks are undertaken outside—in front of the house, in the yard, or in public spaces such as next to the street, fields, pathways and at service-points. Small housing units, often one or two-roomed family houses, leave little space for domestic tasks. Moreover for convenience, householders prefer to attend to domestic tasks at service-points; i.e. laundry at the yard-taps and water kiosks rather than carrying water to the house, a tedious and cumbersome task. We, then, can spatially and temporally relate the defined domestic space to the recurrent practice of toileting.

### 3.4 Results

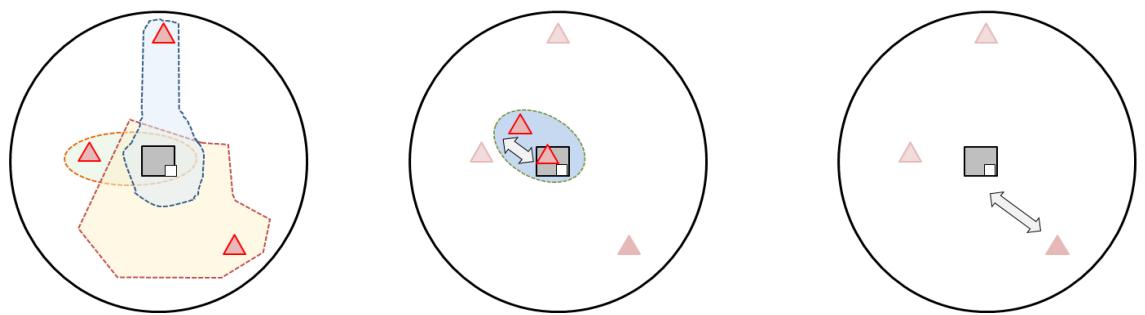
In Section 3.4.1, we describe the everyday life of the three women and how they manoeuvre access to toilets as they go about other domestic activities in time and space. We highlight ‘in brackets’ how the data corresponds to analytical categories. Because the stories of the three women do not capture all the findings from our data in terms of plurality of situations, with varying preconditions and response strategies, we make a summary in Section 3.4.2 that provides some generalizations based on all 32 interviews. Section 3.4.3 exemplifies the heuristic value of the analytical approach using the case of ‘Jitegemee’, a new container-based toilet which is designed like a bucket and consisting of an airtight lid.

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<sup>20</sup> This makes our analysis comparable with previous socio-technical studies where domestic living spaces are conceptualized. Examples include: Khalid R and Sunikka-Blank M. (2017) Homely social practices, uncanny electricity demands: Class, culture and material dynamics in Pakistan. *Energy Research & Social Science* 34: 122-131., Eon C, Breadsell JK, Morrison GM, et al. (2017) The home as a system of practice and its implications for energy and water metabolism. *Sustainable Production and Consumption.*, and Strengers Y. (2013) *Smart energy technologies in everyday life: Smart Utopia?*: Springer.

We visualise the domestic oscillations of the three women in Figure 9 on the basis of empirical data, and label these as Case 1, Case 2, and Case 3. The illustrations emerge as representative examples from our empirical material and are thus context-specific to Nairobi's informal settlements. Case 1: Clara is a woman with several possible alternatives within the maximum extension of domestic spaces but she lacks an in-house option. Case 2, Hanna, is a woman with an accessible in-house or on-plot option. Case 3, Grace, is a woman with several toilet artefacts within the maximum spatial extension but the preconditions do not allow access at any given time.

**Figure 9: Illustrations of oscillations in the domestic spaces of three individuals who have similar maximum domestic space extension**



**Case 1: Clara** has several toilets within the maximum domestic space extension

**Case 2: Hanna** has a toilet within the minimum domestic space extension (in-house)

**Case 3:** several toilet artefacts available within the maximum domestic space extension but none is accessible to **Grace**

### 3.4.1 The stories of three women and their activities in domestic space

#### Case 1: Clara

The 36 years old Clara has several possible toilet alternatives within the maximum extension of her domestic space but lacks an in-house option.

Clara lives in Mukuru-Rorie in a two-roomed house together with her husband and 3 children. Clara is dependent on irregular casual jobs for an income; among them is a weekly journey to a smaller town about 100 kilometres from Nairobi to sell second-hand clothes. Clara's husband works in an industry nearby on a temporary and casual basis.

On a regular day, she goes to a middle-class neighbourhood nearby where she waits outside the entrance for a potential domestic job for the day. She comes home empty handed more often than she manages to get a job (income uncertainties). Clara gets up at 6am, and twice a week she goes to a large second-hand clothing market downtown to buy her business stock. She performs regular domestic tasks everyday like purchasing water and cleaning utensils and clothes from a

nearby kiosk (spatial extension). She finishes her domestic tasks at 10am, after which she visits friends in their houses or goes out to look for any casual jobs (navigating for an income).

*"Visiting friends is nice. You get to know what is going on in the village (...) that's how you easily get involved in community projects, (...) maybe an NGO is having a workshop and you get a little money"*

There are about 3 public toilets Clara and her family can access within her maximum spatial extension. She does not have access to a private toilet. A public toilet about 20 meters from her house is indefinitely not in operation due to internal group management problems (unreliable artefacts and infrastructures). Other alternative public toilets within her domestic space are, respectively, 20 and 50 meters away. One of them is a 'Fresh Life' public toilet, a new option provided by a social enterprise. Whenever Clara has money, she prefers to use the 'Fresh Life' which she finds very clean and smells fresh. But when she does not have money or late at night when the 'Fresh Life' is closed (time/space oscillation), she will use other options which she may consider very dirty (oscillations based on time/space, money, and service-hours; navigating). At night when Clara cannot go outside (time/space oscillations relating to (in)security), she responds to the limitation by using the 'flying toilet' strategy (coping).

*"At night? Which choice is there? You just use 'flying toilet' (...) sometimes you find someone has dropped it outside your door. (...) if you see a nice shiny plastic bag lying on the street, do not trust it!"*

Clara and the family have a routine to visit the toilet right before it closes at 10pm (navigating). This way, there is a possibility of getting through the night without needing a toilet.

Clara was one of the beneficiaries of an innovative in-house container-based toilet named 'Jitegemee', about 2 years earlier. She stopped using it and stored it away when her children started attending boarding school. She found it to be useful only for the children (socio-cultural meaning). For herself, she preferred to find ways to 'navigate' access by asking friends, going to the local bar, or just 'holding' until morning (navigating). For her, the new task of disposing the faecal waste at a toilet and then cleaning the container was unpleasant, time consuming and also consumed too much soap and water. Nonetheless, she uses 'Jitegemee' whenever she is unwell ((in)capabilities related to physiological needs). Also, Clara still uses 'Jitegemee' despite the negative socio-cultural perception attached to it (bending socio-cultural norms), but her husband would never use it (socio-cultural meaning).

*"My husband said he will not use it. Men here refused to use it (...) they said that it is a 'potty' for children (...) you know the houses are small so my husband cannot use it here and the children are here. (...) even in the bathroom he cannot use it there, he prefers to walk around even at night to find an option outside (gender-specific extension of domestic spaces; navigating)"*

*'When Jitegemee' was introduced we (the women) were not shy to use it. We didn't have other options, toilets were very far away. Now that we have more public options we question and laugh at ourselves really what this is that we used" (bending socio-cultural norms)*

For Clara, knowing people who manage toilets is very important as one is able to use the services on credit when without money. Previously, her friend used to operate a public toilet. Her family would use this specific one whenever possible (access based on social relations).

*"It was nice because my children would go to this toilet whenever I was not home to provide them money for the toilet payment. I would later pay this friend the accumulated amount" (navigating).*

Increasing insecurity in the neighbourhood often limits Clara's movement. Interestingly, insecurity conditions fluctuate. When insecurity becomes unbearable, community members often mobilize themselves to deal with the suspected offenders, who are sometimes local community members.

*"After such an operation, the community is much safer but after some time we start fearing again (...) right after those operations you can walk around even in the night (and go to the toilet) and no one will touch you" (time/seasonal oscillation related to (in)security).*

The security situation disproportionately affects women and girls. Clara's 16 year-old daughter is more vulnerable in public spaces, and her mother worries about issues of sexual harassment (gender/age-related differentiation in oscillations). Clara navigates this situation by making sure she accompanies her daughter to the toilet when it gets dark (navigating).

Clara's husband prefers to use the toilets at his workplace every morning to avoid the morning hassle of looking for a functioning toilet (navigating). This saves costs as well. In the evening when he comes back from work, it is common for male adults to spend time at the local social hall to follow the news on TV, where they get free-of-charge toilet access (gender-specific extension of domestic space; navigating). Clara's role as a homemaker means she deals more with the everyday access challenges. As a woman, she is also expected to meet her toileting needs in more private areas compared to male counterparts (gender-related cultural constraints). Furthermore, to meet her menstrual needs, Clara would require more toilet visits (temporal oscillation based on physiology). Clara thinks these differences are the reasons why toilet management groups are populated by women. *"It is an important way to survive for the women"* (navigating). Clara's engagement in the past in a toilet management group helped her to expand access opportunities as she became a trusted person and thus could use toilets at a cheaper rate or even cost-free (access based on social relations; navigating).

### Case 2: Hanna

Hanna, 49 years old, has an accessible toilet within a minimum domestic space extension.

Hanna lives with her husband and 8 year-old grandchild in a two-room apartment block in Mathare-Bondeni. Hanna has been selling peanuts for a living on the main street within her neighbourhood for the past seven years. Hanna's husband is a mason worker, meaning his job takes him out of town for weeks, followed by an unemployment period until he finds another masonry contract (income uncertainties). In this case, Hanna is happy that her stable but low-income business sustains the family during her husband's unemployment periods.

Hanna often wakes up at 6am, prepares her grandchild for school, then carries out domestic tasks. She does most of these tasks inside her apartment (minimum domestic space). Mid-morning she roasts the peanuts before subsequently spending all afternoon selling. Hanna has an in-house pour-flush and sewer-connected toilet. Compared to her previous house in the same area, where she had only off-plot public toilet options, life is less difficult.

*"Even if we got used to the previous life, now I see that I had to do a lot of things, sometimes you have to carry your own water to the toilet, sometimes you have to walk so far away (unreliable artefacts and infrastructures; navigating). When we didn't have money to pay for the toilet we would go down to the river to defecate when it was dark (time/space oscillation based on economic precarity; coping) (...) the toilets were also very dirty, (...) it was very hard especially in the beginning in 1986 when I had just arrived here from my rural home".*

The cost for maintaining the in-house toilet is included in the rent therefore she does not have to make any daily payments for access. Hanna does most of her domestic tasks inside her house because it is spacious and she has an in-house water connection. However, water shortages occur often. Hanna has to rely on water kiosk services often (unreliable artefacts and infrastructures; navigating). She sometimes cleans clothes at the water kiosk. Over the seven years she has lived in the apartment, Hanna has not experienced any problems with the toilet and therefore she has never required alternative options. And because her small-scale business is only a few meters from her apartment, she prefers to walk back home during the day whenever she requires toilet access. Interestingly, one of her daughters who lives nearby (MB8) often uses Hanna's toilet (access based on social relations; navigating) to save on costs from public toilet use.

Hanna is aware that her in-house toilet is connected to a broken sewer that leads to the local stream nearby, and which by this contributes to the unhealthy and unhygienic environment where she must spend most of her day (know-how about health and hygiene). However, she lacks

capacity on her own to improve the sewerage problem (external condition that contribute to oscillations).

### **Case 3: Grace**

For Grace, 40 years old, there exist several toilet artefacts within maximum domestic space extension, but she can never access them (or only has access on very few occasions as a response strategy).

Grace is a widow who lives with her 6 children in a one-room house. Grace is the sole breadwinner of her family and depends on irregular casual jobs for an income. Having a large family and relying on irregular jobs means that Grace and her family live ‘from hand to mouth’ (income unreliabilities).

*“Yesterday when I woke up, I had a little sugar that had remained from the previous day, so I made breakfast for my children (...), lunch I didn’t have anything..., whenever I am successful (to make some money during the course of the day) I stock up for two or three days - I buy sugar, maize flour, and the firewood that is lying outside the house. We can then have a meal and sleep..., the days to follow God will provide”.*

On a regular day, Grace wakes up at 5:30am to prepare breakfast for her children. The children will help each other get dressed, have breakfast and within an hour head out to a nearby school. A two-year-old child remains at home and accompanies Grace all day. Grace then tidies her one-roomed house, takes the dishes to wash along a public path, and once every two days she washes the dirty clothes that have accumulated. She washes the clothes at a water-point about 100 meters from the house (spatial extension). When Grace finishes her domestic tasks between 9am and 11am, she visits friends and neighbours to check if she can get a job for the day (navigating for an income).

*“There are no jobs; even now I was just about to leave the house to ‘hustle’. I just arrived back from a job I was given to clean the church. Now I want to go to the village-centre and see if I will meet someone else who can have a job for me (...) perhaps a farming job, as it is raining right now (...), whatever job comes I will take”.*

Grace and her family are not part of an agreement to use shared toilets that are found close to her house (limitation on social relations). She does not own a private toilet. The closest public toilet to her house is about 500 meters away. Grace considers the toilet too far away and so she does not use the option.

*“We do not have access to a toilet (...), we just try and ask around from neighbours (access based on social relations; navigating), I ask one neighbour today, another tomorrow, all my children do the*

*same, it becomes hectic for us and the neighbours (limitations on social relations), so for my children when time allows (i.e. at night – time/space oscillation) I let them use plastic bags (coping) which we dispose into the solid waste (...), all other private and shared toilets, including that of the church nearby, are ‘padlocked’ (...) even for a pay they will not allow non-congregants (limitation on social relations). The only one that we are able to use for a pay is very far (...), we cannot go all the way there to use the public toilet, it is just too far (...), this whole area does not have a public toilet (...) at night you would not want to wake up your neighbours (time/space oscillation) so we do ‘what we can’ (coping).”*

For Grace, if there was a public toilet within her domestic space extension, she would regard herself as having some access although she states that she still might not always be able to afford daily access for her entire family (economic uncertainty). Also, considering the demanding obligation to take care of her large family, Grace is not in a position to invest in sanitation by buying a toilet, building a toilet or getting membership to a shared toilet group. Furthermore, lack of space to construct and being excluded because she belongs to a minority ethnic group limits her access possibilities (limitations based on economic means or social relations).

*“So where can I build and this room is so small even to live with my children? There is no space. (Also) I have tried to speak with neighbours to collectively get space for a toilet (negotiating), but my neighbours are of a different ethnicity, they will not want to invest with me.”*

### **3.4.2 Relating the stories of the three women to the complete set of interviews**

As the stories of the three women cannot capture all the findings from our data in terms of plurality of situations, preconditions, toileting options and response strategies, we now relate their experiences to those of the other 29 respondents.

We can see that daily precarity in practice preconditions is common-place for all three cases and that gaining and maintaining access depends largely on how they deal with the fluctuations by applying diverse response strategies. Despite the three cases representing what we see as different positions on a spectrum, (i.e. Clara has many options, Hanna has one main option and Grace has no regular option), we see that Clara and Hanna are involved in frequent situations when preferred options fail and alternatives are sought. For Grace, some form of access is acquired despite lacking connection to any toilet option. These are indications of fluctuating preconditions for practices, resulting in a multiplicity of more or less accessible and appreciated options.

For case 1, which represents a situation with a multiplicity of alternatives, there are many fluctuations and aligning preconditions to enable a practice requires a lot of effort and even luck. Clara therefore has to use coping, navigating and negotiating strategies. From the other 29

interview respondents, some<sup>21</sup> that can be categorized as having spatial conditions similar to Clara engaged in the following response strategies: (i) Negotiate: request for cheaper or on-credit access, group visits to toilets, and use on credit. (ii) Navigate: use options managed by women, routinized toilet visits, use toilets at work, walk further to cheaper/cleaner toilets, temporary use of culturally unfit artefacts (i.e. in-house container-based toilets), use friend's toilet, engaging in toilet management groups. Sometimes when several preconditions allow and align, people get the opportunity to use the more convenient, the cleaner or their most socio-culturally desired options. (iii) Cope: open defecation, flying toilet, dumping faecal waste from container-based toilets into drainages. (iv) Contravene: forced public toilet access by breaking doors, using more than paid for.

For Case 2, despite Hanna having a toilet at home, it depends on external infrastructures to function, i.e. when water is unavailable for flushing and she must find an alternative source in order to maintain hygiene. Other interview respondents who like Hanna have an on-plot option gave situations of access precarities when response strategies have to be used. For example, shared on-plot toilet users negotiate the maintenance of toilet facilities among themselves. An illustrative example is that of one respondent who has taken over everyday maintenance of a number of shared toilets, and in return obtains privileged private access to one (MR1). Response strategies mentioned in this category include: (i) Negotiate: get exclusive access in exchange for cleaning services, use a friend's toilet when their septic/pit toilets require faecal waste emptying service. (ii) Navigate: use public toilet when running domestic errands away from the house, choosing to use less preferred option (e.g. a container-based toilet) when regular option is not functioning, use kitchen waste-water for flushing and incremental improvement of existing toilets. Example of an incremental improvement is changing from a pit to septic-tank toilet or connecting to a sewer over time (iii) Cope: open defecation and flying toilet when on-plot pit latrine needs faecal waste emptying and cannot be used.

The Case 3 provided a useful illustration of how social (in)capabilities enable or limit access. For Grace, despite the presence of several toilets artefacts within her domestic space, she could not access any of them because of her social belonging to a marginalised ethnic group or being a non-congregant of a nearby church and therefore being excluded. The other 29 interviews include some respondents with similarly limited access. Stories of the development, over time, of common locations where open defecation is done—so called ‘hotspots’—were prominent among

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<sup>21</sup> We refrain from giving precise numbers because we see the 29 women to be evenly positioned along a spectrum of domestic space oscillation dynamics. Further, our interest is to show similarities at different points of the spectrum rather than pointing out differences.

these respondents. The women accompany each other to these open locations. This way, despite it being a non-desired response strategy involving shame, they make it into a structured practice of going together (FGDs 1 & 3). This illustrates how response strategies may change norms and result in the emergence of new practices over time. Open defecation can under these circumstances be categorized as a collective practice with distinct recognizable elements. People have an understanding—the know-how—about how, where and under what circumstances open defecation is done (FGD 3). The same phenomenon is illustrated by the ‘flying toilet’ whereby many informal dwellers have shared understanding of how to undertake the strategy. The response strategies mentioned by other respondents with similar experiences as Grace includes: (i) Navigate: use friend’s toilet, use at work, and accompany each other to open defecation hotspots. (ii) Cope: establish open defecation ‘hotspots’, use ‘flying toilets’.

Two general observations, related to response strategies, are worth mentioning. First, response strategies can become stabilized and transform into long-term strategies or permanent solutions. For example, people negotiate with neighbours to invest together to construct new toilets. They also negotiate to gain membership to a shared/public toilet group, and as well negotiate with service providers for flat-rate monthly payments by families instead of the regular pay-per-use. Second, there are benefits from response strategies that spill (beyond only toileting) over to other domestic activity-domains. For example, joining a toilet management group enables other joint activities like savings, which contribute to ‘earning a living’ (MB3, NGO rep 1) .

### **3.4.3 Implications of Oscillating Domestic Spaces on embedding of ‘Jitegemee’ toilet**

To exemplify the heuristic value of our analytical approach, we use the case of the ‘Jitegemee’ container-based toilet. It is designed like a bucket and consisting an airtight lid. ‘Jitegemee’ was introduced as an in-house family solution in two informal settlements in Nairobi in 2011. The ‘Jitegemee’ was envisioned by the innovators and providers as an environmentally-superior option to replace open defecation and other unhygienic faecal disposal practices, and also a more decent alternative enabling toileting in the privacy and safety of homes (McSorley, 2012). The users were required to take the container to a public toilet where they would pay to dispose the waste. ‘Jitegemee’ was designed by engineers from an international NGO in 2009, and in 2011 a user-needs survey was conducted before its introduction (McSorley, 2012; Mohanty, 2018). The approach was novel as existing approaches at the time only focused on constructing permanent off-plot public toilets. The NGO piloted 60 ‘Jitegemee’ units, giving them to families in Mukuru-Rorie. Based on interviews with the beneficiaries, there was initial acceptance but very low degree of embedding in the long-term. Of the five interview respondents with experience of ‘Jitegemee’,

none perceived it an adequate single option. Two respondents (MR2; MR3) used it only on very few occasions and the other three (MR10; MR11; Case 1) had completely abandoned it – keeping it stored away or re-purposing it as cleaning and storage containers.

Initially, when the ‘Jitegemee’ was offered, the beneficiaries were very enthusiastic about it and eager to use it. They explained in a group discussion (FDG 4) that they were even confident to show themselves as users in a national TV program that featured the innovation. However, over time, as other conventional services became available (conveniently located public and shared toilets), they stopped using ‘Jitegemee’. An interview respondent (Case 1) and her neighbours only later questioned and laughed at the idea that they had accepted and used it for a while, despite perceiving it as not conforming to their socio-cultural norms. This example shows why it is problematic to assume that practices are based on conformity and neatly-mirrored norms, values or beliefs. There is a more ambiguous relation between what people do and what they see as appropriate, desired, or good, especially when conditions do not permit consistent options. Sometimes, novel service-offerings are accepted even though they are perceived as socio-culturally unfit or involve shame.

Secondly, the ‘Jitegemee’ service option was made useful as an ‘add-on’ to create a more diverse portfolio of alternatives rather than as a permanent replacement of previous practices (MR2, MR3, and FGD 2). ‘Jitegemee’ was not entirely reliable and fitting for all sorts of daily constellations. In addition, the respondents perceived a complete shift to a new option as risky. The majority still maintained the seemingly inferior options that have proved meaningful and useful in specific precarious situations. Households used ‘Jitegemee’ in specific but limited situations—as a full-time solution for children and as an emergency option for female adults on certain occasions. To the knowledge of the respondents, men refused to use ‘Jitegemee’ (MR2; Case 1). The different ways ‘Jitegemee’ was appropriated by household members did not correspond to the expectations of providers to become a ‘family solution’. For the women who used ‘Jitegemee’ occasionally, they still reported other situations when they were still forced to opt for open defecation (MR2, MR3, and FGD 2). The preconditions for making use of ‘Jitegemee’ do not always align with each other. For example, a female household member is not able to use it in the evening when the entire family is sitting inside the one-roomed house—she may thus resort to open defecation outside (CHEO 1). So even if ‘Jitegemee’ is available in the home, its use depends on alignment of the artefact with other practice preconditions. Therefore, the process of embedding new services or artefacts should not only be understood as providing users with the superior artefact, but also as the provision of an additional option that often

demands thoughtful re-arrangements of time-space, social and economic patterns in the Oscillating Domestic Spaces.

Thirdly, interview respondents indicated that the introduction of the 'Jitegemee' may also have increased the practice of dumping faecal waste into open drainage. The inability by users to adapt the faecal waste handling system for 'Jitegemee' undermined the idea of an environmentally friendly alternative. Safe disposal required the unpleasant tasks, by users, of taking the container across the neighbourhood to a disposal-point and cleaning it afterwards. Also, their precarious incomes did not allow the users to consistently afford the daily payments for disposal services. Therefore, users were forced to frequently resort to unsafe dumping to avoid shaming and whenever they lacked money (MR5; MR9; MR10).

### 3.5 Consequences for research and practice

The lack of attention to contextual conditions and users' daily realities can explain why seemingly superior innovative options fail to successfully substitute existing undesirable practices like open defecation in Nairobi's informal settlements. We have been able to make sense of the complexity of everyday life in informal settlements and how embedding of new service offerings works by means of a socio-technical, context-sensitive, and actor-centred approach – namely the Oscillating Domestic Spaces. We suggest that a fruitful approach to introducing an innovation would be to consider the process as a situation that pushes users to reflect on a wide range of constraints, opportunities, and priorities in the entire domestic space. As such, new service offerings should be implemented with a well-informed picture of contextual conditions for practices. This view is actually shared with the innovators behind 'Jitegemee' who consider the initial introduction to be a pilot R&D phase. They are taking lessons from the user-experiences to further develop container-based solutions that would be appropriate for different informal settlements in Nairobi<sup>22</sup>.

*"Me as an engineer designing a toilet, with no community consultation or engagement, was so obviously, a limiting factor and a shortfall. Perhaps fortunately, despite this, it wasn't a failure. This project was an outstanding example of a strong R&D with lot of useful learning."* (Mohanty, 2018)

Further, we suggest that when innovators undertake a market survey, the inquiry should result in a dialogue on the degree of complexity, competing needs and obligations, and the range of considerations for users when they make actual choices.

<sup>22</sup> 'Jitegemee' is collaborating with 'Fresh Life' to develop further container-based solutions in Nairobi in terms of design, functional waste management systems and scaling opportunities. See Oxfam. (2016) Container based sanitation could solve the world's toilet problems. *Oxfam Policy & Practice Blog*. Oxfam.

Our study also shows that in informal settlements users cannot be easily categorized in binaries like individuals ‘with specific access types’ or those ‘without and without access’. This is because under the quickly changing and precarious circumstances, users often depend on multiple types of access options in the course of a day. We suggest that because of this service fragmentation and because of ambiguity in social spaces, one finds a plethora of finely splintered and highly dynamic dispositions among inhabitants instead of rather well-segmented and well-behaved ‘markets’. Categorization is, however, often done in innovation management in order to identify specific market segments, such as those that lack technical facilities, those whose values align with the new service offering, and those who have a critical ability to pay. Market segmenting of this kind often rests upon the assumption of stable practice preconditions. This finding also supports our critic of the linear and mechanistic ‘sanitation ladder’ which is used in estimating access levels in the Sustainable Development Goals. The complex overlap in the utilization of different access levels requires careful considerations. Also in consideration of our critic of insufficient accounting for precarities, we suggest that an estimation of ‘the population using improved sanitation sources which are *available when needed*’ can be added into the list of SDG sanitation indicators. Current indicators maintain the assumption of facilities being either permanently available or absent.<sup>23</sup>

In view of our findings, we derive four important lessons on how innovations can be more successfully embedded. The lessons relate to: (i) users playing proactive embedding role, (ii) ‘acceptance’ and ‘embedding’ as distinct processes, (iii) successful embedding is dependent on broader material and social structures, and (iv) the need to innovate together with people who are knowledgeable about application contexts.

First, users are not passive adopters of innovations but conscious, proactive and often capable managers of their livelihoods in quickly changing and resource constrained contexts. In this sense, a preference by users for a diverse portfolio of alternatives and a partial uptake should not be perceived as a failure. The desired outcome of innovators to have a superior offering quickly substituting an inferior represent the passive view on user agency. Users will often experiment and proactively embed an innovation in a way that best fits to and supports their entire domestic practices and livelihoods opportunities. Therefore, users may often experiment with a new option but cautiously still engaging in old (sometimes inferior) practices that have proved meaningful in the past. They are cautious to see that the new offering can deal with all sorts of conditions and oscillations. In some cases, the perceived advantage of an innovation may

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<sup>23</sup> For a comprehensive list of the indicators (i.e. the 10 ratios), refer to WHO/UNICEF. (March 2018) JMP Methodology 2017: Update and SDG baselines. WHO/UNICEF.

be outweighed by the range of competing obligations, priorities, and handling of logistics and risks. Further, not only does substitution require that users make considerable effort and expend resources, it may also be impossible due to practice preconditions that are influenced by challenging factors that are beyond the user's control (such as lack of infrastructures—roads, water, housing and electricity). The innovation, therefore, may be found to be appropriate just under specific situations of oscillating domestic spaces, thus leading to an incremental improvement or being appropriated in a different way from the vision of the innovator. At an aggregate level, innovators should keep in mind that the proactive appropriation processes by users can also cumulatively reshape societal practices, values and norms or further reproduce the multiple and fragmented nature of service provision options. An example on reshaping societal practices is when 'response strategies' become stable practices. The continued perception by users that any new service offering could best function as 'add-ons' exemplifies the further reproduction of fragmented service options.

Second, 'acceptance' and 'embedding' have to be seen as distinct innovation phases. Acceptance is when users attribute positive meaning to a novel service option. This can be acquired even before having any practical experience with the innovation (i.e. convincing potential users through an education program that 'Jitegemee' is an environmentally superior and a convenient alternative). The attribution of positive meaning, however, should not be seen as sufficient indicator for successful embedding. Embedding only happens when users actually integrate the novel option into their Oscillating Domestic Space such that they are satisfied with everyday efficiency and convenience. Innovators and service providers could still facilitate the embedding process, for example by making practice preconditions more stable and reliable (e.g. providing a consistent disposal location for wastes from 'Jitegemee', and adapting the logistics for disposal to fit with other domestic activities).

