Organising grassroots infrastructures for more inclusive and resilient cities

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Title: *Organising grassroots infrastructure for more inclusive and resilient cities*[1]

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Introduction

The effects of neoliberal policies, agriculture deregulation, structural adjustment programmes, shrinkage of the national governments and the liberalization of international trade have all played a role in precipitating massive rural migration in Global South cities. This has resulted in the growth of spontaneous settlements in cities and it is not by chance that most mega city-slums have emerged and grown since the 1960s. In 2016, more than 828 million people lived in informal settlements, or slums, without adequate shelter and services, and 95% of the urban expansion in the next decades will take place in developing countries (United Nations, 2016). We therefore foresee an increase in urban informal settlements, characterised by overcrowding, insecure tenure and a lack of access to basic services and infrastructures, as well as having an inadequate quality of housing.

A number of institutions are involved in the process of creating urban resilience, including public, private and civil society organisations but the silent encroachment of globalizing processes in many cities of the South has hampered local control of city management (Castells, 1996). Rather than urban authorities predominantly organizing change, multinational corporations, international financial programmes, NGOs and aid agencies are the main actors. Still, continuous disruptions in critical infrastructures make everyday life uncertain for the millions of citizens living in informal settlements, and they constantly have to improvise, create routines, competences, relations and new knowledge to cope with these disturbances. Low-income residents in informal settlements around the world do not remain passive regarding the deteriorating socio-environmental conditions within their neighbourhoods. In the absence of formal infrastructures and services, grassroots resilience initiatives (such as resident associations, women associations, youth groups, self-help groups, community-based organisations, cooperatives, public-private partnerships) articulate the necessary resources, relations and rationales to create and reproduce critical infrastructures

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(e.g. delivering access to money, water or food) and to construct more inclusive forms of urban governance.

Acknowledging the central roll of infrastructures for an inclusive urban development, the social science literature (mostly geography, urban studies or anthropology) has experienced in recent years, what has been called as the 'infrastructure' turn (Graham, 2010). Breaking up with traditional views that infrastructures are apolitical and thus not worthy of attention (MacFarlane and Rutherford, 2008; Coutard, 1999), these scholars approach the study of infrastructures as much more than being mere technological and material issues; they also embody social interests and values (Star, 1999) and therefore become politicized assemblages of artefacts and practices (Graham, 2010).

Previous research has argued that it is possible to understand the politics of infrastructure and its implications through the study of infrastructure disruptions (Graham, 2010) or institutionalized informality, for example in informal settlements in Global South cities (MacFarlane, 2008, 2011, Trovalla and Trovalla, 2015, Zapata Campos and Zapata, 2013) "in ways that are rarely possible when such systems are functioning normally" (Graham, 2010, p.3). Whilst critical studies on infrastructure networks have often focused on the holistic macro dimension of the networks, the practices enacted in more localized parts of the infrastructure network, and the way they localize meaning, seems to be understudied (Chelcea and Pulay, 2015).

The present study intends to contribute to this understanding of the political character of infrastructure, but it shifts the attention towards two aspects less discussed in the literature. First, a redefinition of infrastructures as practice based (Anand 2012) and situational (Chelcea, 2016), which therefore makes it necessary to study everyday infrastructuring practices at the user level. Second, a focus on the role of grassroots organisations in creating and governing these infrastructures in informal settlements.

The paper originally brings together organisation studies, and the study of infrastructures in urban studies. It aims first, to examine the role of grassroots organisations in the production and governance of critical infrastructure in the context of uncertainty and scarcity of Global South cities' informal settlements; and second, to explore the political implications of grassroot infrastructures by examining how they lead to efforts to create governmental structures to maintain them, to connect them to formal systems, and to bring in new infrastructures and services to the informal settlements.

Empirically the paper is informed by the case of three grassroots organisations in three informal settlements in Kisumu, Kenya. The case study includes document studies, ethnographical and participatory observations, shadowing, visual ethnography, interviews, focus group interviews, social media, and stakeholder workshops between 2014 and 2017. Particularly the paper focuses on semi-structured interviews carried out with grassroot initiatives, politicians and public officers.

Next the relevant literature on infrastructure and organisation studies is presented. Then, the history of the three grassroots initiatives is reconstructed. Thereafter the empirical material is analysed and discussed under the light of the theories.

Theory

Urban resilience and infrastructures
Urban resilience refers to the capacity of cities – and networks of citizens, structures, processes and infrastructures to withstand and recover from disasters, including climate change, but also from consequences of rapid over urbanization and its negative social and environmental impacts (Campanella, 2006; Godschalk 2003; Gunderson 2010; Norris et al. 2007), such as inadequate basic services and critical infrastructure. The literature on resilience has acknowledged the role of communities in the process of adaptation following a disruption, identifying key factors such as social capital and community competencies (Chaskin 2008; Cutter et al.2008; Norris et al. 2007).

Resilient cities are characterised in the literature by the adaptive capacity of the stakeholders in the city including authorities and grassroots initiatives, where the diversity and capacity for self-organisation of these actors and organisation structures are key components together with constructive feedback loops (Meijer et al, 2015). This paper focuses particularly on the ability of grassroots initiatives to develop self-organisational structures and make cities more inclusive, safe, resilient and sustainable in times of need.

The case of informal settlements, resulting from processes of rural-urban migration and with significant deficits in terms of services and infrastructures, showcases issues of abovementioned urban resilience. Infrastructure is here typically defined as the most fundamental facilities and systems providing commodities and services essential to enable, sustain or enhance living conditions. It typically consists of technical structures such as water supply, sanitation, waste collection, electricity, drainage and roads, but also 'soft infrastructure' referring to financial systems, education, and management or health systems.

Traditional engineering-based views of infrastructure have however ignored the politicized nature of infrastructure (MacFarlane and Rutherford, 2008; Coutard, 1999) while the infrastructure turn (Graham, 2010) in social sciences has highlighted the politics of infrastructure. This more recent literature has brought attention to the mundane aspects of infrastructure and the everyday practices that render infrastructure political, as they regulate and distribute access to resources as well as the environmental and economic impacts and externalities of the infrastructure works. For example, infrastructure make possible the externalization of the environmental footprint of cities in the form of, for instance, the exportation of electronic waste to other communities with cheaper labour and less strict environmental regulations (MacFarlane, Lawhon, 2012), leading to processes of environmental injustice.

Graham and Marvin have also shown how the 'splintering urbanism' of infrastructure can lead to social and spatial inequalities in provision of services, and in the distribution of environmental costs (Graham and Marvin 2001), through processes of 'cherry picking' (Coutard and Guy, 2007) or 'infrastructural bypasses' (Coutard, 2008). For example, when transporting water to cities, infrastructure can bypass communities lacking this same resource, as the Mombay waterpipes do (Graham, 2000). Infrastructure has therefore the ability to connect but also to disconnect citizens from its benefits. As Latour puts it, we can "die right next to a phone line if we aren't plugged into an outlet and a receiver" (Latour, 1993: 115). Residents in informal settlements struggle to be 'switched on' to the city and the formal infrastructure networks providing services such as water and electricity. They may achieve this by providing themselves with services either through spontaneous and informal practices or through a systematic self-organization of their communities (Zapata Campos and Zapata, 2013).

Much of the recent literature on infrastructures has been influenced by previous work on the ethnography of infrastructure conducted by Star (1999) and Star and Ruhleder (1996) who described infrastructures as being: embedded or 'sunk into and inside other structures, arrangements and technologies'; transparent to use ('it does not need to be reinvented each time or assembled for each task'); providing spatial or temporal reach; learned by members or users; linked with conventions of practice; embodied in standards, built on an installed base of capital (large investments often sunk, as pipes under the earth) and interlocked to other infrastructures; fixed in modular increments; and becoming visible upon breakdown (1999, 381-382).

In correspondence with the last characteristic, the absence of infrastructural flows creates visibility, as it is the case of the deficit of critical infrastructures in informal settlements. In these contexts, the non-presence of infrastructure in people's everyday life paradoxically generates knowledge about these critical infrastructures: the hidden mechanisms that make them work, their costs, and the technical and organisational structures behind them are rendered visible (Zapata, 2014). Trovalla & Trovalla (2015) have argued how in the Nigerian city of Jost, with constant interruptions in critical infrastructures (either electricity, water or petrol) infrastructures are brought to the forefront of everyday life and turn them into superstructures, a tool for envisioning the unknown and reducing the uncertainty in which they live.