The third lesson for innovators is acknowledging that successful embedding is dependent on broader material and social structures. In our case, embedding of 'Jitegemee' required significant rearrangement of interlinked activities in the domestic space. As such, a broader consideration about how an innovation influences other domains of everyday life and the wider community context (and vice versa) can give useful insights. For example, an innovator may present a solution for a problem in one activity-domain but create new social and technical problems for the entire domestic space: an increase of the 'Jitegemee' toilet may have provided a useful alternative for individual beneficiaries but it is suggested to have also contributed to community public health problems when its faecal waste started to be dumped into open drainages. Social relations also influence and are influenced by introduction of new service offerings. Marginalized

groups may become excluded when new social arrangements have to be devised around an innovation. For example, when toilets that were previously open for public use in Kahawa-Soweto were converted to be used only by few families living around it as an off-plot shared toilet. The new arrangement excluded families that had previously depended on it but did not live within the newly defined proximity. As such, caution is required in how a new service offering can influence intra-community social dynamics in terms of social differentiation, exclusions, conflicts and tensions.

Finally, we contemplate that grasping the required multi-dimensionality and systemic perspectives when introducing an innovation is challenging. In fact, it may even be impossible to foresee how a new offering will embed or why. We suggest that innovators do not necessarily need to know this upfront. What is needed instead is to involve a variety of people with the in-depth contextual knowledge as co-innovators. The users themselves can especially be more actively involved in the design processes and all subsequent steps. This way, embedding can be seen as a process that requires continuous calibrating of new service offerings in response to users' experiences in their daily lives.

### **3.6 Conclusion**

This paper contributes with a socio-technical, context-sensitive and actor-centred perspective to understanding embedding of innovations in highly complex and uncertain contexts. We used the empirical case of the introduction of novel sanitation service offerings in the informal settlements in Nairobi, Kenya. Our main contribution is the concept of *Oscillating Domestic Spaces*. It reflects how people need to constantly respond to quickly changing and precarious preconditions by rearranging their daily practices in time and space and developing a multiplicity of alternative options and partial solutions. The approach is different from conventional engineering, economics and psychology perspectives which are highly technology and product-oriented. Our findings indicate how significant it is that innovators and service providers understand the everyday activities and strategies of informal dwellers in order to align their own perspectives with realities on the ground, and consequently to be able to design appropriate interventions and to provide relevant and timely support in the embedding process.

This study makes a contribution to the growing body of work that uses practice theory in the sustainability transitions field. Particularly, the study shows how a practice-theoretical approach helps make sense of innovation processes in highly complex and uncertain contexts like informal settlements – an empirical case which deviates significantly from the conventional application contexts of transition studies which are less complex and maintain significantly fewer

uncertainties. In a wider sense, we hope that this paper's contribution has potential in finding applications beyond the informal settlement. For Global North cities, growing complexity, uncertainty and fragmentation are perceived to be a future concern in basic service sectors (Shove et al., 2012: 95). Also, neoliberal policy reforms as well as environmental concerns in the OECD seem to foster a shift towards heterogeneity and more user involvement (Furlong, 2014). Examples include the decentralizing of water, energy and sewerage systems and user involvements in car sharing, co-production of energy and sustainable consumption. Our concept of Oscillating Domestic Spaces may potentially provide insights on building, maintaining and transforming heterogeneous, user-centred and perhaps uncertainty-laden socio-technical systems in other geographical and socio-economic contexts.

We also reflect that a context with unmet needs, fragmented services and negative outcomes and feedbacks in basically all aspects of daily life can also create a form of 'lock-in' that is hard to escape. Such lock-in mechanisms require further explorations because our findings provide a contrast to the conventional understanding in transition studies. Co-existence of multiple regimes/practices is understood in transition studies to contribute to a destabilisation that creates windows of opportunity for sustainable alternatives to flourish (Turnheim and Geels, 2012). Our conceptualization of the Oscillating Domestic Space shows how users push for diversity in access options as a pragmatic approach to meet their basic livelihoods needs. This consequently resulted in the persistence of non-desired practices like open defecation and only a partial embedding of the seemingly superior alternative. Therefore, we suggest that introducing sustainable alternatives is not necessarily an easy task in multi-regime and unstable contexts and thus lock-in mechanisms in such contexts require further explorations.

At a more modest level, the robustness of our conceptualization of the Oscillating Domestic Space could benefit from further testing with other urban basic service systems like water, energy and solid waste management in informal settlements and in cities in the Global South. Some similarities in terms of heterogeneity of service offerings, challenges in embedding new service offerings, and unreliabilities in preconditions for practices are acknowledged in these sectors (Peloso and Morinville, 2014; Parrot et al., 2009; Marshall and Farahbakhsh, 2013; Singh et al., 2015). Lastly, this study could contribute towards future statistically representative analyses by applying previously undefined analytical elements related to uncertainties (i.e. in the SDG indicators), thereby helping to formulate timely directions and interventions for sustainable transitions.





## **Chapter 4: Livelihoods reconstruction in Oscillating Domestic Spaces**

The findings presented in this Chapter have been considered for a resubmission to Environment and Planning A journal, subject to revisions, with the title: *The challenges of livelihoods reconstruction in the context of informal settlement upgrading*. Authors: Pauline C. Cheruny, Bernhard Truffer, Christoph Lüthi, and Edinah M. Samuel.<sup>24</sup>

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<sup>24</sup> Author contributions in the Appendix section

## Abstract

The literatures on upgrading of informal settlements increasingly recognize that community involvement is a core condition for success. However, the same literature has remained remarkably silent in grasping the wider ramifications of this requirement. Mostly, community involvement has been equated with a narrow interpretation of participation, which largely focuses on the elicitation of dwellers' preferences at the planning stages. We argue that this approach still testifies an overly strong provider-focus, which overlooks the actual needs for livelihoods reconstruction that dwellers have to cope with in the course of the upgrading process. To better conceptualize these requirements, we propose to scrutinize the time-space configuration of livelihood practices, which we frame as constituting *Oscillating Domestic Spaces*. The challenges associated with "transplanting" these spaces are illustrated by a case of a recent settlement upgrading initiative in Nairobi, Kenya. The findings suggest that an inadequate understanding and consideration of the livelihoods dimension resulted in: (i) a dramatic drop in the legitimacy of the upgrading initiative, (ii) a rapid deterioration of the physical amenities and (iii) finally a relegation of the big majority of the alleged "beneficiaries" deeper into poverty. We suggest that planning and implementation of settlement upgrading processes need to better incorporate livelihood construction and maintenance processes in the planning as well as in the implementation of the projects.

**Keywords:** Informal settlement upgrading; Oscillating Domestic Space; Participation; Livelihoods; Relocation

## 4.1 Introduction

According to the United Nations, more than one billion people now live in informal settlements of the world's cities, and by 2050 the population is expected to grow to more than three billion if the current trends persist (UN-DESA, 2018). Informal settlements are residential areas where inhabitants often have no security of tenure for the land or dwellings they inhabit, the neighbourhoods usually lack basic services, housing may not comply with planning and building regulations, and the settlements are often situated in geographically and environmentally sensitive areas, which leaves residents vulnerable to natural and man-made disasters (UN-Habitat, 2015; Corburn and Sverdlik, 2019). As such, upgrading and the prevention of an establishment of new settlements has become a priority for global sustainable development agendas (UN-DESA, 2018; UNSD, 2015).

Various upgrading initiatives have been set up by state and non-state actors, following a realisation that macro-economic growth alone cannot solve the problem of settlements expansions (Gulyani and Bassett, 2007). Today, diverse upgrading concepts and approaches exist that cater to the needs of different settlement types (Abbott, 2002; Abbott et al., 2001; Matamanda, 2019; Rigon, 2014), which can basically be differentiated with regard to whether settlers have to be relocated or not (Abbott, 2002; Abbott et al., 2001; Matamanda, 2019; Rigon, 2014). Formally, all these approaches maintain a similar objective of “putting into motion the economic, social, institutional and community activities that are needed to turn around downward trends in these areas” (Cities-Alliance, 2019). The envisioned transformations are therefore primarily aiming at improved livelihoods conditions and improved living environments. However, actual experiences with upgrading interventions have shown sobering results in many parts of the Global South with projects failing to produce direct benefits to the so-called “beneficiaries”<sup>25</sup>. Problems of politicization and corruption, coordination, complexity of evaluation techniques, and weak financial mechanisms are mentioned in diverse existing literature as some impediments to successful upgrading, e.g. see Abbott et al. (2001), Gulyani and Bassett (2007), Imparato and Ruster (2003), Iweka and Adebayo (2015), Khalifa (2015) and Morrison (2017).

In the present paper, we want to identify another and often overlooked factor for the failure of these initiatives. As many settlement upgrading interventions involve broad changes in social,

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<sup>25</sup> We will at times denote the resettled dwellers as «beneficiaries» because this is a very widely used term in the actual projects. However, ironically many of these people do not reap any benefits and may even end up worse than before. We therefore prefer to call them relocated dwellers or former inhabitants of the informal settlement.

material, economic, temporal and spatial conditions of the dwellers, the transformations will deeply impact their daily practices, as well as the resources they may mobilize and the amenities they may access. This is especially the situation as the transformations happen under conditions of rampant poverty, weak performance of formal institutions, lack of tenure rights, and the multi-cultural structure of communities (Gulyani and Bassett, 2010; Abbott, 2002; UN-Habitat, 2003). Additionally, when relocations are imperative, settlement upgrading becomes more complex, expensive and risks disrupting the livelihoods opportunities of settlement dwellers (Iweka and Adebayo, 2015). These factors contribute to the complexities in achieving successful settlements upgrading, which have been reflected in calls for community involvement in order to better consider the conditions and preferences of settlement dwellers (Rigon, 2014; Imparato and Ruster, 2003; Oakley, 1991). Despite this call, the literature has criticized that actual impacts on the beneficiaries are still under-studied and under-conceptualized (Rigon, 2014; De Geest, 2016; Lewis, 2017). So far, involvement of settlement dwellers has often been approached through a lens of “participation”, in much of the development literature, as well as in policy and practice. The outcome has mostly been achieving a “buy-in” by concerned dwellers into the projects. We suggest that the participation approach in settlement upgrading has largely failed to address the broader challenges that dwellers have to cope with in the actual transformation processes. This is in line with a growing sobering results about the achievements of participation in public policy making (Wesselink et al., 2011). We claim that one major reason for this is the general neglect in upgrading projects regarding impacts on livelihood practices (see also Lewis (2017)), especially when they require relocations.

To elaborate on this point, we mobilize recent insights from practice theory to conceptualize processes of reconfiguring livelihoods. Practice theory aims at understanding how actors organize their everyday lives and how this impacts the uptake of new technologies, practices and services (Cherunya et al., 2019; Hargreaves et al., 2013; Shove et al., 2012). More specifically, we propose to focus on the time-space characteristics of livelihoods practices in order to identify the fundamental challenges that relocation processes entail. For this, we build on the recently proposed concept of Oscillating Domestic Space (ODS), which maps the dynamic areas in which the construction and maintenance of everyday livelihoods activities are organized (Cherunya et al., 2019)<sup>26</sup>. In these terms, relocation can be characterised as the transplantation of the dwellers’ ODS into a new socio-spatial context. Depending on the characteristics of the upgrading project, this transplantation may cause a large number of disruptions in their livelihoods, which are not

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<sup>26</sup> This chapter builds mainly on the concept of ODS which is introduced in Chapter 3 whose work is already accepted for publication in Research Policy journal, subject to minor reviews

compensated by the improved material infrastructures that are provided. By focusing on livelihoods reconstruction, we highlight the agency of dwellers in the broader socio-technical systems change (Shove and Walker, 2007; Hargreaves et al., 2013) compared to portraying them as mere providers of improved planning parameters, as narrow participation approaches would have it.

We conduct the analysis in two steps. First, we reconstruct how dwellers that are relocated during settlement upgrading have to reconfigure their Oscillating Domestic Space by creating and recreating access to opportunities in space under uncertain and constantly changing conditions and capabilities. In a second step, we analyse how these disruptions jeopardize the technical and managerial conditions of the project by creating manifold negative impacts on *the legitimacy of the upgrading process* and even *the physical state of infrastructures and artefacts*. These dynamic interdependencies can lead to widespread failures of the projects, which may even leave some of the former dwellers in much worse conditions than before they had formally become “beneficiaries”.

We test our framework with a Kenyan Slum Upgrading Initiative – Kensup, an integrated top-down government-led initiative in Nairobi that started more than ten years ago and is still ongoing. Our analysis reveals how, despite its embedding in a participatory framework, inadequate consideration of the livelihoods dimension led to severe disruptions of the project and actual dispossession of a majority of the original settlement dwellers. Our analysis draws on 24 interviews with concerned settlement dwellers, with employees of Kensup and with a sector expert. Data was collected during a three week period in 2018.

We have structured the remainder as follows. In Section 4.2, we review approaches to settlement upgrading and how livelihoods reconstruction has been analysed so far. We then introduce the practice perspective and elaborate the Oscillating Domestic Space concept. Section 4.2 furthermore introduces an approach to analyse feedbacks from livelihood construction activities on material and managerial conditions in settlement upgrading initiatives. Section 4.3 introduces the methodology. Section 4.4 provides empirical evidence on how failures in livelihoods reconstruction impacted the legitimacy of the upgrading process and the physical state of infrastructures and artefacts in a case from Nairobi, Kenya. We conclude, in Section 4.5, by discussing the conceptual and practical implications of our findings.

## 4.2. Conceptual approaches

### 4.2.1 Meeting beneficiary needs in settlements upgrading interventions

There are two main forms of settlements upgrading that have gained traction: (i) in-situ upgrading and (ii) upgrading involving the relocation of residents. In-situ upgrading is based on the incremental upgrading without displacement or relocation (Huchzermeyer, 2009). Central to this approach is to provide formal rights to the occupants of the land, introduce infrastructure and other services with minimal disruption of residents' lives. Empirical evidence from numerous upgrading initiatives has shown that in-situ upgrading makes economic sense and minimizes the disturbance to the livelihoods sustenance of the community (Huchzermeyer, 2009). If implemented correctly, this approach involves the community at large, leads to empowerment and increases social capital and trust among citizens. Nonetheless, in-situ approaches are often incremental and may not be the best option all the time – especially in situations where large infrastructures like sewers and roads have to be installed or when the living environments are too contaminated and dangerous. For example, a settlement may be located on a landfill site, or an area that is prone to land or mudslides. In upgrading with relocations, settlement dwellers are temporarily relocated to an offsite settlement (decanting site) before they return to the area of their previous homes, where new housing units with improved basic service facilities have been erected in the meantime.

Contemporary upgrading initiatives, both in-situ and with relocations, have largely failed to produce the hoped-for improvements to the beneficiaries leading to their depiction as being expensive undertakings with at best only limited positive impacts for the urban poor (Turley et al., 2013; Keivani and Werna, 2001; Khalifa, 2015). Problems of politicization, coordination, complexity of evaluation techniques, and weak financial mechanisms are mentioned, in diverse existing literature, as some impediments to settlements upgrading, especially when they are government-led, e.g. by Abbott et al. (2001), Gulyani and Bassett (2007), Imparato and Ruster (2003), Iweka and Adebayo (2015), Khalifa (2015), Morrison (2017), among others. These challenges have been linked to the inefficiencies in planning and management of settlement upgrading initiatives therefore resulting in failures. Additionally, beneficiary-related challenges are acknowledged. In particular, there seems to be a notorious problem of gentrification. Low-income communities are often not able to cope with new lifestyles and financial requirements that come with settlements upgrading and so they resort to giving up ownership and moving back into informal settlements. In their place, middle-income communities move into the upgraded areas (Cadavid, 2010). Gentrification therefore tends to push poor people further into poverty and essentially get displaced from their former living area (Gulyani and Bassett, 2007;

Cadavid, 2010; Gomersall, 2018). While this is widely observed and reported, there are only few studies within the settlement upgrading literature that have done a focused analysis of the lived experiences of settlement dwellers in order to understand why they often resort to giving up their entitlements (Rigon, 2014; De Geest, 2016; Tissington, 2012; Napier, 2007). In the case of South Africa, Tissington (2012: 3) argued that “the nexus between informal settlement upgrading, livelihood creation, informal sector development and economic income generation has not been explored in great detail”. In the same context, Charlton (2006), suggests that the link between where people live and where and how they earn an income is particularly very weakly understood or conceptualised. Additionally, Napier (2007) and Mesplé-Somps et al. (2016) have argued that assessments of upgrading projects in terms of how they have impacted livelihoods have generally not been common-practice. Rigon (2014: 258) found that, “there has been significant bodies of work that explore relationships between ‘the state’ (and other developers) and ‘communities’ but very little literature exist that problematizes the community itself (...), and insufficient micro-level analysis of internal community processes”. The absence of livelihoods related perspectives has also been diagnosed for upgrading projects in the Global North (Lewis, 2017).

In connection with Rigon’s viewpoint (2014) our view is that livelihoods reconstruction processes are often analysed based on provider-lenses particularly when initiatives are proposed by external actors (i.e. government-led upgrading). Providers, such as urban developers may have to accommodate to local circumstances (Mosselson, 2019) but still tend to overlook the intricate aspects related to sustenance of livelihoods by beneficiaries. Participation is widely seen as a remedy, both analytically or by practitioners, but is often motivated by a need for effective project planning. As such, it stops short of eliciting the potential beneficiaries’ hopes and expectations mostly during the planning phase. Empowerment for livelihood reconstruction is however mostly out of the reach of these actors’ mandates. Samndong (2018) found in an analysis of a REDD+ project in Congo that participation was effected mainly as an instrument for legitimization and to improve the efficiency and effectiveness of project planning and as such, the author refers to it as a “participation illusion”. Similar sobering assessments have been reported for the experiences with participation in policy contexts in general (Wesselink et al., 2011).

In the settlement upgrading literature, a broader interpretation of “participation” is mostly promoted. Imparato and Ruster (2003) define participation as "a democratic process in which people, particularly the weak and the poor, are not passive receivers of a development project at the end of a top-down approach, but are requested to identify their needs, voice their demands, and organize themselves so as to improve their livelihood with the help of the financial, technical,

and human resources offered by the development project, as well as their own". This definition suggests that the basis of participation concept is providing a "space" for beneficiaries in decision making and especially ensuring inclusion so that the voices of the marginalized are heard and that they will be supported in coping with the transformation challenges. There is an assumption behind such an understanding of participation that community members know what would work for them in a different socio-spatial setting, they are able to foresee their future needs and are able to give effective feedbacks on new solutions, which are promised in the new settlement structures. In contrast to these ambitions, we suggest that most of the current forms of participation do not capture the degree of complexity and the range of considerations when settlement dwellers have to reconstruct their livelihoods in the course of relocations. More precisely, the complexities and uncertainties that characterize everyday access in informal settlements may even make it impossible for beneficiaries to anticipate how their conditions will look like in the future (Cherunyu et al., 2019). Additionally, conventional participation approaches seem to be not sensitive enough to account for differences of class and gender as they may fundamentally moderate the outcome of upgrading projects (Margalit and Kemp, 2019; Williams et al., 2015). Moser (1998) shares in this critique and suggests that practitioners promoting participatory approaches have failed to operationalize the framework into participatory local-level poverty reduction interventions. In reference to Sherry Arnstein's (1969) popularized "ladder of citizen participation", we suggest that current approaches are essentially limited to encourage information and consultation, but do not proceed to the steps of empowering participants in the form of partnership, or even citizen control of the projects. In particular, deliberative participation may fail to tackle aspects related to representation and power (Wesselink et al., 2011; Morrison, 2017; Rigon, 2014). As such, complementary concepts, methods and approaches are required that enable more intricate engagement with the challenges that beneficiaries encounter in the reconstruction of their livelihoods.

Following our viewpoint that participation approaches have taken a provider-lens and hence work mainly for the benefit of project developers, we propose a conceptualization of livelihoods reconstruction processes that is based on the beneficiary's daily life experiences. Our proposed approach draws on insights from practice theory and aims at capturing how people cope with the reconstruction of their livelihoods when submitted to settlement upgrading initiatives.

#### **4.2.2 Practice theory as a basis for analysing livelihoods reconstruction**

Livelihood opportunities entail the capabilities, assets and activities required as a means of living (Chambers and Conway, 1992; Scoones, 1998). The livelihoods concept has developed to

become mainstream in the 1990s when there was a shift of viewpoint in development scholarship and practice from structurally-oriented towards more actor-oriented approaches (Sakdapolrak, 2014). The central objective of livelihoods approach is “to search for more effective methods to support people and communities in ways that are more meaningful to their daily lives and needs, as opposed to ready-made, interventionist instruments” (Appendini and Zoomers, 2001: 24). Despite wide application, the livelihoods concept has also received some critical reviews, including: lacking integration into established fields that analyse social and economic change processes (Geiser et al., 2011; Small, 2007), a tendency to downplay power relations in access modalities by focusing overly on capital resources and activities (De Haan and Zoomers, 2005), and lack of contextual considerations (De Haan and Zoomers, 2005; Meikle et al., 2001; Moser, 1998). Meikle et al. (2001) and Moser (1998) have argued for the need to further conceptualize the livelihoods concept for its application in tackling urban-related poverty challenges where profile of households assets and activities differ significantly.

In order to tackle these criticism, increasing numbers of researchers are proposing the application of practice-theoretical approaches (see e.g. De Haan and Zoomers (2005), Sakdapolrak (2014), and Thieme (2008)). Practice theory is an established field in social sciences that is used to understand social practices and how they influence societal change processes (Shove et al., 2012; Cherunya et al., 2019; Hargreaves et al., 2013). Practice-theoretical approaches have especially been used to analyse change processes by taking a user lens, i.e. analysing new practices and the structures that support their take-up. Specifically, we build our analysis of livelihoods on the concept of Oscillating Domestic Spaces (ODS), which was formulated to capture the space-time structure of practices in highly precarious and uncertain contexts – like informal settlements (Cherunya et al., 2019). In an analysis of everyday access to basic services, the ODS concept was able to elaborate on “the need for people to constantly respond to quickly changing and precarious circumstances by rearranging their practices in time and space and developing a multiplicity of alternative options and partial solutions” in order to meet their needs (Cherunya et al., 2019). The ODS conceptualization is in line with the understanding of livelihoods practices by Long (1997: 11) who suggests that “livelihood best expresses the idea of individuals and groups striving to make a living, attempting to meet their various consumption and economic necessities, coping with uncertainties, responding to new opportunities, and choosing between different value positions”. Central to the ODS concept is the idea of everyday uncertainties, competing obligations and a need for prioritizing, which pushes people to diversify access options and sometime even fail to conform with socio-cultural expectations in order to meet their needs (Cherunya et al., 2019).

The ODS concept specifies pre-conditions for practices as constituted by materials, capacities and meanings. These elements maintain alignment with “factors” – which have been identified by livelihoods scholars – that are “required for meaningful living”, these being “assets” and “capabilities” (i.e. materialities and capacities), both suggested by Chambers and Conway (1992), as well as “meanings” as suggested by De Haan and Zoomers (2005). Socio-cultural meanings and local power relations are an important factor requiring consideration in the conceptualization of livelihoods and unravelling of poverty – a variable that has been overlooked in the original conceptualization of the livelihoods concept (De Haan and Zoomers, 2005). Additionally, in the context of relocations, we have to look at the space-time structure of livelihoods-related practices. Dwellers will be uprooted from their former homes where they had established their livelihoods practices, and are introduced into a new socio-spatial context. When relocated, livelihoods practices have to be reconstructed. Depending on social and material resources that prevail in these new places, this “transplantation” process may result in various forms of disconnections and disruptions in how practices are carried out. Different from the conventional livelihoods analytical approaches, i.e. the sustainable livelihoods framework, which rather provide a comprehensive evaluation of existing urban livelihoods assets and vulnerabilities (Meikle et al., 2001), we are interested in understanding the space-time structures of livelihoods-related practices.

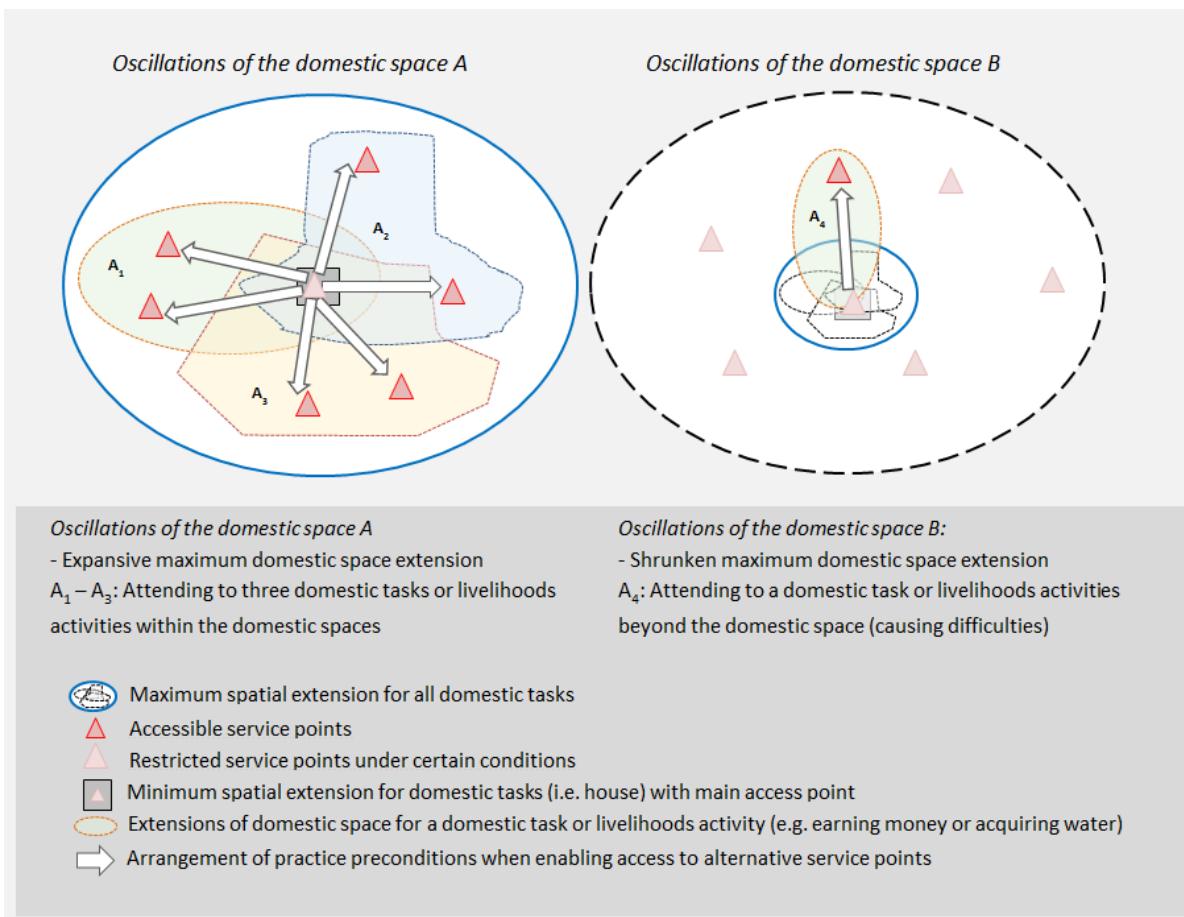
The ODS concept defines the *domestic space* as the “social and material expanse related to making a “home” in which people engage in daily, which is manifested in interactions with other people and the material world in time and space” (Cheruny et al., 2019). *Oscillations* are the regular but also the erratic fluctuations in external conditions and personal capabilities that enable or disable the performance of specific practices (Shove et al., 2012; Cheruny et al., 2019). Conditions of oscillations are challenging because they make it hard to predict how, where and when a domestic activity can be undertaken. For example, for an individual to access a pay-per-use toilet in an informal settlement, a *lack of regular income* (capacity) would imply that he or she may lack money to pay for access in unpredictable ways. This challenge is also combined with *infrastructural precarity* (materialities) whereby the toilets are not always open and available – for example, they can be closed at any time when a water shortage occurs. There exist also *socio-cultural precarities* (meanings) that influence how and where this individual can or cannot access a toilet, as in the case of women being excluded from public toilet access at night because of safety concerns (Tilley et al., 2013). The uncertainties in these practice preconditions push settlement dwellers to constantly rearrange their toileting practices in time and space drawing on a multiplicity of alternative strategies.