Gaining access to infrastructure networks often implies the negotiation of 'gateways' (Guy et al., 2015) that have the ability to switch on (Graham, 2005) the informal settlement with the formal infrastructure system (Zapata Campos and Zapata, 2013). The understanding of the political meaning of these gateways requires a situational approach that shifts the focus towards "the ordinary routines, political subjectivities and citizenship claims of the (communities of) infrastructure users themselves" (Chelcea and Pulay, 2015 pp 2). Chelcea and Pulay argue how ethnographies of infrastructures and citizenship show different "local forms of connection, disconnection and belonging" in different situations. Chelcea and Pulay's 'incomplete' and 'repair and maintenance' citizenship, Anand's 'hydraulic citizenship' (2011), or Von Schnitler (2008) 'pre-paid citizenship', are some examples of this variety of forms of belonging in relationship to the infrastructure, denoting different relations of power, distribution and access. Citizens can embrace, resist, destroy, suffer or learn, just to give some examples, from the production and use of local infrastructures. Without falling in the trap of romantizing self-help efforts of communities to build up their infrastructures, Appadurai has also argued how the urban poor can, in the self-production of these critical infrastructures, turn from subjects of policy making into active agents of change. This new form of deep democracy is named 'the politics of shit' by Appadurai (2001, p.37), in reference to the self-construction of community sanitation infrastructure. In these politics of shit, expertise is decentred from experts to residents (Roy, 2005).

The organising of civil society
In the harsh and uncertain conditions of many African cities, a variety of forms of associational life (i.e., grassroots initiatives or organizations) have developed to address the basic needs of citizens. Yet this associational life can be rendered invisible to the eyes of the (ethnocentric) researcher. Hyden coined the well-known concept of 'economy of affection' to describe the social relations of extended families to protect each other in times of need. These 'invisible organisations' are difficult to discern for the outsiders of the community of practice

because they are "ad hoc and informal rather than regular and formalized" (Bratton, 1989, p. 9).

Simone, agrees with the difficulty for the untrained eye to see the complexity of African cities and its organisational life, and how they can remain invisible. Cities or neighbourhoods therefore can be mistaken as being 'incomplete', just because of their invisibility to those who do not belong to that community of practice:

> "According to conventional imaginaries of urbanization, which locate the urban productivity in the social division of labor and the consolidation of individuation, African cities (and their organisations) are incomplete. In contrast to these imaginaries, African cities survive largely through a conjunction of heterogeneous activities brought to bear on and elaborated through flexibly configured landscapes" (Simone, 2004, p. 407. Words within brackets added by the authors).

Therefore, rather than relying on formal bureaucratic organisations, adhocracy, informality and flexibly configured organisational landscapes are some of the strategies developed by citizens to adapt to the changing environments and unpredictable conditions in which they live. These grassroots initiatives respond to nebulous forms of organising (Melucci, 1996) observed in new networked social movements, where rules and goals are loose; control, sanctions and rewards informal; and membership and hierarchy diffuse. In organisation studies some of these organising practices have been described as 'partial organisation' whereby the organising relies on "less than all organizational elements" (membership, rules, hierarchy, control and sanctions) (Ahrne & Brunsson, 2011, p.84).

Simone has described everyday infrastructure work in African cities as 'people as infrastructure', a "process of conjunction, which is capable of generating social compositions across a range of singular capacities and needs (both enacted and virtual) and which attempts to derive maximal outcomes from a minimal set of elements" (2004, p. 410-411). On the one hand, this 'minimal set of elements' can refer e.g. to a minimal organisational elements mobilized to construct and govern infrastructure, through 'people as infrastructure'. On the other hand, this view of organisations as 'partial' or incomplete could be more related to the inability of the foreigner to discern those 'invisible' organisational elements, as we will argue later in the discussion.

Ostrom (1990) has demonstrated how the successful governance of common resources relies on the articulation of several organizational elements, such as membership, rules, hierarchy, control and sanctions. While complete organizations are based on such factors, partial organizations depend on "less than all organizational elements" (Ahrne & Brunsson, 2011, p. 84). The question then becomes whether – unlike Ostrom's initial ideas – it is possible to produce and govern common resources, such as infrastructure, with a partial/incomplete organisation, i.e. with looser forms of organising more resembling networks. Networks differ from organizations in the sense that they organize non-hierarchical relations, are maintained through reciprocity and trust, have unclear boundaries, and that groups are embedded in other groups (Granovetter, 1985). They are spontaneous and flexible as they are 'lighter on their feet' than organizations are (Powell, 1990: 303). But can these networks provide the necessary stability to develop critical infrastructures? And how endurable are they?

In any case, not everything is constantly changing in networked forms of organising. There are some organisational elements that glue these networks together, meetings being one of

them (Haugh, 2016). So, while the organisational structure of these initiatives might resemble ceremonial rituals or myths (Meyer & Rowan, 1977), other organisational mechanisms such as face-to-face meetings contribute to stabilize and reproduce the organisation. Haugh (2016) argues that to research the "nebulous" reality of a social movement (here read grassroots organisations) it is necessary to map the meetings and sub-meetings that sustain the movement's activities and outcomes since meeting arenas constitute an important infrastructure for such movements.

Building on the literature, in this paper we seek to explore whether infrastructure developed by grassroots organisations is critical not only for providing material goods (such as electricity or water) necessary to sustain the livelihood in informal settlements, but also becomes a social and organisational infrastructure that fuels and supports other resident activities.

The case - Kisumu

With an estimated population of more than 500,000 inhabitants and an urbanization rate of 1.86% Kisumu is the third largest city in Kenya located at the shores of the Lake Victoria . The city has a planned city centre and a large unplanned peri-urban area where more than 60% of its population live in informal settlements with very poor housing conditions and exposed to frail service delivery and unclear legalities. Community toilets and showers are scarce, household waste is hardly collected, unhygienic living conditions cause serious health problems. Kisumu has very fragile public sector functioning in parallel with a growing informal sector in dire need of infrastructure for basic service delivery. NGOs, CBOs and the community at large are left to developing whatever resilience possible. The city is therefore an excellent learning case for bottom-up resilience induced and nurtured to meet the dynamic societal needs.

Manyatta Residents Association

Manyatta Residents Association was started by residents in 2003 as a neighbourhood CBO, prompted by lack of water and sanitation services. It transformed into a Residents Association (registered by the Attorney General's Office) as guided by the partners and also to respond to their expanded depicted by the task forces. The objective of the association is to find ways of bringing key basic services to the residents and create a platform for dialogue with the local authorities and provincial administration, as well as with development partners. Manyatta, just like any other informal settlement in Kisumu, lacked formal infrastructure to facilitate basic service delivery in sanitation, access to clean water, solid waste management, security for the residents, and even land ownership and physical infrastructure development, such as roads. As directly mentioned, "Manyatta Residents Association was created to fight for the rights of the residents".

The establishment of Manyatta Residents Association was supported by external/international partners such as Sana International, CMEDA, Practical Action and Kisumu Urban Apostolic Programme (KWAP). The organization structure consists of the Executive Committee that includes the Chairman, Assistant Chairman, Secretary, Assistant Secretary, Organising Secretary and Treasurer. The Management Board is consititued by the Executive Committee, unit leaders and heads of the task forces. Manyatta informal settlement is geographically divided into six units (Kondele, Kona-mbuta, Flamingo, Gonda, Meta-meta and Magadi). The task forces include water, sanitation, waste management, urban agriculture, drainage, energy

and the recently formed table banking. Table banking is a group funding strategy where members of a particular group meet regularly (often once a week in the case at hand), place their savings, loan repayments and other contributions on the table then borrow immediately either as long term or short term loans to one or a number of interested members. Members often use the money borrowed as capital to boost their micro business or for their livelihood projects.

The members of the Executive Committee are elected every three years, while the unit leaders and heads of the task forces are elected every two years and as per their constitution when registered as a CBO. Manyatta Residents Association is therefore an association of CBOs and self-help groups. It is an overseer and provides for linkages to NGOs, the local government and other institutions.

Although any resident of Manyatta qualifies to become a member, as long as an entry membership fee of approximately 10 USD and an annual renewal fee of 5 USD is paid.

Members meet weekly to receive reports from task forces and also for table banking. The weekly meetings are attended by members of the Board of Management.

Activities for the task forces in Manyatta

Task forces	When created	activities	service coverage
Solid Waste Management Task Force	2003	-Waste Collection -Clean ups	20% - Waste Collection 10% - Clean ups
Water Task Force	2003	-Administering DMMs -Household connections -Connecting, maintaining and managing the sewer line	33% - DMM services 25% - Connections 10% - Sewer connections
Sanitation	2003	-Clean ups - Managing the biocentre which has shower and toilet services at a fee and a biodigester designed for generating electricity. -Manufacturing liquid soap for sale to residents and others	30%
Urban Agriculture	2003	-Offering trainings on kitchen gardening, animal vaccinations, composting and manure manufacture	30%
Economic Empowerment	2016	-Table banking and group savings	80%

Obunga Residents Association
Obunga Residents Association was started in 2005 as neighbourhood association and was registered in 2011 as a Residents Association to look at issues affecting the residents of the Obunga informal settlement and to champion the development agenda in the area. The issues included lack of clean and potable water, sanitation, garbage collection and drainage. The establishment of the Residents Association was supported by Sana International, CMEDA, and WIFI- Women in Fish Industry

The organization structure includes the Executive Committee (Chairman and Vice Chairman, Secretary and Vice Secretary, Treasurer, Organizing Secretary and Vice Organizing Secretary, plus two coopted members) and the Governing Council (members of the Executive Committee, the five zonal leaders and the task force leaders). Obunga in divided into five geographical zones: Kasarani, Central 1, Central 2, Sega-sega and Kamakoa. The zones elect and present their reprentatives to the task forces. The task force leaders are members of the Governing Council but are answerable to the Residents Association Executive Committee.