Settlement dwellers have established various approaches to performing everyday activities under these precarious circumstances. Particularly, they combine varieties of practices in non-conventional ways to meet a domestic task and livelihoods needs. Examples include: dependence of varieties of toilet service options (Figure 10, A<sub>1</sub>), establishing and running various home-based enterprises (Figure 10, A<sub>2</sub>), and the engagement in a multiplicity of neighbourhood welfare groups (Figure 10, A<sub>3</sub>). The various domestic activities have to be attended to in diverse ways leading to a dynamic use of the time-space, and as well resulting in daily interactions with many service providers. The lightly shaded triangles at the centre of the two diagrams in Figure 10 represent the main service option for a family when they become inaccessible under certain conditions of materialities, meanings and capacities, e.g. when an in-home water access point breaks down. The darker shaded triangles represent alternative service points which are spread within the domestic space in the first diagram and beyond the domestic space in the second diagram. The domestic space is represented by the blue circle in both diagrams. The arrows represent alignments in practice preconditions in such a way that they enable access to one or the other service point when the main option at home is inaccessible.

The second oval diagram with broken lines in Figure 10 represents a situation where the domestic space becomes shrunken (e.g. by new socio-spatial setups from relocations), thereby limiting the varieties of response strategies that would enable access when the main service point becomes inaccessible. Therefore, A<sub>4</sub> in Figure 10 represents a situation where a lot of effort must be given to “stretch” beyond the domestic spaces – in spatial, temporal, social and material terms – to attend to livelihoods needs. This will require a lot more effort and resources. In the situation where the domestic space becomes shrunken, various service or livelihoods activity points become inaccessible: represented by lightly shaded triangles in the second diagram.

In settlement upgrading situations, the mapping of activities and access possibilities within and beyond domestic spaces is able to show social agency, material enablers and limiting factors to livelihoods activities, i.e. in how practice preconditions align. Comparisons from one place to another will highlight the kinds of disruptions that have occurred.

**Figure 10: Visualization of Oscillating Domestic Spaces, adapted from Cherunyu et al. (2019)**



With the Oscillating Domestic Space concept, we are able to ask the following questions: (i) where, when and in how many different ways are livelihoods activities carried out? (ii) Within new socio-spatial conditions, what kind of erratic fluctuations in external conditions and personal capabilities of practices do exist? (iii) If preconditions for practices are precarious, how do people respond to the limited opportunities to meeting their livelihoods needs? Answering these questions will enable identification of the specific challenges of livelihoods reconstruction that may support or impede the success of upgrading projects.

#### **4.2.3 Implications of livelihoods outcomes on technical and managerial conditions**

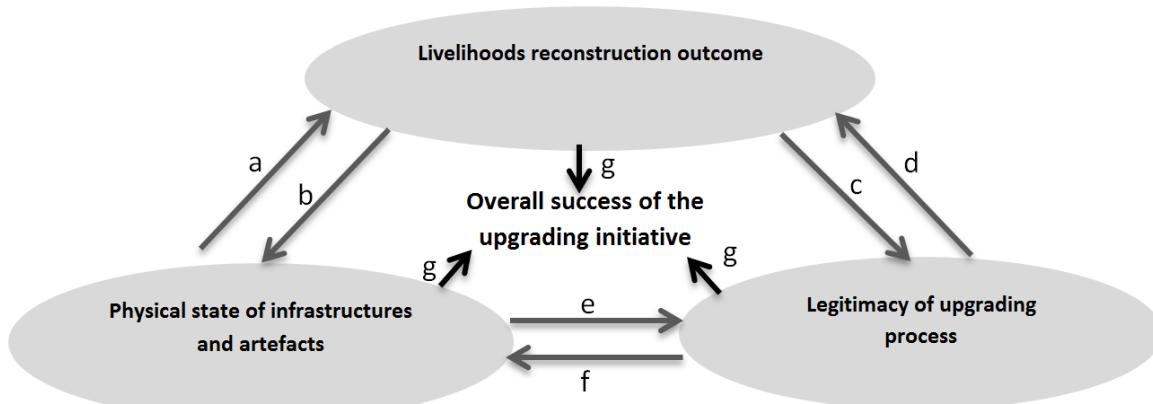
In order to explicate the significance of taking care of livelihoods reconstruction needs, we show how its neglect is likely to impact primary success conditions of upgrading projects: *the legitimacy of the upgrading process* and the *physical state of infrastructures and artefacts*.

*Creating and maintaining legitimacy* of developers among the beneficiaries is a core condition to settlement upgrading. Legitimacy emerges from engaging with informal forms of governance and local leaderships, transparency in project implementation, reaching agreeable forms of financial

contributions and amounts, gender inclusion, creating information sharing and complaint platforms, and developing shared visions, objectives and expectations between project developers and the beneficiaries (Rigon, 2014). These factors are widely discussed in settlement upgrading literature and are established in practice as important conditions for successful interventions. The inability to reconstruct livelihoods may push beneficiaries to question the terms of engagement of the relocation. On the other side this may also prevent the relocated dwellers to comply with the requirements that have been formulated by the developers. This may finally lead to a breach of the social contract that had been formulated between the parties to legitimize the relocation process in the first place (Mitra et al., 2017).

But challenges in the reconstruction of livelihoods may even jeopardize the functioning of the material infrastructure, which is the very starting point of any upgrading project. Physical interventions are primarily motivated by public health and environmental concerns that stem from overcrowding and extremely low quality housing or basic service infrastructures in informal settlements (Corburn and Hildebrand, 2015; UN-Habitat, 2003). The reconstruction of the Oscillating Domestic Spaces has a strong material dimension. People will attempt to also restructure physical environments in the process of livelihoods reconstruction, which might hamper the material integrity of the infrastructures. Therefore, the *maintenance of the physical infrastructures* is one of the key feedbacks related to livelihood construction and may therefore jeopardize a key performance criterion of government-led upgrading, when governments are interested in providing a positive image of their city by being overly technocratic (Mitra et al., 2017).

**Figure 11: Interlinkages between the beneficiary-related conditions for success in settlement upgrading**



The three dimensions must be seen as interlinked and influencing the overall success of a settlement upgrading initiative (Figure 11). This framework can be applied to systematically identify the feedback effects of the three dimensions towards the overall success of the three beneficiary-related dimensions in settlement upgrading. The letters 'a' – 'f' represent the feedback effects among the dimensions and the letters 'g' represent the overall implications from negative or positive feedbacks. As such, physical improvement of settlements alone may not necessarily imply overall improvement on the welfare conditions of settlement dwellers if the livelihoods components are not addressed concurrently. Or, users may lose the trust, which is critical in participatory processes in settlement upgrading. We suggest that these three dimensions specify core conditions for success from a project development point of view. For a full assessment of preconditions for success of upgrading initiatives broader factors would have to be considered that relate to governance structures, power relations, institutional factors, available resources, corruption, among others (Morrison, 2017; Ehebrecht, 2015; Huchzermeyer and Karam, 2006).

### **4.3 Methodology**

We test our framework using the case of the Kenyan Slum Upgrading Initiative - Kensup, specifically the integrated housing upgrading initiative in Kibera, Nairobi. Kensup was launched in 2002 as the first state-led initiative for large-scale settlement upgrading – therefore receiving the first ever national budgetary allocation in 2003. Kensup was supported by UN Habitat, with its headquarter having just been moved to Nairobi. The initiative launched various interventions all across Kenya that would cater for differences in settlement types and for priority needs. The focus was mainly on infrastructure provision (formal water, sanitation, roads, and energy services etc.), housing, land tenure, and economic empowerment. Among them was the integrated housing upgrading initiative in Kibera that we selected as our primary case study. This particular initiative involved temporarily relocating the settlement dwellers to an offsite settlement – a decanting site – giving space to redevelop the settlement, which would be followed by a reallocation into new improved modern housing. Relocation was necessitated by the need to install large sewerage infrastructures and the decision to economise on space by constructing high-rise buildings (Employee-3).

Kensup is well suited to demonstrate the value of our analytical approach because the relocation component provides entirely new socio-spatial conditions for livelihoods to be reconstructed. The initiative, additionally, provides a good case considering its embedding in an "inclusive participatory approach" (UN-Habitat, 2007: 13; KNCHR, 2018). Participation in Kensup is suggested to be "geared towards improving the livelihoods of people living and working in

Kenya's informal settlements, (as) working with them and including their inputs is vital, as only they know what they need, and only they can guarantee programme ownership and sustainability" (UN-Habitat, 2007: 13). Our study would show if the approach was able to adequately cater to livelihoods needs. Participation approach is broadly applied in settlement upgrading initiatives as a core guiding principle, and therefore our findings would provide aspects to reflect upon in how these various initiatives operationalize participatory approaches.

The paper settled for a qualitative case study methodology. The study was conducted based on data from interviews collected during a three-week fieldwork in Nairobi in April 2018<sup>27</sup>. The first author conducted 24 interviews with five Kensup officials, one sector expert representing an NGO, eight people who were living in the decanting site, seven beneficiaries who were living in their new upgraded houses and three people who had moved back into informal settlements (Table 6). In this paper, we will mainly focus on the experiences in the relocation from the informal settlement – that is from Kibera-Soweto Zone-A in 2009 – to the decanting site, this being representative of the livelihood reconstruction processes that dwellers have to enact when moving to new social and material context.

Semi-structured interviews were the main form of inquiry. For the beneficiaries, the interview guidelines contained general thematic categorization of questions to allow participants to tell their own stories in their own terms. The interviews were complemented with observations. The recorded interviews were transcribed and coded using MaxQDA12. The analytical elements, which form the basis of comparison between ODSs in the informal settlement and those in the decanting site, are derived. This comparison provides important insights on how settlement dwellers were able or unable to reorganize their livelihoods. Additionally, impacts on building and maintaining legitimacy of the upgrading project, Kensup, and on the material infrastructures were coded.

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<sup>27</sup> The data is part of a larger data-set containing 50 more interviews of a preliminary 2017 study of Kensup.

**Table 6: List of interview respondents**

<b>Interview respondents</b>	<b>Number</b>
<b>1. (former) Kensup Employees</b>	<b>5</b>
Employee-1 to Employee-5	
<b>2. Sector Expert</b>	<b>1</b>
Project Manager-NGO	
<b>3. Living in decanting site (DS) since 2009</b>	<b>8</b>
DS Inhabitant-1 (having local leadership role)	
DS Inhabitant-2 to DS Inhabitant-8	
<b>4. Beneficiaries of the new upgraded housing units: moved from decanting site to Zone-A in 2016</b>	<b>7</b>
Zone-A Inhabitant-1 – Zone-A Inhabitant-2 (having local leadership role)	
Zone-A Inhabitant-3 – Zone-A Inhabitant-7	
<b>5. Informal settlement returnees</b>	<b>3</b>
Departee-1 to Departee-3	
<b>Total interviews</b>	<b>24</b>

#### **4.4 The relevance of livelihood reconstruction in Kensup upgrading project**

In 2005, Kensup activities started in Kibera-Soweto Zone-A. Section 4.4.1 mainly highlights activities related to building and maintaining of legitimacy between the settlement dwellers to be resettled and Kensup – the project developers. These activities took part in Zone-A between 2005 and 2009. Section 4.4.2 and 4.4.3 will present the experiences of the resettled inhabitants between 2009 and 2016 when they lived in the decanting site. Here we highlight experiences with the new infrastructures and artefacts as well as livelihoods reconstruction activities.<sup>28</sup> Eventually, Section 4.4.4 elaborates on the feedbacks of these livelihoods reconstruction processes on the success of Kensup where we highlight impacts on legitimacy and physical infrastructures of the decanting site.

##### **4.4.1 Building and maintaining legitimacy with beneficiaries**

In order to involve the potential beneficiaries of the project, Kensup officials conducted physical mapping, an enumeration of beneficiaries and a socio-economic assessment of Soweto East in 2005. A survey among the dwellers contained, among others, questions related to socio-economics (i.e. incomes of beneficiaries, assets including housing units and businesses,

<sup>28</sup> In the temporary relocation site, the socio-spatial conditions would be similar with the eventual upgraded homes in terms of being a gated community and the housing units being of similar quality.

expenditures, and rent amounts they would be willing to pay at the temporary relocation site, among other questions (Employee-1; Employee-3). A database was created, which looked into various issues including ownership status and duration to map the intended beneficiaries. Finally, 6,377 families were identified by these activities.

Exchange platforms were also put in place where Kensup and the beneficiaries could deliberate on their varied interests. This was particularly essential in consideration to low levels of trust many settlement dwellers maintain towards government-led initiatives.

*“In fact the deliberations were not very smooth as the beneficiaries feared that once the project was completed, the improved housing units would be given to the rich people and people of Kibera would lose – as was experienced in the nearby high-rise estate<sup>29</sup> project (...) they lied to Kibera people previously”* – Zone-A Inhabitant-3

Community meetings were used as a platform where the viewpoints of the beneficiaries were sourced, where project process information was shared and where sensitizations would be made about different roles and expectations. Additionally, selected community members represented the views and ideas of different social, cultural and economic groups by being part of the Settlement Executive Committee. Considering the disruptive and complex nature of the project, these platforms became very essential in gaining a “buy-in” of the beneficiaries (Employee-1). It was particularly important in the process that the community members were provided with special identity cards, which was a physical symbol for entitlement (Employee-3).

Despite many benefits generated by the platforms, they could not deal with all the contractual conflicts between Kensup and the beneficiaries. One fundamental issue raised in the deliberations was the location of the temporary relocation (decanting) site. While the concerned settlement dwellers disagreed with a proposed location 30 km away fearing they could be abandoned or they may lack basic amenities like schools and hospitals, Kensup was adamant citing cost implications and lack of feasible alternatives that would be situated closer. Eventually they yielded however to setting up the decanting site 4 km from Zone-A as a result of external pressure from influential politicians (Zone-A Inhabitants -1, -3, -4). A “one housing unit per family” principle also faced disapproval by a section of concerned settlement dwellers who were claiming larger compensation owing to larger assets they owned in Zone-A. The dissatisfied community members chose to look for legal solutions that contribute to unforeseen delays – of about two years – in the project (Employee-3).

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<sup>29</sup> This was a National Housing Project which was not funded by government budget.

In summary, at the onset of the initiative a lot of attention was given to maintaining a participatory process, which was essentially geared towards creating legitimacy for the initiative. The project officials conducted socio-economic surveys to capture the livelihoods needs of the beneficiaries. The sensitization meetings provided attention to livelihoods needs, however as we will show in Section 4.4.4, these efforts were restricted to the planning phase and did not carry on into implementation.

#### **4.4.2 Modern infrastructures as new physical conditions to be adapted**

Construction of the decanting site was completed in 2009 and 1,200 willing households were relocated immediately. The decanting site contained modern facilities similar to those in the new housing units that would replace the dilapidated structures in Zone-A.

The neighbourhood was gated and the use of public spaces within was controlled: home-based enterprises were prohibited and domestic chores were required to be done inside the apartments (Information source: protocol, Estate Management Office). These characteristics deviate from Zone-A where many domestic tasks could be executed in the open spaces outside the homes, because of the limited space in the house. For example washing at public water-points and cooking with firewood outside the house etc. was very common (for a detailed study on the structures of ODS in Nairobi's informal settlements, see Cherunyu et al. (2019)). Additionally, setting up home-based businesses in the public open spaces was also common in Zone-A, but highly controlled at the decanting site.

The new housing type offered private in-home access to tap water and sanitation. The sewer-connected toilets however required water for flushing and were to be managed by the households. This is different from public toilets common in Zone-A, which required no or minimal flush water and are maintained by entrepreneurs. It is also common-practice that waste water was used to flush toilets in Zone-A. In the decanting site, the toilets required increased amounts of clean water for flushing. The use of firewood, a common source of energy in Zone-A, was prohibited and beneficiaries were required to switch to charcoal and gas. Additionally, the people living in the decanting site had to adapt to a different way to pay for services. In Zone-A payments for rent and basic services were flexibly organized at pay-per-use, daily, weekly and monthly charges. The decanting site demanded more formal and structured payment, often set at monthly rates.

Only 632 apartments could be provided at the decanting site to host 1200 families, therefore a housing unit had to be shared between two families. The remaining over 5,000 families were required to self-organize for alternative housing. The sharing of an apartment by two families and

the lack of possibility to extend domestic activities outside of the house resulted in social conflicts (Employee -1, -5; Zone-A Inhabitants -2, -4, -7). Many households, however, chose to persevere with the difficult living arrangement as it was meant to be temporary. More importantly, they perceived being present at the decanting site would provide them with a sense of security to maintaining their entitlement as a potential beneficiary.

*"I preferred living in the decanting site because I had a better chance to receive information about the progress of the initiative and this way act accordingly and avoid the risk of being excluded"* – Decanting Site inhabitant-7

Before moving into the decanting site, pre-visits had been organized for the concerned community members to be resettled to get acquainted with the location and the new amenities. Additionally, sociologists were hired to sensitize and educate the beneficiaries on behaviour change issues in preparation to using the new amenities.

*"We did not want them to have culture shock. We prepared them thoroughly, we trained them on how to behave when they move to the decanting site, how to socialize living with new neighbours, also living in the houses that are very different to what they had before"* – Employee-1

#### **4.4.3 Reconstruction of new domestic spaces in the decanting site**

The relocation to the decanting site came with changes in the social, cultural, material, spatial and economic conditions of daily life, which are aspects that, altogether, shape how livelihoods opportunities are sustained. The beneficiaries were faced with many challenges in reconstructing and maintaining livelihoods opportunities. The reconstructions were quite fundamental because only few of the strategies to cope with the fluctuations in practice preconditions in the new socio-spatial context could be maintained.

*"We anticipated such challenges but we really did not expect them to be this difficult and complex to tackle"* – Employee-3

Apparently, the livelihoods complexities could not adequately be captured through the sensitization activities at the onset of the initiative. The decanting site was assumed to provide superior housing and basic amenities, and that the settlement dwellers could easily adapt to the conventional practices of communities who live in Nairobi's middle-class gated neighbourhoods. We show how these complex reconfiguration processes relied on specific materialities (infrastructure conditions), meanings (socio-cultural dispositions) and capacities (both personal and effective).

While the new infrastructures provided more decent living conditions in physical terms, the precarities in service access resulting from *intermittent and unreliable services* led to difficulties in

reorganizing service access. Water service provision at the decanting site became one of the major infrastructure challenges as the water provided was intermittent, some of the higher storeys did not get water at all due to insufficient water pressure and water bills became a financial burden for the tenants. The gated nature prevented water vendors from extending their services into the domestic spaces of its inhabitants. Therefore the in-home access points became the only dependable option – a condition that is largely taken for granted by the developers when planning the settlements – despite its frequent unavailability. The households situated on the higher levels of the apartment block were met with an additional challenge that direct water supply never reached them because of low pump pressure (Decanting Site inhabitant-8). The implication of intermittent water supply was an inability of residents at the decanting site to meet the increased water needs especially for maintaining toilet and sewer systems.

Essentially in many informal settlements (i.e. Zone-A), the intermittent supplies have led to establishment of diverse set of co-existing service options, who fill the provision gaps of each other. The alternatives include services from water vendors and water kiosks. This way, settlement dwellers are often able to find alternatives when the preferred access options are unavailable.

*In Zone-A at least there were many water vendors so there was always a place to source for water. Here (decanting site) we struggle a lot. (...) we have to leave the neighbourhood and go outside the gated area into the neighbouring settlement to find water. (...) we have to carry a lot of water up the stairs –*  
Decanting Site inhabitant-7

Furthermore, there were no restrictions for use of open spaces in Zone-A, and to avoid cumbersome tasks, domestic activities (e.g. laundry) is often taken to the service points.

Living in the decanting site presented *new socio-cultural challenges* for the residents – particularly with the sharing of housing units among families. Two families were required to share domestic facilities like the kitchen space, bathroom and toilet. The consequence was lack of privacy and disputes among families (Employee-5). Congestion was also experienced in Zone-A especially in the context of families having to deal with growing kids. A common strategy of families was to collectively rent a housing unit nearby, which would host some of the young males from all these houses (Decanting Site inhabitant 1; Project Manager, NGO). Essentially this housing unit would be used for sleeping but the occupants would take care of their domestic needs within their own family-homes. This arrangement would relieve household members from pressures related to use and sharing of domestic spaces between older and younger family members—in consideration of the very small housing units found in informal settlements. This livelihoods arrangement could not be reconstructed at the decanting site because all the surrounding apartments had been

occupied and taking an extra housing unit outside the gated neighbourhood was inconvenient for activities like having joint meals. The situation became continuously complex because of delays in the entire project. As of 2018 when the data was collected, the people in the decanting site have been there for nine years instead of the originally-planned period of two years. Family sizes expanded thus exacerbating the congestion problems and bringing about dilemmas for many families whether they should relocate to bigger housing units or stay in order to maintain their entitlements (Decanting Site inhabitant-6).

In terms of *personal and effective capacities to meet livelihoods needs*, the situation became more challenging for the residents at the decanting site. The livelihoods of informal settlement dwellers largely draw on social networks, which were discontinued due to the relocation. We give the example of local savings and loan groups, locally known as “chama”, whereby many people had to quit due to the relocation. People often take membership in order to support each other in maintaining savings from the small-scale, home-based enterprises where income is received on a daily basis. Engaging in the self-help groups assists members to commit more to the shared saving plans in comparison to personal saving plans (Zone-A inhabitants -1, -6).

In comparison to Zone-A conditions of economic precarity were still present at the decanting site. Majority of the beneficiaries were still dependent on informal employments – meaning the income flows were equally intermittent. However, the economic situation for the majority had been made worse because the socio-spatial structure of the neighbourhood – gated community – presented fewer opportunities for people to engage in home-based enterprises. It became challenging to reconstruct economic activities. The survey conducted during the planning stage was used to decide how settlement dwellers can be supported i.e. setting affordable rent levels. A rent charge at the decanting site that is similar to what dwellers paid in Zone-A was decided (Employee-1; Employee-3). Additionally, beneficiaries were trained on business acumen and effective saving plans. These capacity building interventions were useful for reconstruction of economic capabilities in order to meet daily livelihoods needs and the financial requirements to qualify for ownership to an upgraded housing unit. Kensup, however, failed to consider the context where most of the beneficiaries often carried out their economic activities by restricting such activities within these gated communities. Instead, Kensup provided only a few households with business spaces in a nearby market and expected the rest of the beneficiaries to go beyond the gated community to the new neighbourhood to find opportunities for work.

Another challenge of maintaining capacities is the introduction to new form of payment for services requiring regularized remittances (i.e. payments for water, waste management and rent).

This practice did not align with the precarious circumstances of the financial flow of resettled dwellers – whereby irregular incomes are received on daily rather than monthly basis. The regular payment for utility services and rent was perceived too formal and too strict (Employee-5). The residents at the decanting site therefore struggled to meet these financial needs. In Zone-A, many service providers who are often local community members provided flexible payment methods. While economic precarities persisted, the residents were expected to engage in regularized remittances to cover costs for basic service and additionally to make mortgage savings in order to be able to ultimately return back to the improved housing that had been built in the meantime in Zone-A. Therefore, while rent charges remained similar to those in Zone-A, the overall expenses and the payment modalities changed in a way that tenants found themselves incapable to make ends meet at the decanting site.

In summary, the beneficiaries living at the decanting site were challenged by service access precarities, by socio-cultural limitations and by new rules related to access and the use of domestic spaces for income generating activities. These factors destabilized the ability to meet their livelihoods needs. While we have highlighted only a few dimensions of daily life, such challenges have effects on broader domains of daily life including domestic activities like cooking, cleaning, child-care and acquiring food. In conceptual terms, a transplantation of settlement dwellers from Zone-A to the decanting site resulted in a situation where the domestic space actually shrunk – particularly by the “gated community” design of the new neighbourhood. This way, many service points were unavailable within the new confined domestic space – including areas to conduct home-based enterprises and even the customers who would buy from the resettled dwellers. Also, other critical livelihoods resources like the social relations and interdependencies were not available anymore. Furthermore, precarity in service availability and in economic capacities persisted, therefore leading to new restrictions in accessing services. The new rules about how to use the domestic space and how to access services did not tally with other practice preconditions. Therefore, livelihoods could not be reconstructed properly. The resettled dwellers were increasingly getting aware that their former domestic spaces in the informal settlement had been more flexible to accommodate for the different precarities that they are confronted with. The new domestic spaces that were provided by the developers did not anticipate the fluctuations in practice preconditions and therefore overly restricted the response strategies options of the resettled dwellers. We may therefore say that the transplantation of the Oscillating Domestic Space from the informal settlement to the decanting site had not been successful. A major reason being that, neither the developers nor the resettled dwellers had a clear understanding of what it takes to provide livelihoods opportunities in a new socio-spatial

setting. Instead, a rather narrow ideal of “good living conditions” inspired by middle-income neighbourhoods had guided the developers when planning the decanting site. But these ideals turned to be largely inadequate to the conditions of livelihoods sustenance for the resettled dwellers.

#### **4.4.4 Broader impacts on success conditions and overall implications**

The problems of reconstructing livelihoods in the decanting site had major impacts on the more established success conditions of upgrading projects: *the legitimacy of the upgrading process* and the *physical state of infrastructures and artefacts*. We find that the challenges emanating from a lack of efficient support to livelihoods reconstruction resulted in deterioration of physical amenities and reduced trust towards the developers. And more importantly, overall improvement of livelihoods only resulted for a small number of the originally identified “beneficiaries”. A majority of the relocated settlement dwellers remain stranded in the decanting site, while others have given up their entitlements and moved back into informal settlements.

The everyday challenges in accessing basic amenities at the decanting site forced the residents to reconstruct physical amenities to make them relevant for their livelihoods situations (Figure 11, arrow ‘a’). These activities became detrimental to the infrastructures. We give the example of the how unreliable access to water, the high cost for water bought from vendors and the difficult circumstances of going out to look for water forced many residents to disable the flush toilet systems converting them to “pour-flush” to minimise water use (Employee-5). The implication was a blockage of sewer systems in the entire neighbourhood. The issue was worsened when households continued the old practice of disposing solid wastes into toilets without regard to the difference in toilet design compared to what they had in Zone-A. These activities deteriorated the physical state of the amenities leaving people to manage domestic activities in unhygienic environments. For example an observation made by the interviewer that in some households, wastewater would flow back through the toilet bowls into the houses. The feedback on livelihoods reconstruction would be, having the main access option being further non-functional (Figure 11, arrow ‘b’).

*“What is the difference between here and Kibera (Zone-A) is we have to live with faeces inside our homes” – Decanting Site inhabitant-7)*

As a compensation, new water provision arrangements by outsiders started to organically develop at the fringes of the neighbourhood to provide alternative supply. The individuals would use a hose-pipe through the perimeter fence of the decanting site to supply domestic water at a fee. This explains the difficulties faced in the attempts to move towards formal and regulated service

systems in informal settlements. When users are persistently faced with precarious circumstances to manage their livelihoods, they find it pragmatic to respond to these difficulties by using unsafe and unhygienic service options. This nicely exemplifies the challenges and complexities that start to emerge in order to overcome the limitations that resulted from applying a narrow provider perspective and engaging with potential beneficiaries only on the planning stage of the relocation.

Our empirical findings suggest that Kensup made significant efforts in the pre-relocation phase to capture the needs and priorities of the beneficiaries through the survey they conducted and in the setting-up of deliberation platforms. These initial efforts seem to have been useful in developing and maintaining legitimacy, and contributing towards a “buy-in” by concerned settlement dwellers. For example they were able to arrive at agreeable approaches about how the beneficiaries can make their financial contributions towards the initiative. We, however, see that the approaches were not able to capture deeper aspects related to reconstructing livelihoods, as an interview respondent cited:

*We were not ready at all for the new developments at the decanting site, we really learnt a lot from how things developed there – Employee-3*

Additionally, however, fewer community meetings were held at the decanting site compared to previously in Zone-A (Employee-4; Decanting Site inhabitant-2). Also, no regular assessments were conducted throughout the nine year period about daily life experiences and livelihoods reconstruction processes.