Elections are held every three years at all levels. They start with zonal leaders and then the Executive Committee at the Residents Association level by all members. The zones, the table banking and the task forces are registered as Self-help Group, except the water task force which is registered as a CBO as its scope cuts across all zones.

The Governing Council and the Zonal leaders meet weekly on different days of the week. In the Council meeting, zonal leaders present their reports, receive updates from the Residents Association and decide on the activities to be undertaken.

Task forces are formed based on needs of the Obunga residents and members are assigned to them through nomination. Self-help groups, women groups and CBOs are registered to the Residents Association for linkages to NGOs, the local government and other institutions Membership is open to all residents of Obunga after paying the membership fee and an annual renewal fee of 2.5 USD each. A welfare association is available to all Residents Association members.

Activities for the task forces

Task forces	When created	activities	service coverage
Solid Waste Management Task Force	2005	-Waste Collection -Clean ups	15% - Waste Collection 5% - Clean ups
Water Task Force	2005	-Administering delegated management models (DMMs) -Maintaining water lines	85% - DMM services 50% - Sanitation
Child rights	2010	Looking at issues affecting children; child protection, rape and abuse.	15%
Urban Agriculture	2006	Food security	15%
Human rights	2006	Awareness of citizen rights, landlord-tenant issues, dialogue with authorities.	70%
Health	2006	Environment and health issues	80%
Women empowerment	2006	Facilitation of women to do business and improve their income	15%
Information and resource centre	2016	-To provide information to the public and organize for public participation, -Meeting point and office of the RA. - Provision of internet services	60%
Drainage	2005	-Monitoring road construction. -Following up on compensation of displaced residents by road construction	10%

Nyalenda B Neirbourhood Planning Association
The informal settlement Nyalenda has two neighbourhood associations, where Nyalenda B Neighbourhood Planning Association (CBO) is covers part B of Nyalenda. The association was started in 2008 after the post election violence of 2007 and was registered as a CBO in 2009. The purpose of its formaton was to coordinate development partners and advocate for equality in the distribution of resources.

Its organisational structure consists of a Neighbourhood Committee of 17 members which include three representatives from each of the five units in Nyalenda B and two ex officio members (An area MCA and the Assistant Chief). The 17 members form the delegates that elect the neighbourhood executive committee consisting of the Chairman, Vice Chairman, Secretary, Vice Secretary, Organising Secretary and Treasurer. Nyalenda B has five geographical units, namely Western A, Kilo, Got Owak, Nanga and Dunga.

Election is held every 3 years starting from the unit level and at the association level by the 17 delegates. Membership is open to all Nyalenda B residents by paying a registration fee of 1 USD at the unit level. The annual renewal fee has been shelved as members are not honouring it.

The partners supporting the organisation include Kisumu Sanitation (Practical Action), Umande Trust, KWAP, Grassroot Trust (Housing and Advocacy, Establishment of a resource centre), Pamoja Trust (Advocacy), and Transparency International (Governance).

Activities for the task forces

Task forces	When created	activities	service coverage
Solid Waste Management Task Force	2009	-Waste Collection -Clean ups	15% - Waste Collection 5% - Clean ups
Sanitation	2009	-Sanitation champions fighting open defecation	20% - Sanitation
Renewable Energy	2009	Promotion of solar lighting and solar cookers.	5%
Urban Agriculture	2009	New technology in farming eg sack gardens.	5%
Housing	2009	Advocacy for improvement of housing	5%
Health	2009	Promotion of community health volunteers to improve health at household levels and prevent maternal deaths	40%

Grassroots organisations and critical infrastructure
In this section, informed by the literature on infrastructure and the concept of partial/incomplete organisation, we seek to analyse the role of grassroots organisations in the production and governance of critical infrastructure based on the case of resident associations and CBOs in Kisumu's informal settlements. The management and governance of critical infrastructure is characterized by four features that will be unpacked in the following sections:

a) flexibly configured organisational landscapes versus formal façades; b) critical but hidden material/organisational infrastructure sustaining human and organisational life; c) nested infrastructures interconnected/embedded in layers; and d) dormant (discretionary) infrastructures/organisational elements

Flexibly configured organisational landscapes
At a first sight, the studied organisations seem to respond to the characteristics of formal organisations. Formally, they include all the organisational elements that a resident association/CBO shall have: leadership, structure and organisation through task forces, membership and formal rules. However, after a first insight it is clear that this representation of a 'true organisation' (Brunsson, 2006) it is mostly a façade; an illusion created to accommodate the expectations of donors and authorities regarding how a grassroots organisation should look like, and showing that they have access to all the elements of a formal organisation. Creating the illusion of a 'formal complete organisation' helps to maintain the ceremonial ritual (Meyer & Rowan, 1978) to gain legitimacy and attract potential resources.

Soon it is noted how the formal organisation is loosely coupled, at times decoupled, with the community activities. In fact, despite how formal and hierarchical they seem to be from an external perspective, a closer look shows how they, internally, resemble more of a nebulous form connecting semiautonomous cells (Melucci, 1996). This form is contained in a flexibly configured organisational landscape (Simone, 2004) characterized by less structured forms of interaction among highly autonomous groups. When examined more closely, several organisational elements that exist in the formal description of the associations, remain blurry, inexistent or, as we will argue later, dormant. The configuration of these associations responds somehow to the concept of partial (or incomplete) organisations (Ahrne and Brunsson, 2011), where grassroots initiatives build up their organisations with the 'minimum set of elements' (Simone, 2004) they have at hand. They adopt several organisational elements, while others are not included either because of a lack of resources, because they obstruct the use of other elements, because there is resistance, or simply because these formal elements are not needed. For example, despite a membership fee is compulsory, very few members are honouring it and in practice membership is open and fluid.

Critical but hidden infrastructures
While some formal organisational elements are missing, and much of the organisational life is *ad hoc*, there is one particular crucial characteristic of these organisations that is revealed to create cohesion, stability and a guarantee for the continuity of these groups: the existence (or need) of what we here call critical (material/organisational) infrastructures. Water infrastructure can illustrate this concept. Two of the three organisations, Obunga and Manyatta Resident Associations were created as a result of the provision of water meters and water services to the community, in collaboration with the municipal water management company KIWASCO. As a result of this, the Manyatta Resident Association was created and then also other task forces delivering community services, such as waste management or sanitation were created. While some of the task forces are fluctuant, depending on the existence of external funding or sufficient customers to pay for the particular service, others, such as the task force for water provision, have stabilized and expanded in the number of households being connected to the infrastructure network. Also in the case of Obunga, the water management group was the first one to be created and the association has followed a similar development pattern.

Table banking, Merry-go-rounds, or rotating savings and credit associations (Geertz 1962) is another example of a critical infrastructure for those who cannot access services of the formal financial systems. Within each of the three grassroots initiatives there are hundreds of residents involved in small table banking groups. These groups are deeply embedded in trust relationships and networks of solidarity with conditions easily achieved at lower organizational levels. Membership is through trust, being acquainted to a member of the group and they meet face-to-face every week in a given day. These face-to-face meetings do not only contribute to create and recreate every week the necessary financial infrastructure for saving money for their business and household needs. They also turn into a critical organisational infrastructure that maintains the organisation alive, where the face-to-face encounters (Haugh, 2015) promote the necessary cohesion and sense of belonging to stabilize the grassroots organisations and keep them alive.

In other words, these infrastructures are critical, both materially and organisationally, as material infrastructure that sustain life in cities (through the provision of, e.g., water or savings) and as organisational infrastructure for the maintenance of grassroots organizations (being the operating core of the organisation). They also remain hidden and invisible for the outsiders since, as Hyden (1983) has noted, associational life in Africa remains invisible for the untrained eye of the foreigner. These organisations are embedded in certain rationales (of relatives/ethnic relationships, solidarity and trust) and crystalized in flexible and less visible organisational forms. These material and organisational critical infrastructures therefore remain invisible for strangers, sunk (as physical infrastructure often is) under the soil of the grassroots organisations (Star, 1999), but visible for the communities of practice that participate on a daily basis in their production and reproduction (Bowker and Star, 1996).