For the beneficiaries, the failure to reconstruct livelihoods, combined with the inability of Kensup to proactively manage the unexpected challenges of deteriorating or unavailable amenities, led to an increasing distrust in the overall process. The resettled dwellers felt cheated and not supported and thereby led to the loss of a sense of ownership in the entire process (Figure 11, arrows ‘c’ and ‘e’).

*“Many people became disoriented (...) we started feeling like this whole process was an indirect eviction”*  
– Zone-A Inhabitant-7

This resulted in a situation where people stopped contributing towards eventual ownership of an upgraded house.

*“No, we are not contributing (...) we are just staying here (decanting site) until the day they decide to do whatever they decide to us”* – Decanting Site inhabitant-5

Many resettled families now remain in situation of hopelessness in relation to their future livelihoods conditions (Figure 11, arrow ‘d’). They may have been relegated deeper into poverty

situations. Furthermore, the uncertainties about future developments in the project, i.e. whether alternative solutions may be provided for them or not restrict them from moving on and starting again to restructure their livelihoods outside the confinement of the Kensup opportunity.

Despite the rules in relation to maintaining a good state of the physical amenities, the continued breakdown, the lack of alternatives and the failure of Kensup to respond have also increased distrust by resettled dwellers towards the developers. The resettled have ended up losing a sense of ownership in the initiative and a lack of interest to maintain the facilities (Figure 11, arrow 'f'). Many do not any longer follow the restrictions surrounding the use of open spaces. They contravene the requirements by: converting balconies into extra living spaces to reduce congestion, illegally sub-letting the housing units and finding alternative accommodation in the informal settlements nearby and engaging in home-based enterprises even when forbidden (Employee-5; Departee-1; Decanting Site inhabitant-1). These issues led to increased frictions between the estate management team and the local residents. The consequence is a downward spiralling where facilities continue to deteriorate and the resettled feel neglected even more.

The overall consequence from failures in the three success conditions were that many resettlement dwellers are giving up on the initiative or are unable to cope with the daily livelihoods requirements. Three beneficiaries who chose to move back into the informal settlement reported reasons for abandoning life at the decanting site. They reported they were better able to earn decent incomes in the settlements because they had access to more customers and they were able to gain easier and convenient access to basic services (Departee -1, -2, -3). Additionally, the one who has rented his space out uses it as an opportunity to earn regular income, which is more important to him than living in the sanitized environments (Departee-1).

## 4.5 Conclusion

This study aimed at extending the conditions for successful settlement upgrading by including processes of livelihoods reconstruction. We suggest that participation as conventionally conceived by project developers focuses on building legitimacy and acquiring "buy-in" by designated beneficiaries but fails at adequately capturing the challenges of rebuilding their livelihoods. We borrowed insights from practice theory to better understanding these processes. Specifically, we leveraged the Oscillating Domestic Space concept to emphasize the space-time structure of domestic practices in such highly dynamic, resource constrained and uncertain contexts like informal settlements. The transplantation of livelihood activities requires that the dwellers establish new practices for accessing services and opportunities in their new socio-spatial environment. The analysis showed how this transplantation led to serious disruptions, which

neither the developers nor the dwellers were able to anticipate. We suggest that these processes need to receive more attention in settlement upgrading in order to result in actual improvements for informal settlement dwellers. A narrow focus on legitimization of projects in the planning phase and on the provision of physical amenities may even result in indirect evictions for many of the alleged beneficiaries.

We showed in our study that neglecting the livelihoods dimension implied serious negative impacts on the legitimacy of the upgrading project and that it even led to the deterioration of the physical integrity of the newly built infrastructures. As a consequence, one may ask whether the Kensup project has left all parties worse off after having invested huge amounts of public and personal resources. A majority of current inhabitants in the decanting site is confronted with the question of how and where they will have to start rebuilding their livelihoods after nine years of anticipating a new home and eventually not being able to benefit. The numbers suggest that only 822 households, out of the original 6,377 who were resettled, were successful in meeting the requirements and eventually benefiting by acquiring the upgraded housing units that were constructed in Zone-A (KNCHR, 2018). The future of the remaining 80% is definitely uncertain. A proper assessment of these experiences is all the more urgent as the Kensup upgrading programme is now about to be rolled out to the next zones of the Kibera informal settlement.

We therefore conclude that planning and implementation of settlement upgrading initiatives need to develop an intricate understanding of the livelihood reconstruction challenges of the relocated communities. Participatory planning is nothing but a first step on that journey. The Kensup case illustrated that preference elicitation is seriously hampered by the inability of both developers and dwellers to foresee the challenges that are associated with reconstructing livelihoods. The deliberations of behavioural and livelihoods needs in Kensup did not continue beyond the initial planning phases and there was no regularized assessment of how dwellers coped. This would have indicated problems as they arose during the implementation process and would have prevented the rapid and massive deterioration of the physical infrastructures and erosion of legitimacy of the entire process. Livelihoods activities need to be carefully assessed at the beginning of the relocation project and closely monitored in the local context all through the implementation. Attention has, furthermore, to be devoted to the capacities of the dwellers to cope with precarities as well as the socio-spatial resources they are able to mobilize. Considering these challenges goes beyond merely conducting surveys, but needs to involve the potential beneficiaries into decision making during implementation – or in other words to install higher levels of participation in the terms of Arnstein's ladder (Arnstein, 1969).

Our study focused on a case where the relocation led to a high degree of disruptions in the daily domestic routines and livelihoods activities. We focused on how a mismatch between the new socio-spatial location and the new physical infrastructures led to inabilities to reconstruct livelihoods for the relocated families. We suggest, however, that disruptions can also occur when socio-spatial contexts do not change as dramatically, i.e. when no relocations have to be implemented. The relevance of this spatialized view on daily practices is in line with the findings by Lewis (2017) who showed, for an urban regeneration study in East Manchester, that an in-situ upgrading also resulted in challenges to maintain and reconstruct social ties even for those that did not have to relocate. These findings also illustrate that the relevance of the Oscillating Domestic Space concept reaches beyond the realm of informal settlements in cities of the Global South. We would expect to see similar processes operating in urban upgrading initiatives for social housing in Northern cities, in relocations in the context of natural resource exploitations, displacements due to disasters and conflicts, among others – where social, material, economic, temporal and spatial changes are bound to occur.

We limited this study to specifying the relevance of livelihoods reconstruction for successful upgrading from a beneficiary perspective. In order to gain a more encompassing picture of success conditions, additional dimensions would have to be taken into account, such as mismatches in governance structures, power relations, availability of resources, corruption, and so on. However, we maintain that considering the livelihoods dimension remains a necessary condition that cannot be compensated by improvements in any of these other success conditions.



## **Chapter 5: Transformation potential of grassroots groups**

The findings presented in this Chapter are resubmitted for possible publication in the journal Environmental Innovation and Societal Transitions.

Paper title: *Contribution of grassroots groups to sustainability transitions: the case of sanitation in Nairobi's informal settlements*. Authors: Pauline C. Cherunyu and Bernhard Truffer.<sup>30</sup>

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<sup>30</sup> Author contributions in the Appendix section

## Abstract

Grassroots have been key providers of basic services in informal settlements especially when professional providers proved unable or unwilling to serve these areas. We investigate in which ways these grassroots could contribute to sustainability transitions. The roles of grassroots has been analysed extensively in sustainability transition studies. However, the focus has been largely on what we categorize as “ecologically-driven initiatives in resources abundant settings”. The grassroots providing services in informal settlements can instead be termed as *livelihoods groups* and categorized under “socioeconomically-driven grassroots operating under resource scarcity”. Using an empirical case from Nairobi, we analyse the innovative capacities of livelihoods groups using core processes in Technological Innovation Systems (TIS). We also show how these grassroots could hinder further transitions and discuss new actor arrangements that build on the strengths of the grassroots but can evade potential lock-in that hampers longer-term sustainability transitions.

**Keywords:** Sustainability Transitions; Technological Innovation Systems; Grassroots Innovation; Informal settlements; Livelihoods; Sanitation

## 5.1 Introduction

Scholars both from sustainability transitions and development studies have put high hopes into grassroots “bottom-up” initiatives to contribute to societal transformations, although with different emphases. The main focus of transitions research has been on how grassroots engage in socio-technical innovations for alternative lifestyles towards resource efficiency and carbon emission reductions (Seyfang and Smith, 2007; Leach et al., 2012; Gernert et al., 2018). In the development field, the focus has rather been on the role of grassroots in supporting livelihoods for low-income communities – including self-provision of services like water, sanitation and informal banking among others (UN-Habitat, 2003; McGranahan, 2015; Ostrom, 1996). In the provision of basic services, however, the contributions by grassroots are perceived by policy actors to be rather short-term and transitional while waiting for more permanent “professional” solutions for example by public utilities (Sima and Elimelech, 2013; Cherunyu et al., 2015; Joshi and Moore, 2004; Baker, 2012). Specifically, the negative connotations associated with capabilities of “poor” informal settlement dwellers often prevent decision makers from adopting more proactive forms of community engagement in service provision. In this vein, State-based public utilities tend to delegate co-management to private enterprises that are perceived as more professional, reliable, technically sophisticated, and their business models and services as more innovative (Adams et al., 2018; Castro and Morel, 2008; Cherunyu et al., 2015). Starting from the observation that grassroots groups have been able to provide services under uncertain and difficult conditions to large segments of settlement dwellers, we state that more attention should be devoted to how they manage to achieve these results.

Recently, formal private enterprises and the public utilities have increasingly taken active stances in providing and regulating services in informal settlements (Adams et al., 2018; van Welie et al., 2019a). However, they still face consistent challenges as these settlements are contexts that require new capabilities and organizational structures that depart from their normal ways of operation (van Welie et al., 2019a). From this perspective, we see that grassroots can outperform these professional<sup>31</sup> providers, by apparently leveraging resources that the professionals lack. In order to better understand the potential contribution of these actor groups to larger socio-technical transformation processes, we draw on recent insights from transition studies, as this literature has since long emphasized both the diverse capabilities of and the relations among actors. We draw particularly on recent insights from those sustainability transitions studies that have started to engage with innovation and transition processes in informal settlements, i.e.

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<sup>31</sup> We define ‘professionals’ as the actors who are formally licenced to provide services or to engage in innovation activities and have formal proofs of professional qualifications

Silvestri et al. (2018) and van Welie and Romijn (2018). They find the socio-technical systems thinking that is adopted by transition scholars to be useful in understanding the highly complex, multi-scale and persistent societal problems. However, they repeatedly voiced concerns that a one-to-one application of the original concepts showed only limited explanatory power to address the blatant heterogeneities that exist in many development contexts, (see also Ghosh and Schot (2019), Letema et al. (2012) and Wieczorek (2018)). Whereas many OECD countries can be characterized by rather neat and uniform regimes of service provision – as in the case of standardized, reliable and affordable provision of electricity to the entirety of citizens and companies in a country by a centralized power grid and large scale generation facilities – Global South cities are characterized by a large variety of insufficiently performing service alternatives that are poorly aligned among each other. Informal settlements provide doubtlessly the most vivid illustrations for this situation.

Recent work has therefore suggested that “socio-technical regime”<sup>32</sup>, one of the core concepts in transition studies, has to be further differentiated in order to get hold of these complexities (van Welie et al., 2018)<sup>33</sup>. At a first level, we have to distinguish different “service regimes”, which provide essential services to the citizens for better or worse. Service regimes are stable combinations of technologies, user routines and organizational forms of providing and accessing a service. An example is a standardized design for domestic toilets with routinized access conditions in terms of timing and payments in most informal settlements. At a second level, we may identify the socio-technical structures, which exist between and across service regimes that give rise to specific forms of “sectoral regimes”. Adopting this distinction enables to characterize the situation in many cities of the Global South as “splintered regimes”. This is a sectoral regime consisting of several parallel service regimes that are misaligned with one another, and which lead to negative externalities especially for users. This has to be compared to the rather “monolithic” or “polycentric” sectoral regimes that prevail in most OECD countries (van Welie et al., 2018). The existence of splintered sectoral regimes also implies that the different service regimes are maintained by different types of incumbents, who keep these regimes operational and protect them from outside challengers. As a result, we have to consider a much more variegated landscape of alternative and even competing service regimes with manifold actors that will enter into conflict with each other when transitions are about to happen. We may also assume that a wide variety of transition pathways may result under these conditions and simple visions of future

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<sup>32</sup> Socio-technical regime is defined as the institutionalized set of rules in an organizational field related to actors, artefacts, and markets that govern the establishment of basic services and which determine the pace and direction of transition processes.

<sup>33</sup> This is in reference to the already published work which constitutes Chapter 2 of this thesis

sustainability in the sector – often imported from the Global North – prove to be unattainable or even counterproductive for improving the situation on the ground.

Following this conceptualization of service and sectoral regimes, we understand that grassroots groups in informal settlements can be incumbents of specific service regimes. To establish their services, grassroots have to be innovative in many dimensions so as to provide reliable, legitimate and affordable offerings, under admittedly very insecure and resource scarce conditions. The expertise required will perhaps be less significant in terms of generating novel technologies or infrastructures – even though members still need to cope with technical challenges when operating under the real-world conditions presented by informal settlements. Instead, innovativeness will definitely be needed to deal with the institutional and relational elements of the service regimes. Furthermore, successful innovating at the sectoral regime level requires the mobilization of specific resources, which we understand as emerging out of the interplay of grassroots groups and other resourceful and powerful actors (van Welie et al., 2019b). We therefore propose to analyse the different capabilities required to establish operational service regimes by following the core innovation-related functions as suggested by the Technological Innovation Systems (TIS) approach. TIS analyses are concerned with how actors engage in innovation activities, how they interact in manifold formal and informal networks, and how they define or moderate institutions in order to support the generation, diffusion, and utilization of variants of a new technology or service offering (Markard and Truffer, 2008; Bergek et al., 2008b). We translate these system functions into capability domains that actors have to develop in order to build up novel service regimes and contribute to the transformation of sectoral regimes. Mobilizing the TIS framework has an additional benefit that we can look for complementarities between grassroots groups and other service providers.

There is an emerging research strand in the development field which engages in studies related to heterogeneities in service offerings, and which correspond well with our conceptualization of splintered regimes (e.g. Furlong (2014), Jaglin (2014), Lawhon et al. (2017), Letema et al. (2012), Ostrom (1996)). The research strand makes use of socio-technical systems thinking and acknowledges the enduring plurality of urban services. Jaglin (2014: 443) has argued for a need for the emerging scholarship to go beyond acknowledging plurality and contribute with insights about how the co-existing service offerings in Global South cities could function more effectively. This way socioeconomic equity and environmental preservation can prevail and any other negative externalities can be tackled. Through an analysis by mean of TIS functions, we may systematically analyse actor relations and identify potential areas of complementarities within

the heterogeneous service offerings – i.e. the splintered regimes (van Welie et al., 2018; van Welie et al., 2019b).

In order to achieve our goal, we however first have to elaborate on a more differentiated understanding of different types of grassroots initiatives. Ramos-Mejía et al. (2018: 222) noted that “most grassroots innovation cases documented in the transition literature take place in ‘welfare’ settings (and that) more research is needed in ‘informal’ and ‘insecurity’ settings, which should aim at analysing dynamics of alternative and inclusive innovations, and mainly related to basic services”. More specifically, transitions research has largely focussed on long-term societal issues requiring lifestyle changes like tackling peak oil and global warming. Furthermore, there seems to be an inherent assumption in much of the transition literature that the measure of success in grassroots innovation is “niche growth” in terms of the numbers of new initiatives that are ecologically sustainable. However, when analyzing the grassroots in informal settlements of the Global South, they may depart in many respects from these assumptions (Ramos-Mejía et al., 2018). We therefore propose a typology of grassroots that differentiates initiatives according to the “driving force”, i.e. whether the grassroots are primarily motivated by ecological arguments or by socioeconomic livelihood arguments. A second dimension differentiates according to the “resource setting” i.e if the grassroots are operated under conditions of resource constraints or resource abundance. These dimensions generate three additional grassroots types that differ from the majority of cases that are studied in sustainability transitions. The typology has implications on how success of a grassroots initiative is analysed. For instance, the measure of success for a socioeconomically-driven grassroots operating under resource constrained conditions may be the improvement of the welfare of the local community members in a context characterized by a lot of difficulties and uncertainties for providers and high levels of poverty by users (UN-Habitat, 2003). The differences are essential to consider in order to better understand how different grassroots-types may potentially contribute to a sustainability transition.

Within this typology we further elaborate the case of ‘livelihoods groups’, such as those which provide sanitation services to local inhabitants in informal settlements in many developing cities. Empirically, we will report on a detailed case study of a grassroots group in Nairobi, Kenya. The settlements have lacked professional services over several decades during which grassroots increasingly established local self-help provision arrangements. With the enactment of the new constitution of Kenya in 2010, that considered basic service access a fundamental human right for all its citizens, professional providers started to engage in service provision in informal settlements. Additionally, delegated management approaches, which encouraged co-management in services was enacted by many local governments in Kenya (Adams et al., 2018). However, its

operationalization seems to hold strong preference at co-managing services between public utilities and newly established private social enterprises – and a lack of interest in integrating the livelihoods groups (Adams et al., 2018; van Welie et al., 2019a). Therefore, the existing grassroots provision arrangements are expected to be replaced in future by other service regimes.

In our case, we find however that the livelihoods groups can indeed be very resourceful and competent as they were able to conduct a wide array of innovation processes when building up reliable services in their highly dynamic and uncertain local contexts. They mobilized resources and capabilities that the public utility and private entrepreneurs mostly lack. However, we also find that once established the grassroots tend to act increasingly as “incumbents” in their specific service regime contexts. They resist innovations by actors with potentially complementary resources and capabilities as they defend their local monopolies and dominance. Therefore, they can become a hindrance for future transitions.

The argument of the paper proceeds as follows. The next section details the distinction of grassroots initiatives based on “driving force” and “resource settings”, which gives rise to a four-field typology. We then introduce our specific understanding of innovation processes in informal settlements. Section 5.3 provides an introduction to the case, ‘Muungano wa Bondeni’, a group that successfully managed to provide reliable toilet services in over ten years in Mathare-Bondeni, an informal settlement in Nairobi. The section furthermore elaborates the methodological approach. Section 5.4 presents the innovation strategies that Muungano wa Bondeni employed and how they related to initiatives of more powerful and resourceful actors. Section 5.5 discusses in how far livelihoods groups have been successful in regard to provision of reliable services, and whether they support or hinder transitions towards more sustainable futures. We also elaborate potential new actor arrangements that could build on the strengths of the grassroots, while evading lock-in of the current still poorly operating services. The conclusion explores the broader relevance of our study to the transitions literature, importantly the understanding of transition pathways in informal settlements of the Global South.

## **5.2 Grassroots initiatives and their innovation capacities**

Grassroots are self-organized groups of ordinary people that come together to tackle individual or collective challenges, or to engage in activities of common aspirations. Ideally, a grassroots group takes decisions jointly and thus collectively shapes its activities, strategies, and aspirations. In doing so, members develop solidarity attitudes and practices that are anchored on the social capital (Seyfang and Smith, 2007; Ostrom, 1996).

Several researchers point out that grassroots have existed in all kinds of contextual settings and through different combinations of people, ideas, resources, capabilities, and tools (Smith et al., 2016; Gernert et al., 2018; Smith and Stirling, 2017; Seyfang and Smith, 2007; Hossain, 2016). These grassroots have been studied within diverse research disciplines (Smith et al., 2016). In sustainability transition, for example, the focus has been on empirical cases, which particularly focus on civil-society-based pro-environmental social innovation (Seyfang and Haxeltine, 2012). Furthermore, early developments of sustainability transitions concepts were largely based on empirical cases from OECD countries and therefore, there was limited utilization of experiences beyond OECD in formulating the original concepts. Ramos-Mejía et al. (2018: 222) noted that most grassroots innovation cases documented in transition literature take place in welfare settings and suggested that more research in informal and insecurity settings may bring new insights on alternative and inclusive innovations particularly in the realm of improving basic service provision and access.

Buidling on these earlier works, we propose a typology that differentiates two major dimensions to characterize the potential of grassroots activities: “resource setting” and “driving force”. *Resource-setting* represent the socioeconomic context conditions under which grassroots have to operate, which influence how innovations are understood, approached, and managed. The need to be innovative, the processes of innovating, and the expected outcomes of an innovation process are perceived differently in different resource settings. As for *driving force*, we mean those normative and cognitive processes – motivations, values, purpose, rationale for action – that determine individual’s or a community’s engamement in grassroots initiatives (Seyfang and Smith, 2007; Bhaduri and Kumar, 2011; Böcker and Meelen, 2017). Böcker and Meelen (2017) have specified and operationalized three sustainability-related driving forces for community engagements; these being social, economic and ecological. In the following, we further elaborate the ideal type grassroots initiative in the transitions literature as being ecologically-driven and their resource setting being abundant. In a second step, we characterize the ideal-type grassroots studied in development literature as being socioeconomically-driven and operating in resource constrained settings (i.e. the case of *livelihoods groups*). The third step provides some elaborations on the other two grassroots types in a four-field typology. We conclude the conceptual elaborations in a fourth step by specifying how innovation-related capabilities of livelihoods groups can be grouped in line with the established core activities identified by the Technological Innovation Systems (TIS) approach.

### **5.2.1 The standard case in transition studies: ecologically-driven grassroots in resource abundant settings**

Hossain's (2016) systematic review of the grassroots innovation literature of over two decades elaborated cases in some of the core frameworks in transition studies (i.e. Strategic Niche Management, niche-to-regime transition theory and the Multi-Level Perspective). Based on the review, we suggest that the standard empirical cases that have informed transition literature and the grassroots innovation strand are mainly ecologically-driven and conducted in resource-abundant settings. This view is complemented by Böcker and Meelen (2017) in their study of the sharing economy. The motivations of such groups are often driven by broader social-ecological causes (Hossain, 2016). They often maintain longer-term visions and provide space for voluntary participation (Bhaduri and Kumar, 2011; Martiskainen, 2017; Middlemiss and Parrish, 2010; Seyfang and Smith, 2007). Middlemiss and Parrish (2010) have noted that participation in these ecologically-driven initiatives often receives less engagement from low-income communities. Ecologically-driven initiatives include those aiming for ecological knowledge advancement or those that experiment and engage in practical initiatives to change lifestyles (Seyfang and Smith, 2007; Leach et al., 2012; Gernert et al., 2018; Feola and Nunes, 2014). An example for the latter would be the "Transition Town Movements" which is a network of local initiatives that seek to deal with climate change problems by promoting less energy-intensive and less consumptive lifestyles (Feola and Nunes, 2014). Such ecologically-driven initiatives are conceptualized in the sustainability transition literature as 'emerging niches' that challenge the status quo in aspects of technologies, practices and values (Hossain, 2016; Ornetzeder and Rohracher, 2013; Seyfang and Smith, 2007). Niches are, here, understood as protected spaces in which radical innovations can develop without being subject to the selection pressure of the prevailing regime (Kemp et al., 1998; Smith and Raven, 2012). Therefore, the success of grassroots activities is often measured in how far they gain dominance over the incumbent regimes (Ornetzeder and Rohracher, 2013; Feola and Nunes, 2014; Hossain, 2016).

### **5.2.2 The case of most informal settlements: socioeconomically-driven "livelihoods" groups operating in resource constrained conditions**

In the development literature, various studies demonstrate the capabilities of citizens themselves in producing their own services – such as water supply, sanitation, energy supply, waste management and financial services for instance (UN-Habitat, 2003; Ostrom, 1996; Otsuki, 2016; Mitlin, 2008; Joshi and Moore, 2004; McGranahan, 2015; Wamuchiru and Moulaert, 2018; Wamuchiru, 2017). These studies often take informal settlements for an empirical example where service provision activities are largely undertaken by community members within broader

arrangements of meeting livelihoods needs (UN-Habitat, 2003). The activities of these grassroots are often perceived by members to be “a means to an end”, meaning they maintain individual socioeconomic benefits, and majority of participants do not necessarily prioritize in contributing towards socio-political deliberations because of poverty-related constraints (Bhaduri and Kumar, 2011; Hooper and Ortolano, 2012). Poverty conditions motivate individuals to engage in grassroots activities (Hooper and Ortolano, 2012), therefore we term them *livelihoods groups*.

Livelihoods groups have played the role of main service provider over several decades as informal settlements were left out of planning for formal basic service provision. This is attributed to the historical development of Global South cities where the settlements were perceived as illegal (UN-Habitat, 2003; Adams et al., 2018). With the absence of formal provision, local inhabitants developed ways to create access to basic services, mainly by means of self-organized groups that would pool resources and invest in service infrastructures. These groups made local informal arrangements to manage public toilets, public water kiosks, solid waste management services, security, money saving and lending services, as well as spatial planning (Hailey, 1999; Nunbogu et al., 2018; UN-Habitat, 2003). Establishment of livelihoods groups was largely promoted by the community-based approaches and concepts for poverty eradication which prevailed in the 1980s. Therefore, these groups essentially had common-good ambitions. Non-Governmental Organizations (NGOs) played a key role in building capacity of communities to take care of their own livelihoods needs, including self-provision of services (Hailey, 1999). UN-Habitat (2003) reported the rapid growth of livelihoods groups in Africa, Asia and Latin America starting in the 1980s, which were purposed to address basic family consumption and income requirements in a general environment of survival. Today, belonging to a grassroots group is common-practice and has become a fundamental livelihood strategy in informal settlements.

Despite making significant contributions by providing access to essential amenities, the uncoordinated and unregulated activities by these groups have resulted in critique of their long-term societal contributions. We elaborate three of the critiques: First, provision by livelihoods groups is often largely undertaken outside the control of formal regulations. The lack of regulation could impact the quality, efficiency and affordability of services (Kariuki and Schwartz, 2005; Jaglin, 2014). For example, water supply by local community groups may often levy higher charges to users than public utility systems that cater for the middle- and upper-income populations (Jaglin, 2014; Wamuchiru, 2017). Secondly, because service provision activities are entangled with livelihoods arrangements, any local intervention by external actors may be perceived as a risk on livelihoods securities therefore bringing about contentions. In this case,

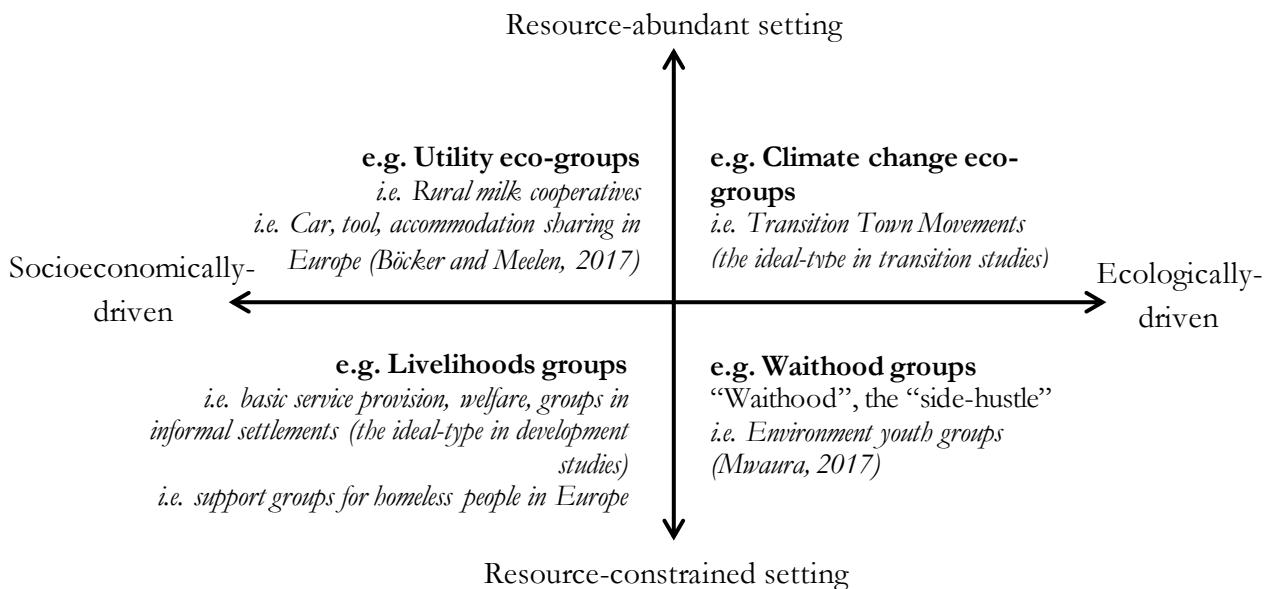
there is a risk that livelihoods groups resist new and potentially complementary activities by external actors in order to maintain control over local service provision activities, and consequently their livelihoods. See, for example, De Bercegol and Monstadt (2018) who studied how “local cartels” resisted a formal electrification project. Thirdly, the unregulated control of essential basic services like water and energy by few grassroots group members could provide them with powers, which may be misused in extortion, exploitation or exclusion (Anderson, 2002). However, the observation that grassroots groups have been able to provide services under uncertain and difficult conditions to large segments of settlement dwellers where professional providers find difficulties today warrants the study on how these grassroots manage to achieve these results.

### **5.2.3 A four-field typology of grassroots initiatives**

We suggest that a categorization of grassroots initiatives by means of “driving force” and “resource setting” provides a useful approach to compare grassroots groups using the four-field table presented in Figure 12. However, we would like to emphasize the view that all sorts of grassroots initiatives and activities are taking place in various socio-spatial contexts with diverse motivations within all these contexts (Smith et al., 2016; Gernert et al., 2018; Smith and Stirling, 2017; Seyfang and Smith, 2007; Hossain, 2016). Therefore, we clarify that our understanding of resource setting is not about a North-South comparison. It is essentially related to the differentiated resource conditions that shape grassroots engagements even within similar geographical settings. The four-field table enables us to give examples of socioeconomically-driven groups in resource-constrained settings, also in the Global North – this being a representation of a livelihoods group that is largely outside the frame of development studies literature (Figure 12).

For ecologically-driven groups in resources-constrained settings, a case-example would be the increasingly popular environmental groups by young people, often referred-to as “side-hustles” and “waithood” engagements (i.e. see. Mwaura (2017)). These are groups of educated youths who are experiencing difficulties in attaining employment. They use group-initiatives as platforms to engage in self-led activities to acquire extra skills – mainly environmental knowledge and entrepreneurship skills. Utility eco-groups such as those for cars, tools and accommodation sharing is representative of a socioeconomically-driven grassroots in a resource abundant setting (Böcker and Meelen, 2017).

**Figure 12: Four-field table to categorize grassroots groups based on driving force and resource-settings**



We will limit further elaboration of the typologies and only focus on the capability of livelihoods groups in service provision and for sustainability transitions in informal settlements. We will also reflect about how this specific grassroots-type can contribute with insights for further transition theorizing. The four-field table presents a direction for further research.

One specific theoretical reflection that is necessary for this study is how we define and measure the “success” of a livelihoods group. We follow Leach et al. (2012) and Baskaran and Mehta (2016) who have argued that innovations need to be understood in terms of what is valued by particular groups or communities in the pursuit of particular goals. This consequentially engages also with ongoing debates on the ambivalence over the concept of sustainability (Leach et al., 2010; Smith et al., 2010; Hossain, 2018). Smith et al. (2010: 437) argue that the precise meanings and trade-offs for society between specific features of sustainability (environmental, social, and economic) need to be open to contextualized interpretation and negotiation. Therefore, in order to sensibly apply a transitions concept in our analysis of livelihoods groups, we find the need to reconsider the conventional approach in sustainability transitions for measuring success – that is by ‘niche growth’. Transition scholars generally perceive grassroots innovators as ‘niche actors’ who enter the mainstream market and start to compete with the incumbent regime actors. The niche actors would experiment with new rules and use patterns in order to eventually, if successful, establish new societal rule sets that can spread to the rest of society (Schot et al., 2016).

For livelihoods types of groups, success is largely in the domain of improving the welfare of the local community members. In the provision of basic services, we define the measure of success as the capacities to provide safe and reliable services in a context characterized by a lot of difficulties and uncertainties for providers and high levels of poverty by users. This is also in the backdrop of their ability to overcome persistent social, managerial and technological challenges in a context where other actors have been largely unsuccessful.

### **5.2.4 Assessing the innovation capacities of livelihoods groups**

In consideration of plurality of service offerings by diverse actors in informal settlements, we are interested in assessing the innovative capacities of livelihoods groups. To make this assessment, we analyse grassroots' contribution to the broader innovation system, as we do not expect that they can manage all the necessary innovation activities in isolation. Successful innovating at the sectoral regime level requires the mobilization of specific resources, which we understand as emerging out of the interplay of grassroots groups and other resourceful and powerful actors. The analysis of the broader innovation system in service provision for Nairobi's informal settlements will entail the relations and synergies between livelihoods groups, the public utility and private social enterprises.<sup>34</sup> Essentially, the public utility and private social enterprises are professional actors who maintain certain powers, resources and capabilities in Nairobi (van Welie et al., 2019b). While the public utility maintains important linkage with the local government, the social enterprises maintain important links with technology markets both at local and international scales. To accelerate the transition from a splintered to a polycentric sectoral regime – where service regimes are well aligned resulting in positive externalities for users and providers – synergies are required between the service regime actors to leverage on their specific resources and capabilities (van Welie et al., 2018). A TIS analysis for the broader innovation system provides a systemic approach to analysing synergies in relation to resources and capabilities.

TIS is defined by Bergek et al. (2008a: 408) as “a set of socio-technical systems focused on the development, diffusion, and the use of innovations”. Fundamentally, a TIS analysis is concerned with how actors engage in innovation activities, how they interact in manifold formal and informal networks, and how they define or moderate institutions in order to support the generation, diffusion, and utilization of variants of a new technology or service offering (Bergek

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<sup>34</sup> An innovation system is primarily an analytical construct, i.e. a tool used to better illustrate and understand system dynamics and performance, thus the interactions are not necessarily coordinated actions. For more, see Bergek A, Hekkert M and Jacobsson S. (2008a) Functions in innovation systems: A framework for analysing energy system dynamics and identifying goals for system-building activities by entrepreneurs and policy makers. *Innovation for a low carbon economy: economic, institutional and management approaches* 79.

et al., 2008b; Markard and Truffer, 2008). The structural approach to understanding innovation has recently been complemented with a more process-focused approach. The literature has provided several sets of core functions, which revolve around how knowledge is generated, how entrepreneurs experiment with new products, how markets are formed, how resources are mobilized, how search processes are steered and finally how technologies gain widespread legitimacy (Bergek et al., 2008b; Binz et al., 2016; Hekkert et al., 2007). Several earlier studies have analysed how individual actor groups make contributions to overall innovation system development by supporting several of the system functions (see for instance about the role of academics in TIS formation by Perez Vico and Jacobsson (2012)). In the same vein, we propose to assess the potential contributions of livelihoods groups to overall innovation development. These contributions will also indicate potential complementarities with other actors, which may inform alternative future co-management arrangements. We understand co-management as an arrangement in which third sector organizations produce services in collaboration with the State (Brandsen and Pestoff, 2006).

We apply the ‘TIS functions’ primarily as an epistemic device for a comprehensive analysis of resources and capabilities by specified service providers. It is beyond the scope of this study to reconstruct the entire TIS which would entail mapping the network of actors beyond only providers (i.e. policy actors, innovators, technology providers etc.), and would also entail more complex relations and resource conditions (i.e. local-global networks and resource flows), e.g. see van Welie et al. (2019b). For the purpose of our specific research task, we aggregate the six functions, proposed by Bergek et al. (2008a: 426), into three broader categories. Market formation and creation of legitimacy are categorized as “social functions”. Entrepreneurial activities and resource mobilization are categorized as “managerial functions”. Eventually, knowledge development and guidance of search are categorized as “skills development functions”.

Market formation and creation of legitimacy refer to the social functions – the resources and capabilities to provide new service offerings or technologies, so that they become accessible to potential users. They entail capabilities to articulate demand and being able to legitimize their activities among fellow community members and external supporters (Binz et al., 2016). Two kinds of legitimization processes are significant in service provision by livelihoods groups: (i) creating legitimacy of the intentions of actors (Thieme, 2015) and proving the value and usefulness of new service offerings or technologies (Feola and Nunes, 2014; Seyfang, 2010). Informal settlement residents are aware that grassroots establishments can in some cases end up becoming too powerful and exploitative (Anderson, 2002; Thieme, 2015). An example from

Nairobi is the now-outlawed ‘Mungiki’ grassroots group, which had established itself with the intention to regulate basic service provision. However, they became very powerful and started to forcefully control all services – as we will elaborate in more detail later (Anderson, 2002). Thus, legitimacy for grassroots’ intentions is very essential. Additionally, livelihoods groups have to prove the value and usefulness of services they offer. Informal settlements are contexts where conditions for provision are highly precarious. Water and electricity shortages, for example, disrupt operations very often. Livelihoods groups, therefore, have to be able to grant reliable services in regard to consistent access, affordability and flexible access terms. In this regard, service providers must have good understanding of the needs and capabilities of the users. Finally, maintaining well-functioning internal group relations is an important aspect of legitimacy. A feeling of belonging, meeting members’ needs, shared emotional connection and interests, as well as leadership are factors that foster harmony grassroots groups (Martiskainen, 2017). This factor is important for livelihoods groups considering poverty-related challenges and needs that may impact degree of participation by members.

Entrepreneurial activities and resource mobilization refer to the managerial function of innovation capabilities (start-ups, diversification; dealing with risks). Scholars who have studied conditions for entrepreneurial activities in informal settlements suggest the need for context-specific skills to deal with high risks and uncertainties (Berner et al., 2012; Thieme, 2017; Thieme, 2015). For example, grassroots require specific skills to organize financial resources locally in a context where poverty would limit the willingness to invest. Further, community members may hesitate to invest when the enterprises lack legal protection as they work outside formal regulations. Furthermore, investment decisions have to be arrived at by group consensus, where individuals maintain differentiated power positions. All these uncertainties require specific capabilities and resources to motivate members and to evade ongoing risks.

Lastly, knowledge development, diffusion and guidance of search are resources and capabilities to acquire skills and knowledge, and to forge values and visions that can have impact locally or at broader contexts. These include access to relevant knowledge platforms, the skills to leverage opportunities, and capabilities to envision positive and shared expectations. For example, a significant source for knowledge and other resources by livelihoods groups are NGOs (Hailey, 1999; Lines and Makau, 2018). The NGOs have also been resourceful for groups in forging shared visions – for example through the international federal of slum dwellers who actively engage with informal settlement dwellers all across the globe (Lines and Makau, 2018; Satterthwaite, 2001).

**Table 7: Summary of analytical elements based on the TIS functions to the innovation capacity of livelihoods groups**

<b>TIS-related analytical categories</b>	<b>Relevant resources and capabilities</b>
<b>Social functions</b>	<p>Related to market formation and creation of legitimacy</p> <ul style="list-style-type: none"> <li>– ability to articulate demand and anticipate disturbances</li> <li>– ability to legitimize new service offerings &amp; to locally embed them</li> <li>– ability to legitimize group intentions</li> <li>– ability to internally manage a group</li> </ul>
<b>Managerial functions</b>	<p>Related to entrepreneurial activities and resource mobilization</p> <ul style="list-style-type: none"> <li>– ability to manage physical and financial entrepreneurial risks (i.e. risk of utility vandalism; continuous availability of funds etc.)</li> <li>– ability to mobilize resources (i.e. local interest to invest; acquiring external funds etc.)</li> </ul>
<b>Skills-development functions</b>	<p>Related to knowledge development, diffusion, and guidance of search</p> <ul style="list-style-type: none"> <li>– ability to maintain platforms for knowledge development, and sharing</li> <li>– ability to shape and to develop shared visions (i.e. popular user perceptions on ideal service offerings at city, national, or international levels; shared service provisioning practices &amp; values etc.)</li> </ul>

All told, we propose to analyse the contributions of livelihoods groups to sustainability transitions by looking at the specific capabilities and resources they are able to mobilize when new service offerings have to be embedded in the very diverse and challenging environments of informal settlements. We hypothesize that they are able to leverage expertise for building up reliable socio-technical configurations, which other, more professional actors may have a hard time to copy. We, furthermore, group these capabilities in line with core innovation system processes, which allow us to extend the analysis to account for complementarities with other actors operating in the same sectoral regimes. This enables us finally to propose potential future co-actor arrangements that might be more successful in transforming the splintered regimes into better performing polycentric regimes.

### **5.3 Methodology**

This paper settled for a qualitative case study methodology. We selected a case based on a preliminary explorative analysis of eight grassroots groups in different locations within the city of Nairobi, Kenya (Appendix B). Among them, we purposively selected the most successful one for the detailed study. This is a grassroots group that manages a public toilet for domestic use and 150

has successfully provided reliable services for over ten years. Additionally, the selected group had indications of possessing most of the resources and capabilities that we specified based on the TIS functions, i.e. social, managerial and knowledge development. A successful, deviant, case selection enables us to provide a more comprehensive elaboration of challenges that can be encountered in service provision and how these problems could be tackled. Such deviant-case samplings can refer back to the larger sample of cases lying in the background of the analysis, i.e. the seven preliminary cases (Seawright and Gerring, 2008). Therefore, in this paper, the preliminary cases, listed in Appendix B, are referred to when they assist in elaborating specific points.

The livelihoods group studied is called ‘Muungano wa Bondeni’.<sup>35</sup> The group of 45 members has existed since 2006, and in 2007 they started providing toilet services to residents of Mathare-Bondeni, a village of 2500 people. The larger Mathare informal settlement in which Mathare-Bondeni is located has a total population is 188,183 inhabitants (Corburn et al., 2012).

The study was conducted based on interviews, discussions and observations during a ten-week fieldwork between October and December 2016. The first author interviewed the users, members of the group, group leaders, local informants, and sector experts (Table 8). In-depth and semi-structured interviews were the main form of inquiries, containing general thematic categorization of questions to allow participants to tell their own stories in their own terms. This was necessitated by the fact that discussing toileting and sanitation needs is generally perceived to be a sensitive topic. A focus group discussion was also conducted with ten residents from Bondeni. The first author conducted the interviews within the settlements and also participated in group meetings of the grassroots. This enabled the interviewer to get insights related to the internal functioning of grassroots especially in relation to profit sharing and re-investments, relations among providers, mid-term and future plans, among other social, managerial and technical issues. Interviews with local informants like administrative officials and community health extension officers, as well as sector experts provided a broader perspective related to the functions of grassroots initiatives in society. The interviews were conducted in the local language, ‘Kiswahili’. All the interviews were recorded, transcribed, translated to English and coded using the qualitative data coding software MAXQDA 12.

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<sup>35</sup> Muungano wa Bondeni are Swahili words that can be translated as “The solidarity of the people of Bondeni neighbourhood”.

**Table 8: Data collection methods and sources of enquiry**

Type on enquiry	Sources	Total number
Interviews at household & group levels	<ul style="list-style-type: none"> <li>– Members of Muungano wa Bondeni (4)</li> <li>– Leaders of Muungano wa Bondeni (3)</li> <li>– Residents (non-members; service users) in Mathare-Bondeni (3)</li> </ul>	10
Interviews with local informants	<ul style="list-style-type: none"> <li>– Local informants in Mathare-Bondeni (6)</li> </ul>	6
Interviews with sector informants	<ul style="list-style-type: none"> <li>– Non-Governmental Organizations (10)</li> <li>– Government agencies (3)</li> </ul>	13
<b>Total expert interviews</b>		<b>29</b>
Participating in meetings & events	<ul style="list-style-type: none"> <li>– Muungano wa Bondeni weekly meetings (2)</li> <li>– ‘Twaweza group’ weekly meeting in Mathare-Bondeni (1)</li> <li>– SDI workshop on grassroots capacity building (1)</li> </ul>	4
Focus Group Discussion (FGD)	<ul style="list-style-type: none"> <li>– In Mathare-Bondeni, containing 10 participants</li> </ul>	1

## 5.4 Resource settings and innovative strategies of Muungano wa Bondeni

In the following section, we illustrate Muungano wa Bondeni as a livelihoods group – which we will further refer-to as “Muungano”. Thereafter, we will elaborate the activities of Muungano and give examples of innovative approaches to deal with social, managerial and knowledge development needs. The last part of this sub-section elaborates the challenges professional actors in Mathare Bondeni have faced when they tried to introduce new services.

### 5.4.1 Resource setting and driving force for Muungano

Muungano was established by local residents of Mathare-Bondeni, a low-income community. The majority of households lack in-home toilet facilities and depend on pay-per-use public toilets to gain daily access. Similarly, water for domestic use can only be bought at water kiosks or from mobile water vendors. The housing units have been developed without any physical planning considerations and thus often leave minimal open spaces for roads and drainage facilities. For an income, most residents are dependent on precarious home-based enterprises where they trade in household consumables or work as casual labourers in industries. Incomes are very low and vary a lot, i.e. from 150 to 350 Kenyan Shillings, equivalent to 1.50 to 3.50 US Dollars per day (Corburn et al., 2012: 39). Mathare-Bondeni lacks a sewer infrastructure and inhabitants have

depended on onsite sanitation systems – mainly septic tanks and pit latrines – since the inception of the village in the 1960s. Crime rates are known to be very high in Bondeni and its environs (Andvig and Barasa, 2014: 66).

There was only one public toilet that served the majority of Bondeni residents by 2006 when Muungano was established. The facility was among a few that the government constructed in the 1980s as a response to Cholera outbreaks. The facilities had since existed without a mandated management arrangement therefore were highly neglected.

*“The public toilet was very much neglected. It was not washed. (And) due to lack of flush-water, the toilets clogged. People would defecate around the clogged toilet bowl or just by the door of the toilet (...) no one was responsible for its cleanliness (...) at some point, this public toilet was not usable anymore and people opted for open defecation”* – Muungano member

As livelihoods groups became established in Bondeni over the years, so did the idea of community-managed public toilets. Muungano took over the management of the neglected community toilet in 2007. The activity became a part of the group’s broader livelihoods activities, but was additionally motivated by a need to provide a more decent toilet access for the local residents. Belonging to grassroots groups has become a fundamental livelihoods requirement locally, with majority of Bondeni residents belonging to more than one.

*“Groups help because you cannot save money alone here. The (intermittent) 200 Kenyan Shillings (2 dollars), as I get it I can very easily and quickly spend it because of too many needs (...). You know the (formal) banks have too many requirements. To get a loan, you must find a guarantor (...) our friends here do not have land or property to use as guarantee. Local informal banking is beneficial as it has fewer requirements”* – Muungano member

*“I belong to five groups. All these groups have different agendas. (...) I can get different opportunities, some for weekly savings, some for monthly savings, some have NGO funding for youth trainings, they help me grow in my career”* – Bondeni resident

A discussion with Muungano members elicited information about economic opportunities being perceived the main motivation for engagement. Membership was suggested to expand opportunities for an income as members would depend on each other for loans for example. The group itself provided quick and easy access to loans. Additionally, when we compare the activities of all the eight groups from the preliminary study, all of them maintained money saving and lending activities as well as informal social insurances.

We questioned Muungano members about the significance of ecological activities, where it was suggested that these become of interest only when they have immediate economic benefits. The group often decides to engage in ecological activities when tangible benefits accrue. Muungano

members would, for example, want to know what tangible benefits a community environmental initiative would bring to them or to the group before they decide to participate (Muungano leader). In a more general sense, the livelihoods groups which are locally referred to as ‘chama(s)’ are suggested to become more prominent for lower-income communities than the richer neighbourhoods (NGO leader).

#### **5.4.2 Innovation capabilities related to the establishment of reliable services**

Mathare-Bondeni is inhabited by people with diverse socio-cultural backgrounds. There exist also recurring changes in people’s capabilities – whereby at one time people have resources and another they completely lack. This is as a result of the precarious conditions for earning an income. In such a context with constantly changing preconditins for practices, it becomes difficult to use conventional market survey tools to adequately capture income levels, market preferences or even willingness to pay.

Being run by locals for the locals and having the majority of members as primary users, Muungano has been in a privileged position to articulate the real needs of the people and to design interventions that effectively deal with the daily challenges of users both socially and economically. Based on this intricate connection with users, Muungano has been able to also build legitimacy – both of their intentions and as well of the products they offer: “*It is ours, we also use it so we have to give a good service*” (Muungano member).

Establishing legitimacy of the group’s intentions was very important during the initial stages when Muungano was established and when they started to provide services. The general condition of mistrust and lack of safety had to be tackled.

*“You know here (in Mathare-Bondeni) we have done a lot of things. Before we got established we had to prove ourselves. This was a big challenge. Community members were suspicious that the group formation was intended to forcefully steal people’s land (...) it was also around the time of the 2007 elections and people were fearful about our intentions”* –Muungano leader

The difficulty in building legitimacy was reinforced by previous experiences where a livelihoods group ‘Mungiki’<sup>36</sup>, had gained a lot of power which started to become counterproductive for the communities surrounding Bondeni. The group had established itself with the intention to regulate basic service provision. However, they started to forcefully take over the management of most services including water, sanitation, transport, and security.

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<sup>36</sup> See Anderson DM. (2002) Vigilantes, violence and the politics of public order in Kenya. *African Affairs* 101: 531-555. for a paper which analysed the activities for Mungiki in Mathare

*“The group (Mungiki) got so powerful here in Mathare and very much feared (...) but they started becoming problematic when they moved towards undertaking justice locally (...) especially on what was locally perceived as personal moral issues like infidelity (...) they (also) started reallocating housing units while applying their own rules (...) when they interfered with the alcohol brewers, who have their own solidarity group by the way, that is when the community members started revolting against them” – Local informant*

Furthermore, Muungano had to be innovative under the uncertain conditions of service provision in order to gain legitimacy as providers of reliable services. In 2007, Muungano acquired the neglected public toilet facility from a previous group that had been unable to maintain reliable services.

*“The first group to come up with the idea of managing this toilet for a fee was a group of young people. Actually, they were the first group to ever manage a public service facility in this area (...) but they started having money problems among themselves. Also, women felt insecure because some of the boys in the group used to hide inside those toilets and steal from customers” – Muungano member*

*“The toilets would be shut down for a number of days as they solved the internal group conflicts. The community members are the ones who suffered from this so they were very unhappy” – Muungano member*

To counter this trust problem after the acquisition, Muungano registered as a Community-Based Organization (CBO) as strategy to show their commitment to the needs of the public. Registering as a CBO sets Muungano apart from many local groups that function without any formal recognition. However with the registration, a CBO is only recognized as a self-help livelihoods group but not as a potential partner in formal basic service provision because most of the members lack formal skills.

The group further established internal strategies to maintain trust among members. The first was done by distributing leadership roles to avoid creation of hierarchies among members. For example, the group maintains three financial accounts for the different major projects and each account has three members as signatories, with one of them acting as a chairperson of the project. This way, more members are involved in leadership and thereby creating a strong sense of ownership and responsibility. The structure of Muungano leadership is not the standard structure by grassroots groups (Muungano leader). It was locally adopted by Muungano based on what they had been taught by an NGO of which Muungano is affiliated with – the Slum Dwellers International.

*“Since we have many activities going on, each has different committee members who follow up and report. Some deal with toilets maintenance and incomes, some with housing projects, so really everyone feels involved” – Muungano member*

A second strategy by Muungano to develop and maintain trust among members was related to transparent management of finances. For example in the collection of fees from customers, the numbers of toilet paper rolls consumed would be used to estimate daily income. The members acquired special toilet papers which would be counted in advance and at the end of the day, those sold would represent the income expected. Additionally in the initial stage, members would take daily turns as operators. But the group decided to hire a non-member to carry out the daily toilet operations also as a deliberate strategy to avoid conflicts, mistrust and blame (Muungano member). These simple accountability strategies, particularly the toilet roll accounting, have been effective and are now broadly applied by other grassroots providers across the city.

*“The toilet roll idea started with us. Other groups did not use it. Other groups initially had set a fixed minimal daily amount which would be expected from the operator. This did not work very well as the individual would keep the outstanding amount” – Muungano leader*

Muungano has to deal with diverse risks and uncertainties which are associated with service provision locally. Particularly, dealing with insecurity and being able to mobilize local resources consistently from low income individuals is a challenge. Vandalism, flooding, and fire-outbreaks are common occurrences in Mathare-Bondeni (FGD). Exemplary approaches of Muungano in dealing with the risks and uncertainties are presented below.

The first approach was to invest as a group rather than privately. The strategy is important in encouraging investments under risky conditions because a larger group implies less capital investments by each individual member, and consequently losses would be minimal for every member.

*I don't think anyone (in Mathare-Bondeni) would be willing to invest in such (resource intensive) business on their own. What if a fire starts? That is a lot of losses. Majority here would form ‘Chamas’ (livelihoods groups) around investments – Muungano member, FGD*

Furthermore, a group investment enabled Muungano members to pool resources together being able to invest in resource intensive activities like water and sanitation service provision. To deal with intermittency of incomes, their saving and lending activities entail flexible approaches, i.e. daily, weekly or monthly savings. Registering the group as a CBO was also a core strategy in resource mobilization whereby this way they can be eligible for community development funds by various State and non-State funders. Support from international NGOs was used by Muungano, at early stages of acquiring the public toilet, to refurbish the facility: to reconnect the toilet to a water source, to replace the toilet bowls, to unclog the sewer and by replacing doors that were missing.

The second approach by Muungano to deal with risks and uncertainties was to nurture a sense of collective ownership with other community members in order to prevent vandalism and theft. This was achieved by providing free toilet access to children under the age of five, the elderly and the physically disabled individuals. Additionally, strategies were put in place to allow for flexible forms of payment for access – such as by credit and making advance payments on weekly or monthly basis (Discussions in meeting).

The third approach of Muungano in dealing with risks and uncertainties is through diversifying their activities. The aforementioned risks like flooding, vandalism, and even a lack of steady financial resources, motivated Muungano to maintain several activities such that when one fails, another would sustain the group both financially and in terms of keeping membership active.

*Some activities are good and we can rely on them more while others get influenced a lot by ongoing issues in the neighbourhood (...) sometimes we can never be sure about the toilet service we offer because for example last week, another group was contesting ownership (...) it is, thus, important to diversify our activities – Muungano leader*

Muungano involves itself with the following activities: weekly savings by individual members (banking), welfare contributions in equal amounts (to cater for hospital bills, weddings, visit to each other's rural homes, and burials), water kiosk service, toilet service, saving scheme to purchase land and housing, money lending services, revolving funds, and short-term development projects. Interestingly, individual members also diversify at a personal level by belonging to several groups thus making grassroots engagements robust and very active livelihoods practices.

*"Many of us, when we do not have any money we borrow from one group and pay into the other. Belonging to several groups is very useful" – Muungano member*

*"The community is so busy, no one is just idling, you find a man today in this group and tomorrow in another" – Muungano member*

To exemplify the capacity of Muungano in resource mobilization, the group was able to raise 1.3 Million Kenyan Shillings (13,000 dollars) to finance the purchase of land where their toilet structure is situated. Muungano was able to encourage investments by members, to maintain profitable entrepreneurial activities, and to put in place appropriate savings schemes to achieve this. Such a large local resource mobilization and a plan to re-invest in sanitation are uncommon in informal settlements. The example from Muungano, nonetheless, proves that livelihoods groups can be innovative and can contribute with resources towards sanitation improvements. On a negative note however, a more-recent follow-up (Interview, Muungano leader, July 2018)

found that once the fund raising target was reached, members started to be at odds if they should actually reinvest in the toilet or opt for more profitable business of house rentals.

### **5.4.3 Innovation capabilities related to skills development and scaling up**

We highlight one important organization, the Slum Dwellers International (SDI), of which Muungano is affiliated and has been able to provide skills and knowledge in service provision and poverty alleviation to informal settlements various actors. SDI is an international network of initiatives by slum (informal settlement) dwellers.<sup>37</sup> Being part of the network, Muungano is able to participate in exchange programs, workshops, and skills training that are facilitated by SDI locally and internationally. For example, the first author of this paper participated in a workshop in Nairobi where local SDI-affiliated grassroots – including Muungano – were invited to learn about their constitutional rights and to explore opportunities in policies to participate in community building. SDI also facilitated the participation of two women,<sup>38</sup> residents in Nairobi's informal settlements, in the international Habitat III conference in 2016 in Ecuador. Additionally, members of Muungano have been able to attend various SDI-supported skills-development activities locally and internationally. Examples include two recent exchange visits of two SDI-affiliated groups to learn about alternative service provision models for public toilets.