Nested and floating infrastructures
When looking closer at these grassroots initiatives we observe a combination of groups embedded into other groups (Star, 1999) and nested in layers (Ostrom, 1990); and a nebulous of semiautonomous groups (Melucci, 1996) floating in the organisational flux of the organisation without a clear connection to a hierarchy.

Task forces working with different types of infrastructure are an example of such nested organising. In Manyatta, the association meets every Thursday to give reports at four o'clock in the afternoon. The six units/villages of Manyatta A are organised as CBOs consisting of self-help groups. The water management group takes advantage of the existing water infrastructure and connects to the water service provider to operationalize a delegated management model (DMM) to supply portable water to the residents.

The table banking groups illustrate the floating infrastructure. For example, when interviewing the members of the associations, table banking groups were not actively described in the formal accounts for the grassroots organisation. Still, after observing their everyday activities, the importance of these table banks is rendered fundamental to understand how the neighbourhood associations generate cohesion and keeps alive. These table banks somehow seem to exist within the organisational umbrella of the grassroots organisations even if they are not formally connected to any hierarchy but rather 'float' within the organisational flux.

Dormant infrastructures
Some of the task forces were formally described as part of the organisation but were inoperative for long periods and can be described as dormant infrastructure. They have the ability to remain latent/dormant with a minimum or non-existing resources, but can quickly be articulated when resources arrive (or can be attracted) from donors or the government. Task forces that were operative until resources dried up, remain latent as part of the formal organisation until/if new resources are mobilized. This system can continue operating because of the existence of a critical infrastructure, such as the water provision or the table banking abovementioned, that provides the minimum necessary activity to keep the cohesion of this loose organisation. From this perspective, the grassroots organisation could correspond more to the definition of a network in the sense that there is a lack of boundaries that supports qualities such as spontaneity and flexibility, and therefore resilience in an environment of scarcity and uncertainty.

Political implications of grassroots infrastructure
Grassroots infrastructure seems to have developed a resilient form of organising critical material and organisational infrastructures in the context of Kiusmu's informal settlements. But who is being included/excluded in/from this grassroots infrastructure? And what are the environmental, economic and democratic implications of this form of organising? In this section we develop the political implications of grassroots infrastructure a) for the governance of informal settlements and cities, b) for the welfare of the community, c) for the organisation of the community infrastructures, and d) for informal settlement's citizens

Governance implications
The grassroots initiatives, in the process of creation of community infrastructure, also established connections with formal infrastructure systems. Waste collected from households was sometimes disposed at illegal dumping sites, sometimes at transfer points where the municipal truck would collect it and evacuate it to the municipal Kachock dump site. Part of the money saved through table banks can also be saved in the group's formal bank account.

These connections were of different kinds. Materially, residents built up connections with the main water pipes to connect their master water meter and secondary networks of pipes to the KIWASKO network. Politically, residents negotiated the conditions for accessing this formal network but quite often the negotiated conditions of this connection were destabilized and became more of loose arrangements. That is for example the case with the system of waste collection from transfer points and skip containers in the informal settlements that was interrupted years ago because of the lack of sufficient municipal trucks. The result of this being that the socio-environmental entrepreneurs, that have started to provide these services in connection with the resident associations, need to find out alternative forms to bypass the nonexistent connection between the formal waste collection services in parts of the city and the waste services taking place in the informal settlements. For example, by paying other transporters to evacuate the waste to the dump, or by reimbursing money for the fuel to the municipal truck driver (Gutberlet et al., 2016).

Waste transfer points and water meters represent critical and obligatory mediators (Marvin, Chappels and Guy, 2011), "obligatory passage points" (Latour 1992, p.234) that create a gateway to access, in the case at hand, to the formal city infrastructure. The design of the utility meters and its conditions has therefore interests and values inscribed. For Latour, mediators "transform, translate, distort, and modify the meaning of the elements they are

supposed to carry" (2005, p.39) while intermediaries "merely transport, convey, transfer" between them (Latour, 1993, p.80). Latour also says: "no matter how complicated an intermediary is, it may, for all practical purposes, count for just one – or even for nothing at all because it can be easily forgotten. No matter how apparently simple a mediator may look, it may become complex; it may lead in multiple directions which will modify all the contradictory accounts attributed to its role" (Latour, 2005, p39). Latour calls for looking behind the assumed neutrality of certain actors, and the assumed agency of others. In other words, he highlights the hidden work of mediation. Moss et al. (2011) have argued on this note the necessity for research to "look beyond the formal roles and responsibilities of different actors involved in the governance of urban infrastructures to raise the visibility of a whole host of actors, activities and relations, including informal arrangements, hidden technologies and hidden work that are important, even if not visible, to the dynamics of such socio-technical systems (Star, 1999)" (Moss et al, 2011, p. 7). The question therefore is to what extent these grassroots organisations that produce and govern community infrastructure are intermediaries or mediators. The answer is that it depends on the context and situation, and in the case at hand, these organisations are both intermediaries and mediators, at times being instrumentalized by the municipality to expand the water infrastructure in the informal settlements, being no more than mere transmitters (intermediaries) of the water. At times, resisting and negotiating (as mediators) the connection with, for example, waste collection and sanitation infrastructure.