*"(after learning from the other group), we think the Biocenter is an interesting model (...). This one, people will accept (...) we can do it based on what we saw in the Kibera group when we (Muungano) visited them – Muungano leader*

*"Some group members also represented us in Nakuru town the other week and they visited the Biocenter there – Muungano member*

The SDI platform has been especially impactful in creating a network that shapes the visions of informal settlement dwellers in Nairobi. A national federation exists that connects over 1000 SDI grassroots groups all across Kenya. The federation strives to align the visions and values of the affiliated groups at the national and international levels. For example, SDI encourages what they term a “simple to complex” principle when groups establish themselves. They would start with fewer activities and expand them over time with increased experience. A Project Manager at SDI National office informed that the principle is especially important in shaping common aspirations by tackling simple problems members face in their everyday lives.

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<sup>37</sup> See Lines K and Makau J. (2017) Muungano nguvu yetu (unity is strength): 20 years of the Kenyan federation of slum dwellers. Human Settlements working paper, International Institute for Environment and Development, London, for a detailed review of the 20 years existence of the Kenyan federation of slum dwellers.

<sup>38</sup> The women are members of two groups that were investigated in the exploratory round of this research (See Appendix 2)

*“Community groups or members would be encouraged to pick a discussion, or tackle a simple shared problem or initiate a small project (...) the issue as simple as it is must give them strength. The moment they (re)solve it they consider the next issue in that area which will require them to bring more people or more resources. So they gradually grow. Once you deal with an issue as simple as managing to get a solution for sharing toilet keys, and making a cleaning regimen, they celebrate the little wins and so from there they are encouraged to discuss and tackle bigger issues. For example, tenants confronting structure owners to provide services, or groups applying for bigger water and sanitation projects. So it starts building slowly from simple to complex” – Project Manager, SDI-Kenya*

The establishment of Muungano in 2006 was especially inspired by the activities of SDI-Kenya, who held a series of community workshops in Mathare-Bondeni. They aimed to build knowledge and capacity of the community members to be advocates for basic rights, mainly relating to local land ownership and basic service access problems. They were also encouraged to engage in livelihoods activities (Project Officer SDI-Kenya). One objective of the capacity building workshops by SDI-Kenya was to trigger the community members` interest in the shared challenges – and this would generate local collaborative efforts not only for advocacy but also to find local solutions.

*“we praise this organization (SDI-K) very much because it opened our eyes (...) there was no solidarity in this place (...) they taught us what our rights were as a community, such as we must have water, we must have good toilets (...) as well clean living environments (...) we then came up with the idea to improve a neglected public toilet” – Muungano member*

During the initializing of Muungano, group activities were fewer, the organizational structure less complex. The group started at more than 100 members and daily savings was their only activity. The activity-domains expanded as the group became more skilled in managing collective projects. As the group articulated its visions and activities, the membership gradually declined until the current number that has stabilized at 45 members, and the group is now ‘closed’ meaning it does not recruit new members.

We also observed a shaping of rationales at grassroots and community levels in relation to sanitation technology choices. SDI comes from human rights foundation and as such advocate highly for equal access for all urban dwellers – whether from low-income or high-income areas.

*“Those other forms of provisioning (non-sewered solutions) are temporary. They should be seen as temporary. (...) advocating for them only encourages the state not to take up their mandate more seriously (...)” – Project Manager, SDI-Kenya*

Enquiry about how Muungano would want to improve their toilet facility in the long-term led to a revelation that sewer connections would make the best option. This was also expressed in the Focus Group Discussion.

The SDI network was also a significant actor in the scaling up of the locally-devised innovation and practices of toilet roll accounting, free access for special groups of individuals and leadership structure. A neighbouring group (the Twaweza group) indicated to have replicated not only the unique leadership structure of Muungano but also the accounting and the access rules. Muungano is not only innovating for itself but contributes to ideas that shape entire sectors through the SDI network platforms. While Muungano currently relies largely on external actors to steer them and support them to engage in advocacy activities, their engagements so far shows potential to lead towards more intrinsic motivations by group members to engage in advocacy activities of their own.

#### **5.4.4 Capability deficits of professional actors operating in informal settlements**

In order to assess whether grassroots groups may mobilize hard to copy capabilities, we now investigate the challenges that professional providers encounter when operating in informal settlements. We focus in particular on a private social enterprise and the Nairobi City Water and Sewerage Company (NCWSC). This way, we can identify potential leverage points where livelihood groups could complement the capabilities of professional actors.

The social enterprise, successfully established container based sanitation solutions in other areas in Nairobi. In Mathare however, they were forced to abandon their toilet project due to security concerns both for their staff and in regard to vandalism of their facilities (Project Officer, Social Enterprise; Muungano leader). Additionally, the project officer cited challenges the social enterprise encountered in acquiring space to instal the sanitation facilities. In this regard, the social enterprise lacked social and managerial capabilities to legitimize their activities in Mathare-Bondeni.

The NCWSC experienced resistance from local community members when they installed pre-paid water meters in Mathare. Similarly, the resistance was also experienced when Nairobi's public electricity utility failed to legitimize new pre-paid electricity services in another informal settlement in Nairobi (Project manager, local NGO). For Muungano members, they were not satisfied when a water kiosk they operated also receive a pre-paid meter installation. This way, water could be accessed only by means of a prepaid debit card at an automated water dispenser – therefore the role of an operator was made redundant. Muungano's role was in this case shifted from an operator to a caretaker and therefore expected to take care of the facility without compensations. Further, the automated system relayed the revenues directly to the water utility. Muungano members perceived the changes as a revelation that their efforts are not recognized by the local government and the public utility. It resulted in tensions between Muungano members

and public utility officials. The implications of these changes on customers was that they could not anymore access services on credit terms – as access required the customer to always have money in the prepaid card. This is different from previous access conditions where customers could be provided with access even when they would organize payments at a later time or date. A local resident additionally cited the implementation of the new access arrangement did not take into consideration the broader community risks, such as fire outbreaks, which would require more access and control to water by the community (FGD). Such conflicts have led to situations where facilities by social enterprises and utilities have been vandalized (Project Officer, local NGO; Local inhabitant, Kahawa-Soweto).

To conclude this sub-section, we suggest that the challenges private social enterprises and the public utility faced in Mathare Bondeni are essentially related to their limitation to gain a link with community members in order to leverage essential social, managerial and knowledge development needs. In contrast, we earlier presented evidence of what it took for Muungano group to gain legitimacy with local community members, which led them to understand socio-economic needs and to contain managerial risks. Further, Muungano has connections with other essential outsider actors, like the SDI, of which the professional actors lack. In this line, Slum Dwellers International argues that there is still huge potential for utilizing the knowledge, resources, and capabilities of grassroots to improve service access in informal settlements. SDI sees potential in aligning the activities of professional actors and the grassroots, and has been experimenting along those ideas within two informal settlements in Kenya.

*“We want to have grassroots groups converted into neighbourhood and residents` associations also in informal settlements. (...) forming the associations will provide a basis for co-production arrangements (between professional actors) with the local residents (...), same as what we have in Runda<sup>39</sup> (...). The approach is more inclusive as everyone living in a specific area will be a member of the local association, including tenants” – Programmes Manager, SDI-Kenya*

## 5.5 Positioning grassroots in the wider innovation system context

The conventional analyses of livelihoods groups, as conducted by many development scholars, have focussed on their role in supporting livelihoods for low-income communities. The potential contribution of these groups to innovation and sustainability transition is still not well understood. This paper set to analyse the resources and capabilities livelihoods groups could

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<sup>39</sup> Runda is a high-income neighbourhood in Nairobi that has been able to organize itself as a residents` association and secured a co-management arrangement with the Nairobi Water and Sewerage Company. SDI is exploring such an arrangement in an informal settlement which can be a challenging task considering land tenure problems or the highly transient nature of tenants who make the majority of residents.

leverage under the condition of a splintered sectoral regime and how they could complement initiatives of other actors aiming for better service provision in informal settlements. We are of the view that successful innovating at the sectoral regime level requires the mobilization of complementary resources, which we understand as emerging out of the interplay of grassroots groups and other resourceful and powerful actors. Using the case study of Muungano wa Bondeni, we saw that despite being production-driven and needs-oriented, the livelihood group was able to mobilize specific resources that professional actors lack. In particular, the case shows how livelihoods groups can potentially leverage “links with the users”, a core capability deficit of public utilities and private social enterprises. By providing services to communities, which they belong, livelihoods groups are in a better position to articulate local needs. Hence, they have an expertise in terms of the “social function”. The public utilities and private social enterprises have struggled in informal settlements despite possessing strong capabilities in terms of technologies and financial resources. For new forms of provision to successfully build up markets and legitimacy, the providers are required to appreciate the variety of people and develop an in-depth contextual knowledge about their practices and livelihood strategies. Livelihoods groups are in a better position to assemble this expertise because they are part and parcel of the same communities.

This context knowledge and capability also supported Muungano to mobilize specific resources for the “managerial function”. Muungano has been able to evade entrepreneurial risks and resource mobilization challenges through diversifying their activities, by making group investments and also by developing sense of community ownership and in this was able to signal the benefits to the general community.

Finally, grassroots can also be important and proficient actors when it comes to the “skills development function”. Livelihoods groups should not be seen as isolated groups of city dwellers that can only draw on the intelligence and ingenuity of its local members. They may also build up networks through which they may access experiences and expertise of other similarly organized groups. In particular, they are increasingly connected to national and international NGOs, which provide platforms for knowledge exchange across geographical scales, as exemplified by the role of SDI. These knowledge and exchange platforms present opportunities for consolidating the experiences of individual grassroots groups and by this ultimately support the scaling up of sustainable innovations. This may happen within a specific city like Nairobi but may extend to the entire country or even contribute to South-South learning. The exchange between Muungano and other groups within the international federation of slum dwellers exemplifies this point very vividly.

Despite the unique capabilities, we find that livelihoods groups could also have limitations. Livelihoods group manage – therefore maintain considerable control of – services that are very essential in society, like water and sanitation access. Therefore, if this power position is misused, they have potential to undermine the well-being of many. In terms of their contribution to longer term transition processes, these groups may want to maintain the status quo if the situation is beneficial for them, thereby resisting innovations by other actors. A contra-intuitive view of the criticism by Muungano on their water kiosks being digitalized can be suggested to result from the introduction of an increased control on revenues by the public utility – which consequently reduced the benefits the group could enjoy. One of the major drivers for resistance is that individuals and groups want to secure their livelihoods opportunities.

Additionally, because decision makers have not been motivated to adopt more proactive forms of community engagement in service provision, there is still inexisting formal regulations that hold livelihoods groups accountable in their activities to provide essential services. This is despite the livelihoods groups still maintaining the position of main providers of sanitation services in many informal settlements – inlcuding Mathare Bondeni. The lack of formal regulations leave livelihoods groups with a lot of freedom in how they would want to develop their service provision activities in future. We provided as an illustration, the more recent developments for Muungano where they have been deliberating a possibility to convert from sanitation provision to rental housing. This is despite the facility being community-owned. Muungano successfully mobilized local funds to buy the land where the toilet is located. Therefore with lack of regulations, they have the power to even demolish the toilet structure and set up more profitable business ventures in the land which they now own.

Given the capabilities and limitations we have highlighted, we suggest that: what is required to enable livelihoods groups to contribute to sanitation innovations and to a sustainability transitions is perspective from a system level of innovation. A coordinated co-management strategy could result in service offerings that meet the socioeconomic needs of the community members but also do address the limitations of grassroots in relation with resistance and exclusion. We observed one of such system-level strategy in Nairobi by the SDI. They are exploring possibilities to convert livelihoods groups into residents' associations. This way, the grassroots could continue being socioeconomically-oriented but also become formally recognized as service providers. Such an approach is compatible with delegated management contracting concepts by local governments. This way, the local grassroots would have a policy basis for engagement with the professional providers – particualrly the public utility. In addition, residents

associations are inclusive by being based on the locality of residence rather than organic groupings within the community.

## 5.6 Conclusion

We investigated in which ways grassroots groups have to be innovative when implementing reliable services and how these capabilities could contribute to support sustainability transitions in informal settlements. We maintained that these capabilities and resources can be complementary to those of other more resourceful and powerful actors. We first specified the kind of grassroots we are analysing based on insights from the grassroots innovation and development studies literatures. We characterized our empirical case as a socioeconomically-driven initiative in a resource-constrained setting – thereby categorizing it as a *livelihoods group*. In our analysis, we found that the livelihoods groups can potentially leverage social and managerial resources and capabilities, which are essentially derived from actors with strong links with community members, and with intricate knowledge of local context of service access and provision. However, their activities may also hinder sustainability transitions, when these groups fail to be inclusive for all community members and when they resist the potentially complementary innovations by other actors. Given the resources, capabilities and limitations, we suggest that a coordinated co-management approach could foster sustainability transitions in informal settlements.

We now want to reflect on the broader relevance of our study for the transitions literature, importantly the understanding of transition pathways in informal settlements. Our findings provide empirical evidence about the variety of strategies of different forms of incumbents within splintered sectoral regimes (van Welie et al., 2018). As a result, we have to consider a much more variegated landscape of alternative and even competing service regimes and to consider the role and agency of seemingly less powerful actors in transition processes. In particular, we have to be much more explicit regarding power relations in Global South cities and how they intervene in the ability to contribute to the generation of better livelihoods. In our analysis, we also found that the conventional understanding of niche-regime relationships as portrayed in sustainability transitions literature has to be fundamentally moderated; we see that grassroots in informal settlements may maintain institutionalized powers. This challenges the notion in transition studies that these grassroots groups are primarily operating in niches. Rather, we have to understand how different actors may have incumbent positions in different contexts. Transformations are therefore less of a niche versus regime type but rather result in the mutual shaping of different regimes in specific local contexts.

The sustainability transitions field has also struggled with how the normative views on “sustainability” should be addressed conceptually. Our proposed typology based on the two dimensions of “resource setting” and “driving force” provides a useful approach in specifying sustainability for different types of grassroots initiatives in general, i.e. also outside of settings in the Global South. Our tentative typology should be seen as a starting point for the development of more detailed, extensive and robust future typologies. Further development on typologies may also lead to structured comparisons between grassroots initiatives in diverse geographical settings, thereby contributing towards making transition frameworks more place specific and geographically representative (Hansen and Coenen, 2015; Truffer et al., 2015). Comparisons may potentially even uncover convergences in grassroots initiatives where cross-learning can happen. For example, the grassroots-based sharing economies, which are an emerging reality globally, could profit from insights generated for the grassroots groups in informal settlements.



## **Chapter 6: Conclusions**

## Chapter 6: Conclusions

This thesis made a detailed analysis of the roles and agency of informal settlement dwellers in innovation and transition processes, by taking the case of sanitation in Nairobi, Kenya. The study was guided by the following research questions:

1. What are the characteristics of socio-technical regimes in Global South cities, and how do informal settlement dwellers are constituted into, and stabilize, these regimes?
2. How do informal settlement dwellers in their daily activities shape the process of embedding innovations into their local contexts?
3. What resources and capabilities do informal settlement dwellers possess for transforming socio-technical regimes?

The broader objective of the user-focused studies was to contribute to the debate about why more diverse sustainability transition trajectories need to be envisioned for Global South cities. The second broad objective was to provide new insights for further theorizing, in the sustainability transitions field of study, in relation to how users are conceptualized and understood. In the following sections, I will present the key findings of this thesis and reflect on them for a broadened view of what it takes to apply transition approaches in heterogeneous contexts.

In Section 6.1, conceptual and methodological implications from this thesis are discussed. This is followed by practical implications in Section 6.2, and eventually, I conclude by highlighting some inroads for future transition studies.

### 6.1 Conceptual and methodological implications

In Section 6.1.1, the characterization of socio-technical regimes in Global South cities as being “splintered” where users take central positions and have proactive roles is discussed. Section 6.1.2 discusses new insights about sources of regime stability emanating from users and their contexts. In Section 6.1.3, I discuss the implications of user activities for local embedding of innovations. Section 6.4 follows with a reflection on the value of combining socio-technical regime and practice-theoretical approaches. Additionally, I reflect on the application of Northern theories in Southern contexts.

### **6.1.1 Splintered regimes in Global South cities and the central position of users**

The theoretical anchor of this study is the sustainability transitions field of research. An imperative starting point for me was to think through the core concept in sustainability transitions—the socio-technical regime—and the inherent assumptions it maintains in order to more effectively operationalize it for my analyses. The main interest here was how to conceptualize the heterogeneous service provision and access conditions that are typical in Global South cities. This was necessary because the original transition frameworks were developed based on insights from few OECD countries, where socio-technical characteristics of basic services are very different from those in Global South cities. Primary data collected from users, providers, innovators, and sanitation sector professionals in Nairobi was used to reconstruct the prevailing heterogeneous sanitation regime.

In order to get hold of the complexities, we specified two analytical levels “service regimes” and “sectoral regimes”, which provided a conceptual space wherein the socio-technical configurations of service options as well as the alignments between them were more clearly visible (Chapter 2). First, the service regimes were defined based on analysing the stable combinations of technologies, user and provider routines, organizational forms and shared meanings in provision and accessing sanitation. Methodologically, a focus on user and provider practices was required to define the service regimes, where insights from practice theory were used. Taking practices as a methodological approach was necessary because identifying the sources of socio-technical regime stability requires the unearthing of tacit knowledge. The conventional approach in sustainability transitions would be to analyse legislations, documented protocols and other codified data on technological artefacts for service provision. This would not be adequate for Global South cities where varieties of provision practices are informal and not regulated. The result of this way of conceptualising basic service provision and access is that we identified five parallel service regimes in Nairobi: “domestic sewer”, “shared onsite”, “public sanitation”, “coping sanitation” and “container-based sanitation”. A focus on provision technologies, rather than materialities in access, would for instance have overlooked the coping sanitation, which is a service regime that is organized by the users themselves and is not formally considered a viable alternative. Coping sanitation regime is also a shameful practice which people partake secretly and not openly discussed.

Additionally, the activities of users in organizing services through local grassroots groups in the “public sanitation regime” was identified through the methodological attention on user and provider practices. This provision mode is largely perceived by policy makers in Nairobi as a

temporary solution. Its position in the socio-technical regime would largely be under-represented in formal databases of service providers.

At a second level, the alignments or misalignments which exist across service regimes were analysed. They give rise to specific forms of the “sectoral regime”. Alignments at the sectoral level are a function of the complementarities between various service regime components and inter-operability between the different service regimes. Adopting the two analytical levels enabled the characterization of the situation in many cities of the Global South as “splintered sectoral regimes”. The splinteredness implies that users have to assume very proactive roles to mend the splinters across misaligned service regimes and to create livelihoods opportunities. It was therefore necessary to understand in more detail how users actively construct their daily practices, which led to the conceptualization of the Oscillating Domestic Spaces.

In Chapter 3, I describe how the mending of splinters occurs – entailing complex daily activities across time and in space, which I conceptualize as “Oscillating Domestic Spaces”. The concept reflects the need for people to develop a multiplicity of alternative options and partial solutions to be able to manage access under difficult and uncertain socio-material conditions. This comes as a result of precarities in practice preconditions, i.e. a lack of consistent availability of access options daily, and fluctuations in social and economic enabling conditions for practices. Therefore, despite many alternatives to choose from, none of the options is available or accessible consistently, thereby requiring proactivity by users across time and in space to bridge the different unreliable services. The Oscillating Domestic Space concept was able to provide insights to why “coping sanitation regime” remains persistent despite being perceived by users as entailing shameful and unhygienic practices. A person can sometimes be left with only a non-desirable access option during some specific situations of precarities in practice preconditions (Chapter 3). The practices related to coping become established over time, for example the well-known waste disposing practice called “flying toilet”<sup>40</sup>. Coping sanitation regime is categorized among the five sanitation regimes that has become established in Nairobi and is entirely organized by the users themselves (i.e. not relying on a service provider).

In addition to the proactivity by users in dealing with the daily fluctuations in practice preconditions, splintered regimes are characterized by proactive activities by users in service provision within their engagement in grassroots groups. The grassroots groups are an important form of livelihoods sustenance activities on which many settlement dwellers rely (Chapter 5). In

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<sup>40</sup> Flying toilet is a local term in informal settlements in Kenya and refers to the strategy of defecating into a plastic bag while inside the home and throwing the waste, unnoticed, into the open environment. These strategies are performed because of a lack of toilet access.

Nairobi, one-third of the population – those that live in informal settlements – are primarily served by grassroots provider groups, i.e. categorized as public sanitation regime. Grassroots have become established as key providers since the last half a century, when informal settlements were considered illegal and no formal services were provided, i.e. by public utilities (Chapters 2 and 5). These grassroots have resources and capabilities which may be useful for further improvements of service provision in informal settlements, but they may also enter into conflicts and competition with other service provision actors (Chapter 5). These positive and negative potentials of grassroots will be discussed later in this section.

A key insight that emerges from this description of the splintered regime, is the need for more diverse transition trajectories to be envisioned, that acknowledge and can build on the active roles of users. The trajectories have to go beyond the idea of Northern-inspired transition towards a “monolithic regime”; which are “abstract systems” where users assume very minimal roles (van Vliet and Spaargaren, 2010). The monolithic sewer-based sanitation systems are still the aspirational standards in much of the public debates in Kenya and elsewhere. In Chapter 2, we discuss how the diffusion and dominance of a monolithic “domestic sewer regime” may be unattainable in Nairobi due to the current state of stability of all the five service regimes, and because of lack of capacities by public utilities. The heterogeneity may not disappear in the near future. Therefore, the alignments of the four service regimes (i.e., domestic sewer, the container-based, public sanitation, and shared on-site regimes) could provide a more realistic trajectory with accelerated effect in improving service quality. In this sense, a transition from the splintered to a polycentric typology would be of interest to envision and explore.<sup>41</sup> Regarding the proactive roles of users, it can be assumed that the four “transition pathways” that are discussed in Chapter 2 maintain different degrees of user engagements – with “monolithic” maintaining the least, followed by “polycentric”, and by “fragmented”, and eventually “splintered” regime which demands the most from users. Therefore, a transition from a splintered to a polycentric regime will require careful attention to, and consideration of, how the currently proactive users will foster or hinder sustainable innovation and transition processes.

### **6.1.2 Towards a re-conceptualization of stability and change in niches and regimes**

The specification of splintered regimes in this thesis revealed more diverse sources of regime stability – particularly from unexpected places and by unexpected actors in comparison to the

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<sup>41</sup> If a polycentric regime can be achieved, a replacement of the still widespread but non-desirable coping sanitation regime and the negative externalities related to it are likely to be eliminated. Refer to Chapter 2.

general perspective in sustainability transitions. Here, I discuss the sources of regime stability in informal settlements with its residents and by grassroots groups.

For Global South cities, the conceptualization of the splintered regime shows how the splintering is, in itself, stabilized in such a way that none of the five identified service regimes seems to be in a clear declining trend. Transition scholars would have a different view of a phenomenon with multi-regime coexistence or with an emerging niche. For example, Turnheim and Geels (2012) suggested that a context with multiple regimes and practices leads to instability or destabilization of socio-technical regimes because there will be competition among them. The regimes would compete with one eventually gaining dominance and the other(s) disappearing. For Nairobi, I found that many incumbents exist in parallel who maintain different service regimes within similar contexts or with some local spatial differentiations, e.g. grassroots groups acting as incumbents of public sanitation regimes in informal settlements while public utilities are the sewer regime incumbents in the richer neighbourhoods within Nairobi. The Oscillating Domestic Space additionally shows how users push towards diversifying their access options as a pragmatic approach to meeting their basic livelihoods needs in their uncertainty-laden context. This consequently contributes to the persistence of non-desired and unsustainable services like the coping sanitation regime. Users in their daily activities are therefore a significant force to the stabilization of splintered regimes. The Oscillating Domestic Space also explains the partial embedding of a seemingly superior service offerings – which is discussed in more detail in the following Section 6.3. Therefore this thesis reveals that contexts, such as informal settlements, which are characterized with unmet needs, fragmented services and negative outcomes and feedbacks in basically all aspects of daily life can also create a form of ‘lock-in’ that is hard to escape.

Regime stability will also result from the engagement of users as providers of services, mostly in the form of grassroots initiatives – an unexpected actor. Scholars in sustainability transition maintain the assumption that grassroots are actively bargaining for a destabilization of unsustainable regime practices and they nurture sustainable niche practices. This view is based on the fact that sustainability transition scholars have largely studied those ecologically-driven grassroots which advocate for lifestyle changes towards reducing carbon footprints of individuals and organizations (Chapter 5). In this sense, grassroots groups are largely conceptualized as sustainable “niche” actors. I studied grassroots initiatives that engage in service provision, and additionally ecological activities, in informal settlements and found that they can sometimes attain the characteristics of incumbent regime actors and therefore they resist change. To protect livelihood sustenance activities, which are largely established around the services they offer within

the public sanitation regime in informal settlements, the grassroots tend to resist the activities of new actors (i.e. public utilities and social enterprises). The new actors who have potential complementary resources to contribute towards a polycentric regime transition are unable to introduce new service offerings or to implement coordinating structures in informal settlements when grassroots react by protecting the status quo in service provision.

The new insights showing resistance to change emanating from users – and especially in low-income contexts differs from the conventional perspective in transition studies that industries and policy makers are the main incumbents in transition processes (e.g. see Geels (2014)). Here, I again show the value of taking practices as a methodological approach to identifying regime stability. These insights complement the views by Ahlborg (2017), Shove and Walker (2007), and Wittmayer et al. (2016) who have pointed to the need for more studies in transition studies focusing on the user/demand side, and as well theoretical and methodological approaches which capture micro-political and social struggles, and conflicts of interest inherent in societal transitions.

Further, the new insights have implications for grassroots innovation theorizing. Grassroots need to be explored beyond the current focus on those which are ecologically driven. The study in Chapter 5 of this thesis has provided a starting point for further development of a typology of grassroots initiatives based on the dimensions of “resource settings” and “driving forces”. The comparisons made in the simplified typology provided a preliminary indication that diverse types of grassroots initiatives can be identified. The agency of diverse types of grassroots on sustainability transitions processes can be anticipated to be more diverse than the typical way the transitions literature portrayed them, i.e. as being opponents of unsustainable incumbent regimes.

### **6.1.3 Implications of Oscillating Domestic Spaces on local embedding of innovations**

In addition to helping in identifying socio-technical regimes, practice-oriented approaches make studies of systems in transition less retrospective and distanced (as is the situation with historical analyses), and in this way is better able to make claims about how individuals and organisations can or should act to steer transitions Shove and Walker (2007: 2). The operationalization of the Oscillating Domestic Space concept in Chapters 3 and 4 was able to provide insights about the implications of embedding innovations in splintered regimes. Embedding entails finding a ‘fit’ for an innovation or new service offering, and its related practices, within the broader domain of daily life. This relates to how different elements have to be arranged such as resources, the use of time and space, complementarities with other artefacts, infrastructures and practices, perceptions by family members and other community relations. The key finding is that innovations have

potential to reproduce heterogeneity and splintering of regimes, when they are introduced without an understanding and consideration of a systemic perspective. Local context conditions and needs as well as broader implications are necessary to consider.

Innovations can lead to increasing heterogeneity in service offerings. Central to the Oscillating Domestic Space concept is the idea about everyday uncertainties, competing obligations and a need for prioritizing, which pushes people to diversify access options. Sometimes, they even fail to conform with socio-cultural expectations in order to meet their needs, e.g. by using socially non-desired coping strategies in the access to sanitation. Such daily struggles imply that when an innovation is introduced, it may anchor to only a part of the complex domestic space and remain in disarray with the actual needs in the broader domain of daily life and livelihoods needs. Therefore, despite the knowledge by the user/beneficiary about the merits of a new offering, (i.e. its health and hygiene benefits), he/she may take it as an ‘add-on’ to create a more diverse portfolio of alternatives rather than as a permanent replacement of previous practices. This way, the new service offering leads to more heterogeneity in existing service options. The importance of a broad portfolio of service alternatives and livelihoods sustenance activities for informal settlement dwellers is illustrated in Chapter 4. Settlement dwellers were relocated to an entirely new neighbourhood where they had to reconstruct their domestic space. I showed how this was a challenging endeavour requiring a lot of material and social capitals. Additionally in the new context, the fluctuations in practice preconditions persisted but the portfolio of service access and livelihoods options were drastically restricted. This resulted in many people giving up the settlement upgrading initiative and moved back into informal settlements.

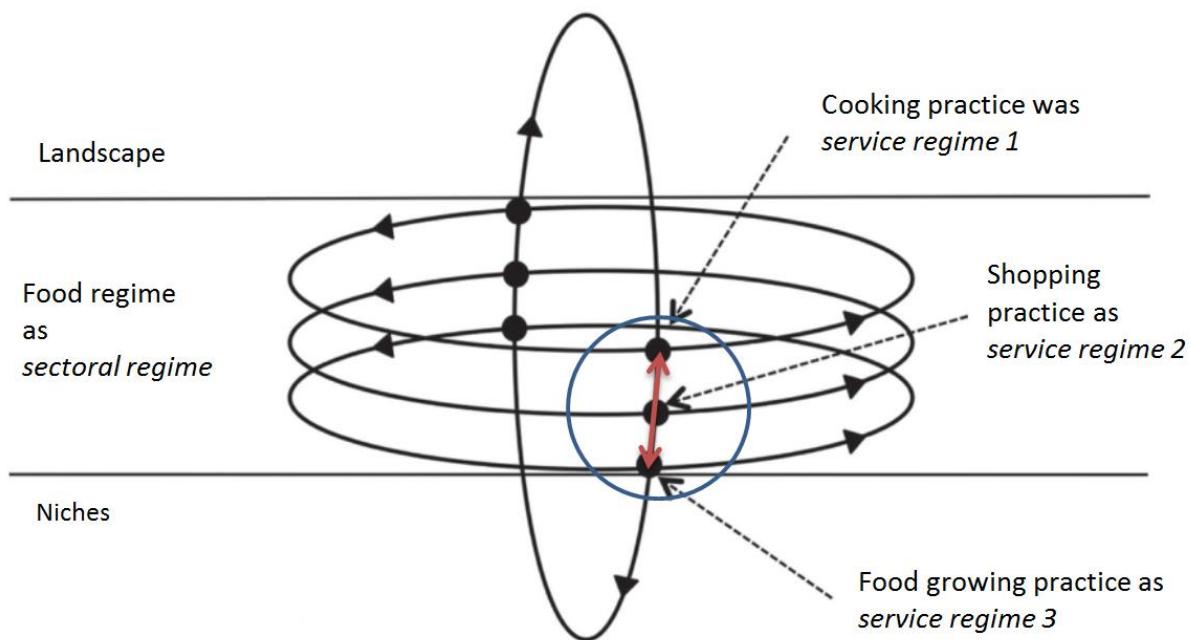
New service offerings can result in the reproduction of splintering when a systemic perspective is not considered by the innovator or service provider. This was illustrated in Chapter 3 where users were unable to successfully reconstruct a waste disposal infrastructure that would support the new sanitation service option presented to them (i.e. an in-house container-based toilet). The users therefore adapted a convenient but unhygienic approach to waste disposal from the container toilet, by dumping the faecal waste in open drainages. To avoid the splintering in this case, the innovator is required to analyse the potential broader positive and negative needs and implications of the new service offering. Additionally, if an innovation is targeted at becoming a replacement to a non-desirable or unsustainable practice, the process has to be seen as entailing both the embedding of the new practice and dis-embedding of the old practice concurrently. This approach may help to understand where resources are required to support the re-structuring or domestic spaces in such a way that the non-desirable practice is eliminated.

### 6.1.4 Value of combining socio-technical regime and practice-theoretical approaches, and scope of application

This thesis shows that practice theory can be made more productive for socio-technical transitions research in identifying key features that stabilize regimes that are not otherwise visible through a focus on technological artefacts. Therefore, an integration of the socio-technical regime and practice theory can be valuable for transitions research.

In their work, Hargreaves et al. (2013) have explored the integration of the socio-technical regime and practices. They show in their framework the link between “food regime” and three practices of “food growing”, “shopping” and “cooking”. However, they have rather taken regimes and practices as being exclusive from one another and only maintaining some “points of intersection”. This thesis provides insights about how the two approaches can be integrated further in such a way that they are consistent with each other. The “food regime” example they give in their framework can be categorized as the “sectoral regime” whereby the three practices can be seen to consist “service regimes”. This proposition would fit with the use of practices in characterizing the service regimes – as has been applied in Chapter 2. Additionally, the framework by Hargreaves et al. (2013) fails to provide insights about how the different “points of intersections” of regimes and practices are interconnected (the black dots, Figure 13). The specification of “alignments” between service regimes, as applied in Chapter 2, could be applicable for this purpose (see double-pointed arrow I incorporate in Figure 13). In Chapter 2, alignments between service regimes are showed to give rise to different degrees of stability to sectoral regimes. In the same light, an analysis of the degrees of connection across the points of intersections, by analysing practices, may give insights about how diverse types of food sectoral regimes function and their implications to sustainability. The analysis of interrelations in practices could be done using the practice-theoretical approach “bundling of practices” (Shove et al., 2012), which is represented in Figure 13 with the blue circle.

**Figure 13: Integrating socio-technical regime and practices using service and sectoral regimes and Oscillating Domestic Spaces as analytical approaches.** The image has been adapted from Hargreaves et al. (2013)



My research was limited to the conceptualization of socio-technical regimes and did not explore the Multi-level Perspective (MLP) approach about the interrelation between the niche, regime and landscape levels (e.g. see Geels (2002)). Therefore, here, I limit the discussions on the contribution this study makes to the regime level in Figure 13. In their study, Hargreaves et al. (2013) have taken a more comprehensive approach, where in the first step, they integrate practices and the regime. Then, at the second step they analyse the vertical relations of niche, the regime and the landscape. While it may be necessary for specific transition cases that the vertical levels are differentiated, it is not necessary for all cases. In fact, some scholars have even argued for a need to abandon the “nested hierarchy” as it is possible for regimes to be seen as being the stabilised or routinized practices, with niches being seen as more emergent, fluid, practices (Geels, 2011; Smith et al., 2010). The conceptualization of splintered regimes in this thesis takes a similar perspective where different degrees of institutionalization of the service regimes are analysed, rather than trying to differentiate niches, regimes and landscapes.

However, the conceptualization of the Oscillating Domestic Spaces in this thesis provides a complementary approach to analyse factors that lead to the success or failure of novel service offerings (i.e. which could be seen as niches), to embed. The development of the framework was motivated by a need to understand the diverse contextual factors that challenge the embedding of innovations in domestic spaces (Chapter 3).

Discussing complementarity of the work of Hargreaves et al. (2013) and the work presented in this thesis shows that the frameworks I propose in this thesis can have analytical value beyond the empirical case of sanitation in informal settlements. My case can be seen as an empirically rich context to help make transition concepts more robust in dealing with more complex transition challenges than those being currently tackled. In Chapter 2, we have given an example where the “transport regime” for the United States of America can be categorized as being a “fragmented sectoral regime”. Fragmented regimes may require more efforts by users and may have more uncertainties in managing daily access in comparison with a polycentric or monolithic transport regime. In this regard, the Oscillating Domestic Space concept may have value in understanding the user-related challenges and opportunities for expanding the use of train services or integrating new service regimes like cycling, for instance. Additionally, the growing interest in decentralization of water, energy and sewerage systems in OECD contexts – with a potential shift to polycentric regimes may make use of the extensions proposed in this thesis on the transition frameworks, as they are able to better explain multi-regime processes. In the same light, more proactive user-roles (e.g. in car sharing, co-production of energy and sustainable consumption) are suggested as potential pathways towards low-carbon societies. For example, see a recent PhD thesis by Meelen (2019) on the role of users in sustainability transitions in car sharing and electric vehicles. Therefore, as user roles might become more significant for service provision and access in the future, analytical approaches that are able to more centrally incorporate the analysis of users in sustainability transitions are increasingly called for.

To conclude, I would like to reflect on the ongoing debates, especially in social sciences, about whether “Northern theoretical frameworks” can or should be used to analyse Global South development challenges, e.g., see Furlong and Kooy (2017), Lawhon et al. (2014), and Storper and Scott (2016). This debate seems to be gaining resonance within the sustainability transitions community, because the original frameworks were developed based mainly on empirical examples from few OECD countries (Markard et al., 2012; Hansen et al., 2018). While some scholars assert that transition frameworks should not be used outside the contexts where they were developed, others see its value when necessary extensions are made.

I see the merit of the second perspective in consideration that the fundamental concept in sustainability transitions, of “socio-technical systems thinking”, does not maintain significant normative connotations and therefore can be applicable in diverse contexts. In this thesis, I made careful considerations about assumptions that may be inherent in the transition frameworks and then made the necessary extensions in the frameworks. The splintered regime and the Oscillating Domestic Spaces concepts have been able to provide useful insights for my research.

Additionally, they seem not to be in conflict with the viewpoints from development scholars who have studied livelihoods and basic service conditions in the Global South: see for example Coutard (2008), Jaglin (2014), Kooy and Bakker (2008), and Ranganathan (2014) on basic service heterogeneity; see Long (2001) and De Haan and Zoomers (2005) on their conception of the livelihoods concept, which is compatible with the Oscillating Domestic Spaces; and lastly, in relation to the use of “TIS functions” see the call by Jaglin (2014) for more approaches for analysing transformation capacities of actors and organizational modes of service provision in the Global South.

Additionally, I share the views by Fuenfschilling and Binz (2018) and Onsongo (2015) who have suggested that the world is increasingly becoming globalized leading to many shared ideals about how modern societies organise themselves (e.g. democracy, capitalism, culture). Additionally, there is increasing value in developing frameworks that can enable globally-comparable knowledge development in sustainability transitions, e.g. in tackling global warming effects. The socio-technical systems approach in sustainability transitions provides the fundamental neutral starting point to studying transitions in basic service provision and access globally.

## **6.2 Practical implications**

In Section 6.2.1, I reflect on the call by development scholars for more analytical approaches with practical applications. This is followed by implications for the introduction of novel service offerings, by innovators and service providers, in Section 6.2.2. Implications for the planning of development interventions by policy makers and city governments are discussed in Section 6.2.3.

### **6.2.1 Beyond contemplating about heterogeneity: insights into transformation potentials**

The broad objective of this thesis was to further develop the transitions concepts in a heterogeneous context like informal settlements. The development literature has already engaged with the conceptualization of heterogeneity in basic services since long, e.g., Coutard (2008), Jaglin (2014), Kooy and Bakker (2008), and Ranganathan (2014). For transitions in basic service sectors of Global South cities, Jaglin (2014) has argued that there is now relatively good understanding about heterogeneity of services and that more is required for the ‘subsequent steps’ of contributing with approaches to analyse how these services could function more effectively. This is in relation to the multitude of challenges innovating actors face, related to technical, political, institutional, cultural, and financial aspects. This thesis brings new insight for both fields in relation to innovation dynamics and prospects. With the innovation perspective, I am able to go beyond just adding another account of describing the heterogeneity. It enables me

to formulate practical implications for the management of science, technology, and innovation related to sustainable sector transformations (Fagerberg et al., 2013: 169).

For a transition to a polycentric sectoral regime, it is necessary to map out the resources and capabilities that can be leveraged from different actors. The application of the “TIS functions” in Chapter 5 illustrated its value as an epistemic device for the analysis of resources and capabilities by three specified service providers. The grassroots groups were found to maintain specific resources and capabilities that the public utility and social enterprises lacked. They have intimate knowledge about the conditions under which settlement dwellers have to construct their livelihoods and daily practices. In relation to more recent unsuccessful innovation activities by public utilities and social enterprises, actors who mostly lacked an understanding about local contexts, the study showed that the grassroots groups could contribute to the broader system of innovative actors with this knowledge, if collaborative efforts are fostered.

The Technological Innovation System framework revealed complementarities only among three actors: grassroots groups, social innovators and public utilities. A more comprehensive analysis to map a broader network of actors beyond only providers (i.e. policy actors, innovators, technology providers etc.), which would also entail more diverse relations and resource conditions (i.e. local-global networks and resource flows) will inspire new transition pathways towards a polycentric regime. Our application of the TIS functions suggests that the sustainability transitions field enables going beyond the mapping of heterogeneity. By analysing the actual relations among innovating actors and their contributions to a broader innovation system, these frameworks suggest new strategies of different actors in their mutual interdependence (see also van Welie et al. (2019a) and van Welie et al. (2019b)).

Additionally, the Oscillating Domestic Spaces was able to show practical application beyond the description of the complex context conditions under which settlement dwellers have to manage their daily lives. Particularly, the concept provided insights on conditions for successful embedding of innovations and development interventions, as will be discussed in the following sections.

### **6.2.2 Implications for innovators and service providers**

In order for innovators and service providers to successfully embed innovations in informal settlements, viewing the embedding processes as being systemic will prevent the simplistic view that more superior technologies is the solution for replacing inferior practices. For example, the practices related to the coping sanitation regime cannot be perceived by innovators as

“behaviours” which can be replaced by means of the ‘ABC’ – attitude, behaviour, and choice – approach. An understanding of the dynamics within Oscillating Domestic Spaces shows that the process is much more complex and requiring adequate understanding of daily practices. The introduction of novel service offerings has to be understood to result in disruptions in diverse domains of daily life and therefore often, the offerings are approached by the users with a lot of caution. While users may appreciate the superior service offering, they may still maintain the non-desirable practices out of caution. When the new offering is too disruptive, they will still have the opportunity to revert back to the old non-desirable practices, which proved useful in the past. Therefore, innovators and service providers need to understand the degree of complexity, competing needs and obligations, and the range of considerations for users when they make actual choices. As discussed in Chapter 3 and 5, an understanding of these factors will require that the external innovators and service providers exchange ideas with people who have deep knowledge about the local contexts, e.g. through partnerships with local NGOs. Additionally, the innovators and service providers ought to consider users themselves as being a key source of knowledge on contextual conditions. The users have to be seen as co-innovators and that novel service offerings can be calibrated and optimized based on the user daily experiences and feedbacks. This is particularly important because it may be difficult to foresee exactly how a specific innovation will influence the broader domain of daily life. Therefore, new lessons from daily applications can be used to further improve the innovative service offering.

An appreciation of the complexities in service access and the understanding of contextual dynamics will enable innovators and service providers to set their expectations right in relation to time and resources that need to be invested for innovations to embed. As has been discussed in Chapter 3, acquiring “acceptance” by users is only a pre-requisite for reaching “embedding”, this being a second stage that needs additional support from innovators and service providers. For example, support may be required in improving the infrastructures, which new service offerings depend on. The empirical case in the study showed that challenges in waste disposal led users to stop the use of an innovative container-based toilet. Successful embedding would require the innovators and service providers to give support in making the waste disposal system functional. Additionally, when the expectation of innovators and service providers is to eliminate a non-desirable practice, such as open defecation, by providing an alternative, the process of introducing a novel service offering will have to be conducted concurrently with a process to de-legitimize the non-desirable option. The process therefore has to be seen as requiring double efforts. The first effort would be the dis-embedding of coping, e.g. through health and hygiene educations, and the second being the embedding of the superior alternative, e.g. use of container-

based toilets. The superior service offering cannot replace the non-desirable practices in a simplistic way. In relation to this however, I found in this research that the problems is mainly not the lack of knowledge about the risks of open defecation. Instead, I would emphasize that the biggest challenge for users is how a new service offering can be made compatible with broader daily practices. For this, innovators have to acquire a solid understanding of the domestic spaces and livelihoods activities.

### **6.2.3 Implications for policy makers and city governments**

For policy makers and city governments, the findings presented in this thesis provide insights related to planning. First, the increasing interest in exploring delegated management approaches (Chapters 2 and 5), shows that a socio-technical view of service improvements is increasingly appreciated by policy makers and the city governments. There is increasing understanding that change is not necessarily driven by a technological focus but can emanate from socio-managerial innovations, for example through the collaborative engagements. In view of the increasing consideration for delegated management approaches, this thesis shows that there is potential in engaging with grassroots groups in order to leverage the resources and capabilities they maintain – particularly their knowledge on service provision in the specific context of informal settlements. Therefore, negative connotations associated with capabilities of “poor” informal settlement dwellers, which prevents decision makers from adopting more proactive forms of community engagement in service provision needs to be re-thought.

Working with informal settlement dwellers does not necessarily entail giving full responsibility to grassroots in terms of standard setting, supply, maintenance, monitoring and billing, or responsibility for entire settlements. The co-management arrangements have to be organized in such a way that settlement dwellers do not become over-burdened and as well so that aspects related to quality, pricing, human rights to access are enforced by the relevant and capable actors. Grassroots groups could, for example, limit their role to being paid operators of service amenities, which belong and are maintained by city governments. Other more diverse innovative co-management arrangements will need to be explored – including those that are able to tackle the sources of resistance by grassroots against new and potentially complementary actors. In my view, however, a key pre-requisite in co-management of basic services is the involvement of city governments. They maintain considerable resources, e.g. access to public funds and being able to influence policies. Therefore, co-management has to involve sharing of management authority, responsibilities and benefits between the city governments and other relevant non-state actors (e.g. including the users in their grassroots). City governments, therefore, need to understand why

more diverse transition trajectories are required, and how delegated management approaches may contribute towards polycentric sectoral regimes.

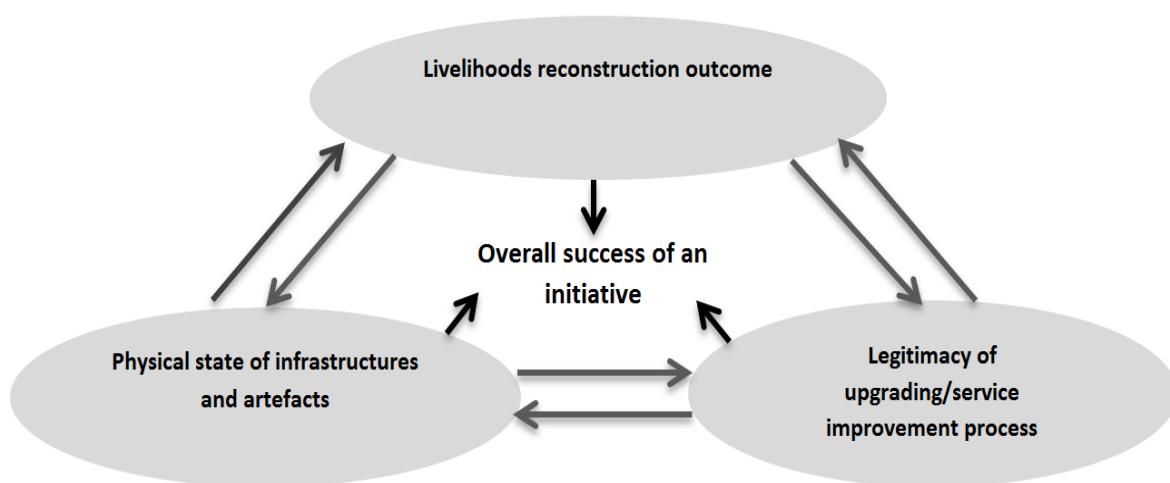
For an understanding about why more diverse transition trajectories are required for cities like Nairobi, the city governments and policy makers need to interact more with transition scholars, for example through trainings and conferences. Perhaps the perception by policy and other decision makers can be broadened beyond the over-reliance on specific forms of provision, i.e. the monolithic sewer regime. The actors may gain interest in further exploring the potential of small-scale sanitation innovations and those frugal and less technical innovations that are designed and initiated by local community members.

In relation to streamlining the activities of grassroots, it may be necessary for city governments to reconfigure the activities of some groups, which do not meet minimum criteria to co-manage services (e.g. implementing new revenue collection procedures as shown in Chapter 5). Reconfiguring the activities of grassroots is not an easy task: it should be seen as a complex process requiring dialogue and finding common grounds. Grassroots are actors with potential to resist change, or to slow down the process, when they defend their sources of livelihoods from being disrupted. Successful dialogue can be achieved by putting in place appropriate discussion platforms where community groups, or their representatives, can proactively induce their influence – rather than having passive participation roles. Similarly, dialogue and exchange is necessary with community members in general to be able to understand and take care of livelihoods construction during settlement improvement initiatives. This is showed in the study on settlement upgrading, presented in Chapter 4. It revealed that policy makers and city governments need to ensure a “higher level of participation” by settlement dwellers where they can proactively contribute to decisions throughout the projects’ process, rather than only at the onset as is often the case. However, the findings showed that participation platforms are not always adequate to capture aspects related to oscillations in domestic spaces. Therefore, the project developers could consider having sociologists within the targeted informal settlements where they can continuously learn about the changing contextual conditions and needs of the users/beneficiaries, while the project progresses. This way, city governments can be able to find solutions to the impacts of project developments on livelihoods sustenance.

In Figure 14 below, I reintroduce an adapted version of a figure from Chapter 4 which illustrates how neglect in supporting livelihoods sustenance during relocations, resulted in a negative feedback on trust towards the project developers and a negative feedback on the physical integrity of the entire initiative. Such negative feedbacks could be anticipated also in the

introduction of new service offerings but without relocations. An example is in the situations where public utilities would forcefully take over the financial control of service run by grassroots groups in their attempts at streamlining. This can lead to reduced trust between actors and situations where community members resist activities by public utilities, e.g. by destroying amenities belonging to public utilities as showed in Chapter 5. Therefore, city governments need to enter into dialogue with grassroots and community members about how co-management arrangements can be organized, or initiatives introduced, in such a way that livelihoods sustenance activities are maintained.

**Figure 14: Interlinkages between the beneficiary-related conditions for success in settlement upgrading. The arrows across the dimensions represent feedback effects.**



To conclude the practical implications, this thesis shows that the planning and implementation of innovations and interventions in informal settlements require a systemic perspective. More specifically informal settlement dwellers cannot be relegated to the position of passive consumers. To achieve sustainable transitions, users have to be seen and engaged as equal counterparts in solving the basic service provision and access challenges of informal settlements.

### 6.3 Future outlook

Concluding, I would like to highlight some of the inroads for future transition studies, which can contribute to further development of the ideas presented in this thesis. This work has prepared ground for a much more systematic approach of transition studies in contexts of development. Additionally, this work presents useful concepts, which can be made applicable beyond the

development context. To fully show the explanatory and practical potential of these approaches, a wide number of future research activities should be embarked on. Here, I will highlight four potential inroads for research in the medium-term.

First, the splintered regime and the Oscillating Domestic Space concepts were able to explain what it takes for innovations to embed and for users to contribute towards sustainable transitions in the sanitation sector. The concepts could be valuable for analysing conditions for successful embedding of innovations in other service sectors of Global South cities, like water, energy and solid waste management. These sectors are suggested to have characteristics of socio-technical system configurations similar to what is observed for sanitation, i.e. in terms of heterogeneity, challenges in embedding new service offerings, and unreliabilities in service access (Marshall and Farahbakhsh, 2013; Parrot et al., 2009; Peloso and Morinville, 2014; Singh et al., 2015). Therefore, an exploration into the user roles and agency in these sectors in relation to innovation activities – an aspect that is not largely studied – could provide useful insights for sustainable transitions.

A second line of study could be in further development of policy and governance oriented transition studies in for Global South cities. Here, I reiterate the call by Jaglin (2014) for more studies about how heterogeneous sectoral regimes can function more effectively. This is in relation to a multitude of challenges the innovating actors in Global South cities face related to technical, political, institutional, cultural, and financial aspects. One starting point for such a study is by building up on the Technological Innovation Systems approach the way it has been applied in Chapter 5 – where it showed potential for broader application. The mapping of the full Technological Innovation System of sanitation in Nairobi could provide more insights for successful co-management arrangements among service providers, innovators, policy makers, funding organizations, the users, among many other actors could be identified. I make the assumption that co-management will require a wide range of conditions and principles such as local political support, enabling legislations, networking and advocacy, trust building between partners, adequate stakeholder involvements, availability of financial resources, and property and land tenure rights in informal settlements.

Additionally, the complementarities between the Oscillating Domestic Space concept and the livelihoods concept, discussed on Chapter 4, suggest that further integration of the two can provide a more comprehensive tool for the analysis of urban livelihoods conditions. The Sustainable Livelihoods Framework has been criticized to lack adequate applicability for the

urban contexts (Meikle et al., 2001). In particular, an integration would enable the assessment of time-space factors and be able to capture the oscillations.

Beyond informal settlements, a third line of study could be an analysis of how users are constituted into and stabilize fragmented, polycentric and monolithic sectoral regimes. I make the assumption that user engagements would be highest in splintered regimes, followed by fragmented, then polycentric and eventually the least user engagements in the monolithic sectoral regime. User engagements in the other types of sectoral regimes also imply that the Oscillating Domestic Spaces can provide valuable insights beyond splintered regimes in relation the barriers and opportunities for embedding innovations. For example, we characterized the transport sectoral regime for the United States of America as being fragmented. Perhaps an “oscillating mobility space” or a mobility space with a certain degree in fluctuation in practice preconditions can be identified. The approach could then be further operationalized to identify barriers for users, for example in the introduction of a “cycling service regime”.

Additionally, the Oscillating Domestic Space concept could be explored in other contexts, even those that are resource abundant, e.g. as in the case of Western middle-income families when they want to adopt environmentally friendly lifestyles by getting rid of a car. Having to reconstruct the daily practices represents a major challenge that the families have to cope with and they might abandon the project because of being over-burdened by the disruption. This can provide insights for broader explanations to why it is difficult to adapt environmentally-friendly practices. In line with this view, there is a broad range of applications that could also build on a practice conceptualization of domestic spaces. The Oscillating Domestic Space can also provide a complementary explanation in health psychology that actions of people are not entirely motivated by health considerations: diverse contextual factors influence practices, e.g. see Stocker and Mosler (2015) and Wessel (2019). For example, the Oscillating Domestic Space may explain the view by Wessel (2019) that everyone seems to have a gym membership card which they rarely use.

Finally, the fourth line of future study can be on the further development of a typology of grassroots initiatives, from what has been proposed in Chapter 5. Particularly, more empirical data is required to provide evidence and create robustness for the four-field table that was created using the dimensions “resource settings” and “driving forces”. Further development of the framework can provide an approach for sustainability transition scholars to consider broader understanding of the concepts: “innovation” and “sustainability”. This can be of great relevance especially as these concepts have continued to raise debates about their definition and general

applicability. This follows the views by Leach et al. (2012), Baskaran and Mehta (2016), and (Smith et al., 2010) who have argued that innovations and sustainability need to be understood in terms of what is valued by particular groups or communities in the pursuit of particular goals. Therefore, further development of the typology may provide one approach to specify innovation and sustainability in relation to driving forces and resource settings of grassroots initiatives. Further development of the typology can be done by identifying similarly-categorized grassroots in diverse geographical settings: for example, identifying “livelihoods groups” in both Global South and North contexts. This is necessary to more clearly define “resource-settings”, and to clarify that the understanding of resource setting in this thesis is not about a North-South comparison. It is essentially related to the differentiated resource conditions that shape grassroots engagements even within similar geographical settings.

To conclude, this thesis has illustrated that aspects related to poverty represent core factors influencing the trajectories of transitions in splintered regimes. Therefore, scholars have to consider, in their studies, how poverty contributes to sustainability transition processes – this being an aspect that may not have been considered within the original transition frameworks which were developed in richer empirical contexts. In a more general sense, this thesis has showed that beyond the major focus on studies related to transitions towards low carbon economies, sustainability transition scholars have huge potential to also contribute with insights towards a “transition out of poverty” for millions of people worldwide currently living under extreme deprivation.