Furthermore, by providing critical infrastructure, and by representing a number of residents, the grassroots organisations are also gaining legitimacy to participate in the participatory budgeting process that the County started in 2016 (check this). Although that this new 'participatory governance infrastructure' has been criticized by the grassroots organisations for being more of a token, they have articulated strategies to resist to comply to a uni-directional process and claim for a more genuine participatory process, for example, by demanding that the County should provide the documents and budgets well in advance, thus once again advancing from being intermediaries to being mediators.

Community implications
As mediators, grassroots organisations can create gateways that include citizens and parts of the city that are abandoned by the government in an increasingly functional community infrastructure. Still, they can also exclude other potential users, and even hinder or lock in (Corvellec, Zapata & Zapata Campos, 2013) the development of other innovations. For example, the existence of a dormant waste management task force in the Obunga Resident Association represented a hindrance to new youth groups in the community that were willing to provide these services as an independent initiative. .

Similarly, the connections these grassroots infrastructure make can shift power dynamics towards greater social, economic and environmental justice but also perpetuate power dynamics shaping a "tyranny from below" (Zapata Campos & Zapata, 2015) in which the "grasstops" (Briggs, 2008) and their leadership block progress and control or capture benefits intended for the poor, misusing them for private interests (de Wit & Berner, 2009).

In other words, the creation of these grassroots infrastructures and organisations does not deny persistent challenges of clientelistic relationships between some members and the residents. On that note, a report conducted in collaboration with the NGO Practical Action observed that "while the new system of service delivery through SMEs was intended to have a 'pro-poor' focus, in practice it has become exclusively based on a 'citizen as consumer'

model. Perpetuating on an individual basis, the model does not encourage the development of a collective strategy to manage public spaces, which is critical, given that waste disposal practices have effects beyond the individual household level" (Frediani, Walker and Butcher 2013, p. 20).

Another implication relates to the levels of efficiency and to what extent the practices succeed to provide critical services to the residents of informal settlements. Water coverage has increased dramatically as a result of a co-production of this service with the KIWASCO, reaching levels of 85% in Obunga. Still, waste management services cover less than 15% in Obunga and hardly reach 20% of the residents in Manyatta, in spite of the waste collection service organised by some micro-entrepreneurs has been working since 2003 and is well connected to the Manyatta Resident Association.

Citizenship implications
Finally, we argue that building up the infrastructure and bringing it into the organising of the community, not only serves to the fulfilment of basic material needs and the organisational survival of these initiatives, but foremost contributes to the generation of active forms of 'hydraulic' (Anand, 2011) and financial citizenship, through new forms of 'infrapolitics' (Scott, 1990) in line of what Appadurai calls, the politics of shit.

Concluding discussion
This paper has examined the organising of critical grassroots infrastructure in the context of scarcity and uncertainty of Global South cities' informal settlements. It shows how grassroots organisations developing resilient organisational and material infrastructure resemble a hybrid between an incomplete/partial organisation (Ahrne & Brunsson, 2011) and a networked movement (Melucci, 1996) characterized by a flexibly configured organisational landscape combined with formal hierarchical façades; critical and hidden material/organisational infrastructure sustaining human and organisational life; nested infrastructure interconnected in layers in combination with floating organisational cells; dormant and/or invisible infrastructure providing discretionary services; leading to the creation of governmental infrastructure to connect, or switch on (Zapata Campos and Zapata, 2013) both the organisation and the infrastructure to formal governmental systems.

Finally, the paper problematizes the implications of these resilient forms of organising and draws our attention towards how organisational 'incompleteness' and nebulous/networked forms of organising can be both inclusive and exclusive, combining both grassroots with grasstop representations, fostering but also impeding other innovations to grow.

What control systems need to be set in place to guarantee a just development through these grassroots organisations and the grassroots infrastructure they create, manage and govern is a question for further research.

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