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Appendices

## **Appendices, summaries, publications, acknowledgements, CV**

## Appendices

### Appendix A: List of anonymised interview respondents for Chapter 3

<b>1. Women inhabitants from 3 villages</b>		
<b>Mukuru-Rorie (MR)</b>		
Respondents	Age range (years)	Occupation
MR1	21-30	Industry part-time casual jobs
MR2	31-40	Community Health Volunteer; Jitegemee beneficiary
MR3	31-40	Field project officer in an NGO; Jitegemee beneficiary
MR4	31-40	Community Health Volunteer
MR5	41-50	Street-food seller
MR6	31-40	Unemployed
MR7	21-30	Unemployed
MR8	41-50	Unemployed (unwell from effects of industry jobs)
MR9	41-50	Street vegetable business
MR10	41-40	Runs a small retail shop; Jitegemee beneficiary
MR11	31-40	School teacher; Jitegemee beneficiary
Case 1: Clara	31-40	Intermittent jobs (hawking, house-cleaning); Jitegemee beneficiary
FGD 4 (8 participants)	Adults	Various
FGD 5 (10 participants)	Adults	Various
<b>Mathare-Bondeni (MB)</b>		
Respondents	Age range (years)	Occupation
MB1	51-60	Social worker
MB2	31-40	Intermittent jobs (political campaigning; data collection; clothes business)
MB3	41-50	Runs an unregistered local bar
MB4	51-60	Unemployed
MB5	21-30	Runs a small retail shop
MB6	41-50	Runs an unregistered local bar
Case 2: Hanna	49	Street peanut business
MB8	31-40	Street vegetable business
MB9	21-30	Intermittent jobs (hawking either tea or clothes)
MB10	61-70	Runs an unregistered local bar
FGD 1 (10 participants)	Adults	Various
<b>Kahawa-Soweto (KS)</b>		
Respondents	Age range (years)	Occupation
KS1	41-50	Intermittent jobs (hawking & cultivating)
KS2	50-60	Unemployed (dependent on children)
KS3	31-40	Runs a local restaurant
KS4	51-60	Field project officer for a local NGO

KS5	41-50	Street clothes business in the city
KS6	31-40	Farming and intermittent house cleaning and cultivating jobs
KS7	31-40	Hawking & Community Health Volunteer
KS8	41-50	Local fruits and vegetables distributor, and intermittent cultivating jobs
KS9	41-50	Sells charcoal from her house
Case 3: Grace	41-50	Intermittent jobs (hawking, cultivating, house-cleaning)
FGD 2 (10 participants)	Adults	Various
FGD 3 (10 participants)	Teenagers	Various
<b>2. Other experts and informants</b>		
NGO rep.	NGO representatives (1-22)	
CHEO	Community Health Extension Officers (1-3)	
LMR	Local male residents (1-3)	
LAL	Local administrative leaders (1-9)	

## **Appendix B: Set of preliminary selection of livelihoods groups which informed Chapter 5**

<b>1. Groups</b>		
<b>Settlement</b>	<b>Group</b>	<b>Activities</b>
<b>Mathare Bondeni</b>	Muungano wa Bondeni (the case we use for the detailed study)	A livelihoods group that provides public toilet services
	Twaweza Group	A livelihoods group that provides public toilet services - the group applied a lot of strategies they learnt from Muungano wa Bondeni to the toilet service provision - existed for 8 years (by 2016)
<b>Mathare 4A</b>	A women`s group and a youth group	Livelihoods groups that provide public toilet services - one toilet facility is managed by 2 livelihoods groups on monthly rotational basis
<b>Kangemi</b>	Kaptagat Usafi Group	A livelihoods group that also provides public toilet services - existed for 13 years (by 2016) - successfully purchased land for all its members
<b>Mukuru Rorie</b>	Mukuru Environmental Group	A livelihoods group that also provides public toilet services. - membership to the Mukuru Savings Network, a consortium of community groups that were given the Biocenter projects. - a member was supported by SDI to participate in the Habitat III conference, Ecuador, 2016

<b>Mukuru Kayaba</b>	KUUM Kayaba Group	A livelihoods group that also provides public toilet services (Biocenter). - membership to the Mukuru Savings Network, a consortium of community groups that were given the Biocenter projects - existed for 11 years (by 2016)
<b>Kahawa Soweto</b>	Wamama wa Biashara Group	A livelihoods group, but do not offer toilet services - mainly dealing with advocacy on public toilet improvements in communities - rely on group businesses for incomes - existed for 3 years (by 2016) - a member was supported by SDI to participate in the Habitat III conference, Ecuador, 2016
Soweto Kongo Community Health Volunteer group		A livelihoods group that is organized by a local dispensary - do not offer toilet services - the group members depend on frequent health promotions by the dispensaries where they gain some incomes - existed for over 10 years, membership and activeness of the group changes often depending on relationship with dispensary administration

## 2. Aggregate list of activities by the eight groups

- Service provision (water, sanitation/toilet, solid waste management, security, transport, electricity & energy,
- Loans (to members and non-members)
- Revolving funds
- Welfare savings (in equal amounts to cater for hospital bills, weddings, visit to each other's rural homes, and burials)
- Individual savings (daily, weekly or monthly)
- Saving program for housing & purchase of land (sometimes supported by NGOs i.e. SDI)
- Learning (exchanges with other groups; local workshops on entrepreneurship, human rights)
- Advocacy (on rights to land and service access)
- Local associations (brewers; traders; motor-cycle transporters; young mothers; youths)
- Community health programs (these groups are coordinated by local dispensaries/hospitals)
- Short term development projects

## Summary

In the informal settlements of Global South cities, people live in overcrowded conditions and lack access to minimum basic amenities like sanitation, water and dignified conditions for living. The exploration of alternative forms of sanitation provision and access – beyond the reliance on large scale sewer systems – has grown considerably in the past years. These innovative activities are complemented with debates about whether more diverse “transition pathways” should be envisioned for these cities. This thesis analyses the roles and agency of users in innovation and transition processes – taking the case of sanitation in Nairobi, Kenya. This thesis is based on qualitative primary data, collected in a period of six months, in Nairobi, between 2016 and 2018.

Using analytical approaches from “sustainability transitions” field of study, this thesis aims to: (i) characterize the socio-technical regimes in Global South cities, and to establish how users are constituted into, and stabilize, these regimes; (ii) analyse how informal settlement dwellers shape the process of embedding innovations through their daily activities; and (iii) analyse the transformation potential of informal settlement dwellers for a transition towards a more sustainable sanitation sector.

The mapping of socio-technical regimes required an extension of the original concept in order to make it applicable to Global South cities, where service provision and access conditions are highly heterogeneous. We specified two analytical levels: “service” and “sectoral” regimes. Service regimes are stable combinations of technologies, user routines and organizational forms of providing and accessing a service. The service regimes are identified based on user and provider practices. At a second level, alignments between the existing service regimes are used to specify the forms of “sectoral regime” of cities. Adopting this distinction enabled the characterizing of Nairobi as a “splintered regime”. A key characteristic of splintered regimes is the proactive role of users: in mending the splinters in order to gain access, and by being service providers in organized grassroots groups. The splintered regime is compared with “monolithic”, “polycentric”, and “fragmented” sectoral regimes which can be found in other geographical settings globally. The four sectoral regimes also represent more diverse “transition pathways”.

The active user roles in Nairobi’s splintered regime called for an extension of the analysis of practices in order to understand the processes of embedding innovations. I describe how the mending of splinters occurs. It entails complex daily activities across time and in space, which I conceptualize as “Oscillating Domestic Spaces”. The concept is specified based on insights from practice theory and the socio-technical regime. The concept reflects the need for people to

develop a multiplicity of alternative options and partial solutions to be able to manage access under difficult and uncertain context conditions for practices. The preconditions for practices are specified as the lack of consistent access options daily, and fluctuations in social and economic enabling conditions for practices. The Oscillating Domestic Space in informal settlements is then taken as a research context for application of an innovative container-based toilet in Nairobi's informal settlements. The study showed that lack of understanding of the contextual preconditions for practices resulted in failure of the innovation to embed in line with the expectations of the providers. The innovation anchored only to a small part of the Oscillating Domestic Space and was in disarray with the broader needs and norms of users most of the time. The analysis showed that, when innovations are introduced without a systemic perspective in a context with oscillations, they can potentially result in further splintering – when users take up the innovation as an add-on rather than as a replacement to a non-desirable service option. Therefore, the concept shows how regime stability can emanate from contexts with unmet needs, fragmented services and negative outcomes and feedbacks in basically all aspects of daily life.

Subsequently, the value of paying attention to oscillations in domestic spaces is demonstrated when I use the Oscillating Domestic Space concept to analyse livelihoods reconstruction in a settlement upgrading initiative – where relocations disrupted these “spaces”. The disruptions resulted in multitude of negative feedbacks on the physical integrity of the upgrading initiative and as well in the legitimacy by beneficiaries in the entire process. The settlement dwellers now need to spend significant efforts to rebuild their livelihoods.

Eventually, I conduct an analysis on the transformative potential by informal settlement dwellers for a transition from a splintered to a polycentric regime. The technological innovation system and grassroots innovation concepts are applied in the analysis. The study finds that community members, in their organization into grassroots groups, have resources and capabilities which “professional” actors lack, which can be leveraged. However, these grassroots can also hinder further transitions when they defend their local monopolies against new (and potentially complementary) actors. I discuss new actor arrangements that build on the strengths of the grassroots but can evade potential lock-in that hampers longer-term sustainability transitions.

To conclude the thesis, I present the key findings and reflect on them for a broadened view of what it takes to apply transition approaches in heterogeneous contexts – particularly in relation to the roles and agency of users. Additionally, I discuss practical implications for user-oriented sustainability transitions for Nairobi's sanitation sector. I eventually highlight inroads for future transition studies.

## Samenvatting

In informele nederzettingen leven mensen in overbevolkte omstandigheden, vaak zonder toegang tot basisvoorzieningen zoals sanitaire voorzieningen en water, en ontbreken waardige omstandigheden om te leven. Onderzoek naar alternatieve vormen van sanitaire voorzieningen, om onder de afhankelijkheid van grootschalige rioleringen uit te komen, zijn de afgelopen jaren aanzienlijk gegroeid. Als gevolg van deze innovatieve activiteiten wordt gedebatteerd over de vraag of meer diverse “transitiepaden” zouden moeten worden overwogen om duurzame transities in deze sectoren te realiseren. Dit proefschrift analyseert de rollen van gebruikers in innovatie- en transitieprocessen, waarbij de sanitatie situatie in Nairobi, Kenia, als casus wordt gebruikt. Het proefschrift is gebaseerd op kwalitatieve primaire data, die verzameld is in een periode van zes maanden in Nairobi, tussen 2016 en 2018.

Met behulp van analytische benaderingen uit het vakgebied van duurzaamheidstransities, beoogt dit proefschrift: (i) de socio-technische regimes in steden in lage inkomens-landen (“the Global South”) te karakteriseren, en vast te stellen hoe gebruikers deel uitmaken van het regime en hoe ze dit stabiliseren; (ii) het proces te analyseren hoe bewoners van informele nederzettingen innovaties in hun dagelijkse activiteiten inbedden; en (iii) het transformatie potentieel van bewoners van informele nederzettingen te analyseren voor een transitie naar een duurzamere sanitaire sector.

Het in kaart brengen van socio-technische regimes vereiste een uitbreiding van het oorspronkelijke concept om het toepasbaar te maken op steden in het Global South, waar dienstverlening en toegangsvoorraarden zeer heterogeen zijn. We hebben daarvoor twee analytische niveaus gespecificeerd: “service” en “sectorale” regimes. Serviceregimes zijn stabiele combinaties van technologieën, gebruikersroutines en organisatorische vormen voor het aanbieden van, en toegang krijgen tot een dienst. De serviceregimes zijn geïdentificeerd gebaseerd op de gebruikers- en dienstverlenerspraktijken. Op het tweede niveau worden de verbindingen tussen de bestaande serviceregimes gebruikt om de vormen van het “sectorale regime” in steden te specificeren. Door deze twee onderscheidende analytische niveaus aan te nemen, kon Nairobi worden gekarakteriseerd als “versplinterd regime”. Een belangrijk kenmerk van versplinterde regimes is de proactieve rol van gebruikers: in het creëren van interoperabiliteit tussen de splinters om toegang tot services te krijgen, en door hun dienstverlenende rol in grassroots-groepen. Het versplinterde regime kan worden vergeleken met “monolithische”, “polycentrische” en “gefragmenteerde” sectorale regimes, die voorkomen in andere delen van de wereld. De vier sectorale regimes vertegenwoordigen potentiële “transitiepaden” voor Nairobi en andere steden.

Om de processen van het van innovaties te begrijpen, vroegen de actieve gebruikersrollen in het versplinterde regime van Nairobi om een uitbreiding van de analyse van praktijken – ten opzichte van de conventionele manier van analyseren in de transitie en innovatieliteratuur. Ik beschrijf hoe het creëren van interoperabiliteit tussen splinters plaatsvindt. Dit houdt complexe dagelijkse activiteiten van gebruikers in tijd en ruimte in, die ik met de term “Oscillerende Reproductieve Ruimtes” omschrijf. Dit concept is gebaseerd op inzichten uit praktijken theorie en het socio-technische regime. Het concept weerspiegelt de noodzaak om een veelvoud aan alternatieve opties en deeloplossingen te ontwikkelen, om ervoor te zorgen dat mensen toegang tot services hebben, zelfs onder moeilijke en onzekere omstandigheden. De randvoorwaarden voor dagelijkse praktijken worden gespecificeerd als het gebrek aan stabiele dagelijkse toegang tot services, en de veranderlijkheid van sociale en economische randvoorwaarden voor praktijken.

Oscillerende Reproductieve Ruimtes in informele nederzettingen zijn hier als de context genomen voor onderzoek naar de implementatie van een innovatief container-toilet in Nairobi. De studie laat zien dat een gebrek aan begrip van de contextuele rand-voorwaarden voor praktijken ertoe leidde dat de innovatie niet kon worden ingebed in overeenstemming met de verwachtingen van de aanbieders. De innovatie verankerde slechts een klein deel van de Oscillerende Reproductieve Ruimte en was meestal niet in overeenstemming met de bredere behoeftes en normen van de gebruikers. De analyse toonde aan dat wanneer innovaties worden geïntroduceerd zonder een systemisch perspectief in contexten die worden gekenmerkt door oscillaties, ze mogelijk kunnen leiden tot verdere versplintering: bijvoorbeeld wanneer gebruikers de innovatie gebruiken als een toevoeging, in plaats van als vervanging voor een niet-gewenste serviceoptie. Op deze manier biedt het concept een systemisch aanpak die laat zien hoe regime stabiliteit kan voortkomen uit contexten met onvervulde behoeften, gefragmenteerde diensten en negatieve uitkomsten en terugkoppelingen in vrijwel alle aspecten van het dagelijkse leven.

Vervolgens wordt de toegevoegde waarde van aandacht voor oscillaties in huishoudelijke ruimtes aangetoond, als ik het Oscillerende Reproductieve Ruimtes concept gebruik om de wederopbouw van bestaansmiddelen te analyseren in een project voor het verbeteren van informele nederzettingen – waarin gedwongen verhuizingen deze “Ruimtes” verstoren. Deze verstoringen resulteerden in een groot aantal negatieve effecten op de fysieke aspecten van de nieuw gebouwde huizen, en ook op de legitimiteit voor het gehele process door de begunstigen. De bewoners van de informele nederzettingen moeten daardoor nu aanzienlijke inspanningen leveren om hun bestaansmiddelen weer op te bouwen.

Uiteindelijk voer ik een analyse uit om het transformatie potentieel door bewoners van informele nederzettingen in een transitie van een versplinterd naar een polycentrisch regime te begrijpen.

## Samenvatting

Het technologische innovatiesysteem en grassroots-innovatie concepten worden toegepast in deze analyse. De studie stelt vast dat leden van de gemeenschap, in hun georganiseerde grassroots-groepen, over middelen en capaciteiten beschikken die “professionele” actoren missen, die kunnen worden benut. Deze grassroots kunnen echter ook verdere transities belemmeren wanneer zij hun lokale monopolie verdedigen tegen nieuwe (en mogelijk complementaire) actoren. Ik bespreek nieuwe actorarrangementen die voortbouwen op de sterke punten van de grassroots, en die kunnen ontsnappen aan potentiële lock-in die duurzame transities op de langere termijn belemmeren.

Tenslotte presenteert ik in dit proefschrift de belangrijkste resultaten en bediscussieer ik deze, om een bredere kijk te krijgen op wat er nodig is om transitiebenaderingen toe te passen in heterogene contexten, met name met betrekking tot de rol van de gebruikers. Daarnaast bespreek ik de praktische implicaties voor gebruiksgerichte duurzaamheidstransities voor de sanitatie sector van Nairobi. Uiteindelijk benadruk ik invalshoeken voor toekomstig transitieonderzoek.

## Resümee

Menschen, die in den informellen Siedlungen der Metropolen des globalen Südens unter den Bedingungen zunehmender Urbanisierung leben, fehlt es an Zugang zu Grundversorgungsleistungen wie Wasserversorgung, Abwasserreinigung und würdigen Lebensbedingungen. In diesem Kontext gibt es in den vergangenen Jahren ein wachsendes Interesse an alternativen Formen von Abwasserversorgung und Sanitärdienstleistungen, die über konventionelle Kanalisationssysteme und Netzwerkinfrastrukturen hinausgehen. Diese innovativen Aktivitäten werden bestärkt durch Debatten darüber, ob Städte diversifiziertere „Transitionsfade“ einschlagen sollten, die über das Ideal von „modernen“ Netzwerkinfrastrukturen hinausgehen. Diese Doktorarbeit analysiert die Rolle und Handlungspraktiken von Nutzern in Innovations- und Transitionssprozessen anhand der Sanitärsituation in Nairobi, Kenia. Die Arbeit basiert auf qualitativen Primärdaten, die innerhalb von sechs Monaten zwischen 2016 und 2018 in Nairobi erhoben wurden.

Unter Verwendung von analytischen Ansätzen aus dem Forschungsfeld der Nachhaltigkeitstransitionen, zielt diese Arbeit darauf ab: (i) soziotechnische Regime in Städten des globalen Südens zu charakterisieren, und zu verstehen wie die Nutzer sich mit diesen Regimen einbringen und stabilisieren, (ii) zu analysieren wie Bewohner informeller Siedlungen den Prozess der Einbettung von Innovationen in ihre Alltagspraktiken gestalten; und (iii) das von Bewohnern informeller Siedlungen ausgehende Transformationspotential für eine Transition hin zu einem nachhaltigeren Sanitässektor zu analysieren.

Das Nachzeichnen sozio-technischer Regime bedarf einer Erweiterung des ursprünglichen Konzepts, um auf den Kontext von Städten des globalen Südens anwendbar gemacht zu werden, wo Dienstleistungsversorgung und -zugang hochgradig heterogen verteilt sind. Wir spezifizieren zwei analytische Ebenen: „Service“ und „Sektor“ -regime. Serviceregime sind stabile Kombinationen von Technologien, Nutzerroutinen und Organisationstypen zur Versorgung mit, und für den Zugang zu einer Dienstleistung. Serviceregime werden auf Grundlage von Nutzer- und Versorgerpraktiken identifiziert. Auf der zweiten Ebene, werden gegenseitige Anpassungsprozesse zwischen bestehenden Regimen verwendet, um die verschiedenen Formen von Sektorregimen in Städten zu spezifizieren. Die Verwendung dieser Unterscheidung erlaubt eine Charakterisierung von Nairobi als zersplittertes Regime. Ein zentrales Charakteristikum von zersplitterten Regimen ist die proaktive Rolle von Nutzern: durch das Flicken der Splitter zur Gewährleistung von Zugang zu einer Dienstleistung, und durch die Aneignung von Versorgerrollen durch sogenannte Grassroot-Gruppierungen. Das zersplitterte Regime wird verglichen mit „monolithischen“, „polyzentrischen“, und „fragmentierten“ Sektorregimen, die

## Resümee

global in anderen geographischen Kontexten gefunden werden können. Die vier Sektorregime stellen potentielle Transitionsfade für Nairobi und andere Städte dar.

Um den Prozess der Einbettung von Innovationen zu verstehen, verlangte die aktive Rolle von Nutzern in Nairobi's zersplittertem Regime nach einer Erweiterung der konventionellen Analyse von Alltagspraktiken, wie sie in Transitions- und Innovationsforschung üblich ist. Ich beschreibe wie das Flicken der Splitter sich vollzieht. Es besteht aus komplexen alltäglichen Aktivitäten von Nutzern über Zeit und Raum, die ich als „oszillierende Reproduktionsräume“ beschreibe. Das Konzept wird auf Grundlage von Erkenntnissen aus Praxistheorie und der Literatur um soziotechnische Regime spezifiziert. Das Konzept reflektiert das Bedürfnis von Menschen diverse alternative Lösungen und Teillösungen für den Zugang zu Dienstleistungen unter schwierigen und unsicheren Kontextbedingungen für ihre Praktiken zu entwickeln. Als Voraussetzungen für die identifizierten Praktiken werden ein Mangel an regelmäßigen Zugangsoptionen im Laufe des Tages und sich verändernde soziale und wirtschaftliche Rahmenbedingungen für bestimmte Praktiken ausgemacht. Das Konzept der oszillierenden Reproduktionsräume wird zur Untersuchung des Falles einer innovativen Container-basierten Toilette in Nairobi's informellen Siedlungen angewandt. Die Studie zeigt, dass ein fehlendes Verständnis für die kontextuellen Voraussetzungen von Praktiken die Einbettung der Innovation im Sinne des Versorgers verhinderte. Die Innovation wurde nur zu einem kleinen Teil im oszillierenden Reproduktionsraum verankert und stand im Widerspruch mit den breiteren Bedürfnissen und Normen der meisten Nutzer über den größten Teil der Zeit. Die Analyse zeigt, dass Innovationen, die ohne eine systemische Perspektive in Kontext mit Oszillationen eingeführt werden, potentiell zu einer weiteren Zersplitterung des Regimes beitragen: zum Beispiel, wenn Nutzer Innovationen eher als Ergänzung annehmen, anstatt als Ersatz einer unerwünschten Serviceoption. Auf diesem Weg liefert das Konzept einen systematischen Ansatz, der aufzeigt wie die Stabilität eines Regimes aus Kontexten mit unerfüllten Bedürfnissen, fragmentierten Dienstleistungen sowie daraus entstehenden negativen Rückkopplungen in allen Lebensbereichen erwachsen kann.

Der Wert einer größeren Beachtung von oszillierenden Reproduktionsräumen wird demonstriert, indem ich das Konzept der oszillierenden Reproduktionsräume zur Analyse von sich verändernden Lebensgrundlagen innerhalb einer Siedlungsentwicklungsinitiative verwende, in denen Reproduktionsräume durch Umsiedlung gestört werden. Diese Störungen führen zu einer Vielzahl von negativen Rückkopplungen, die sich auf den baulichen Zustand der Häuser auswirken, wie auch auf die Legitimität des gesamten Prozesses für die Nutznießer. Die Siedler müssen nun große Anstrengungen betreiben, um ihre Lebensgrundlagen neu aufzubauen.

Schließlich führe ich eine Analyse des von Bewohnern informeller Siedlungen ausgehenden Transformationspotentials für eine Transition weg von einem zersplitterten hin zu einem polyzentrischen Regime durch. Die Analyse stützt sich auf den Ansatz der technologischen Innovationssysteme und das grassroot-Innovationen Konzept. Die Studie zeigt das Community Mitglieder, in ihrer organisationalen Aufteilung in grassroot-Gruppierungen, Ressourcen und Fähigkeiten mobilisieren können, die „professionellen Akteure“ fehlen. Andererseits können grassroot-Bewegungen Transitionsprozesse auch verhindern, wenn sie ihre lokalen Monopole gegen neue (potentiell komplementäre) Akteure verteidigen. Ich diskutiere neue Akteurskonstellationen, die auf die Stärken der grassroot-Bewegungen aufbauen, jedoch auch potentielle Lock-ins hervorbringen können, welche längerfristige Nachhaltigkeitstransitionen erschweren.

Um die Arbeit abzuschließen, präsentiere ich zentrale Ergebnisse und reflektiere sie für eine breitere Sichtweise, um darzustellen, worauf es bei der Anwendung von Transitionsansätzen in heterogenen Kontexten ankommt – insbesondere mit Hinblick auf die Rolle von Nutzern. Zusätzlich diskutiere ich praktische Implikationen für nutzerorientierte Nachhaltigkeitstransitionen in Nairobi's Sanitärsektor. Schließlich hebe ich Anknüpfungspunkte für zukünftige Transitionsforschungen hervor<sup>42</sup>.

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<sup>42</sup> Aus Gründen der Lesbarkeit verzichtet die deutsche Übersetzung des Resümeees darauf, geschlechtsspezifische Formulierungen zu verwenden. Soweit personenbezogene Bezeichnungen nur in männlicher Form angeführt sind, beziehen sie sich auf Männer, Frauen und Andersgeschlechtliche in gleicher Weise.

## Publications

### Status of articles derived from this PhD study (as of August, 2019) and author contributions

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.

Pauline C. Cherunya, Mara J. van Welie, and Bernhard Truffer contributed equally in the conception and design of study and the analysis and interpretation of data. Cherunya and van Welie collected the data. Writing the full manuscript was led by van Welie with the support of Cherunya. Critical revision of the manuscript for important intellectual content and approval of the version to be published was done by all authors: Pauline C. Cherunya, Mara J. van Welie, Bernhard Truffer, and James T. Murphy.

Cherunya P.C., Ahlborg H. and Truffer B. Anchoring innovations in oscillating domestic spaces: Why sanitation service offerings fail in informal settlements. Accepted (subject to minor reviews) for publication in the journal *Research Policy*.

Pauline C. Cherunya, Helene Ahlborg, and Bernhard Truffer contributed equally in the conception and design of study and the analysis and interpretation of data. Cherunya collected the data and wrote the full manuscript. Critical revision of the manuscript for important intellectual content and approval of the version to be published was done by all authors: Pauline C. Cherunya, Helene Ahlborg, and Bernhard Truffer.

Cherunya P.C., Truffer B. Contribution of grassroots groups to sustainability transitions: the case of sanitation in Nairobi's informal settlements. Resubmitted to the journal *Environmental Innovation and Societal Transitions*.

Pauline C. Cherunya made the main contribution in the conception and design of the study. Cherunya and Truffer contributed equally in the analysis and interpretation of data. Cherunya collected the data and wrote the full manuscript. Critical revision of the manuscript for important intellectual content and approval of the version to be published was done by both authors.

Cherunya P.C., Truffer B., Samuel E.M., Lüthi C. The challenges of livelihoods reconstruction in the context of informal settlement upgrading. Considered for a resubmission to the journal *Environment and Planning A*.

Pauline C. Cherunya made the main contribution in the conception and design of the study. Cherunya and Edinah M. Samuel collected the data. Cherunya and Truffer contributed equally in the analysis and interpretation of data. Writing the full manuscript was led by Cherunya with the support of Bernhard Truffer and Christoph Lüthi. Critical revision of the manuscript for important intellectual content and approval of the version to be published was done by all authors: Pauline C. Cherunya, Bernhard Truffer, Edinah M. Samuel and Christoph Lüthi.

## **Additional publications**

Cherunya, P.C., Janezic, C., & Leuchner, M. (2015). Sustainable supply of safe drinking water for underserved households in Kenya: Investigating the viability of decentralized solutions. *Water*, 7(10), 5437-5457.

Cherunya, P. C., Van Welie, M. J., Truffer, B., Nairobi's Splintered Sanitation Sector. Sandec News, August, 2019

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*Pauline Cherunya*

Munich, August 2019



## Curriculum Vitae

Pauline C. Cherunyia completed a bachelor degree in 2009 in Environmental Studies and Community Development at Kenyatta University, Kenya. After that, she worked for a Kenyan NGO on a programme that focussed on inter-communal dialogue for the restoration of the ‘Mau Forest Complex’ – the biggest water tower in Kenya. Pauline then proceeded to pursue a master degree in Sustainable Resource Management at the Technische Universität München (TUM) in Germany. In her master thesis, she studied the viability of decentralized water kiosks in the provision of safe drinking water in rural and urban Kenya: taking a project by Siemens Foundation as the case study. Pauline received an award for best master thesis for the class of 2014.

In September 2015, she started her PhD research in the Department of Environmental Social Sciences at the Swiss Federal Institute of Aquatic Science and Technology, Eawag, in Switzerland. Pauline was affiliated with the Innovation Studies group of the Copernicus Institute of Sustainable Development in the Faculty of Geosciences in Utrecht University, the Netherlands. She presented her work at various conferences and (co-)organized various international workshops and conferences. Among them, Pauline was a lead organizer of an annual conference of the Network of Early Career Researchers in Sustainability Transitions (EPFL Lausanne, June 2017) and was a lead organizer of a workshop on “transition towards a sustainable sanitation sector and the prospects of innovations in Nairobi” (Kenyatta University Nairobi, July 2018).





