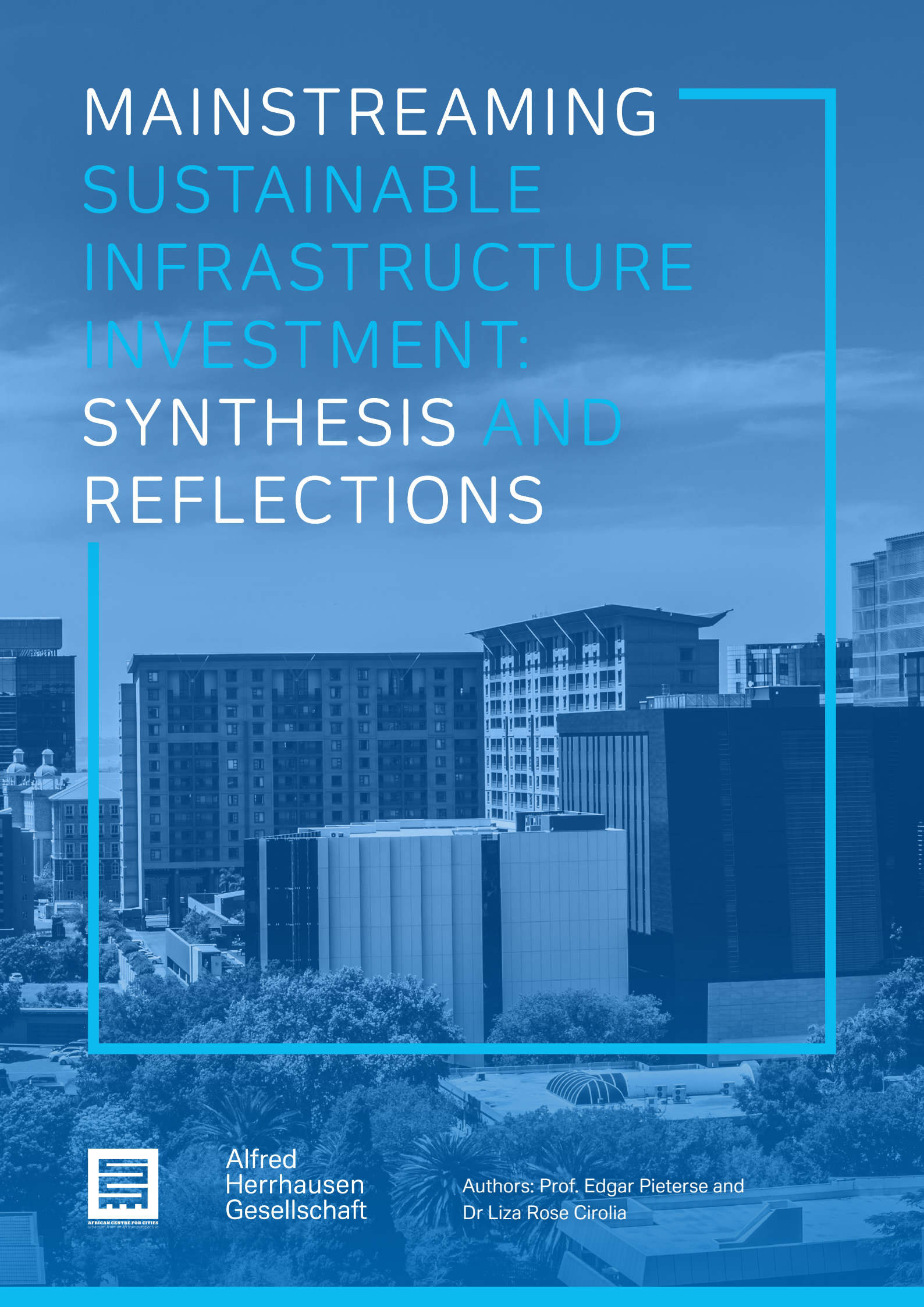
MAINSTREAMING SUSTAINABLE INFRASTRUCTURE INVESTMENT: SYNTHESIS AND REFLECTIONS



AFRICAN CENTRE FOR CITIES

Alfred Herrhausen Gesellschaft

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Acknowledgement

This work was funded as part of the Alfred Herrhausen Gesellschaft (AHG) and the African Centre for Cities (ACC) collaboration on sustainable infrastructure finance in Africa.

About the African Centre for Cities

The ACC, which is based at the University of Cape Town, is a leading knowledge centre conducting meaningful research on how to understand, recast and address pressing urban crises, particularly on the African continent. As most urban challenges, for example, food security, climate change adaptation, economic inclusion, cultural vitality, and tolerance, are inherently interdisciplinary and spatially layered, the ACC nurtures the co-production of knowledge favouring and cultivating critical Southern perspectives. Through its research, the ACC aims to develop imaginative policy discourses and practices to promote vibrant, just, and sustainable cities. This purpose has become all the more pertinent with the adoption of Agenda 2063 at a pan-African level, which aligns with the 2030 Agenda for Sustainable Development.

About the Alfred Herrhausen Gesellschaft

The Alfred Herrhausen Gesellschaft promotes a free and open society and its cohesion. Democracy, the social market economy and sustainability are the foundations of such a society. Our work is based on the values of Alfred Herrhausen: on freedom and responsibility, on competition and compassion. Alfred Herrhausen thought and acted with the aim of crossing and overcoming boundaries. In his memory, the Alfred Herrhausen Gesellschaft creates platforms for discussions to enrich relevant discourses during selected events, and in publications and other media.

About the Authors

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Please cite as: Pieterse, E. & Cirolia, L.R. (2022) Mainstreaming Sustainable Infrastructure Investment: Synthesis and reflections. Cape Town: African Centre for Cities & Alfred Herrhausen Gesellschaft.

CONTENTS

1 INTRODUCTION

The strength of this series rests in its commitment to unpack the monolith of sustainable infrastructure – what it means for different actors, across various sectors and at different scales. This focus is augmented by moments of synthesis and generalisation. Paper 1 frames the series and this paper (Paper 6) summarises and positions the work in future-looking debates.

2 INSIGHTS FROM ACROSS THE SECTOR PAPERS

The information and communications technology (ICT), sanitation, mobility and energy sector reports provide a rich and varied discussion on Africa's sustainable infrastructure challenge from sectoral viewpoints. This latitudinal approach provides several vital insights, as follows:

Existing infrastructure delivery models fail on their own terms. The status quo approaches for investment in urban infrastructure in Africa has not – and likely will not – result in universal coverage. From energy to transport, large-scale investment programmes in many countries have made significant impacts on the quality, affordability and accessibility of service delivery systems. So too have innovative finance mechanisms. Progress is notable in the ICT and energy sectors; however, these investments (and the concomitant innovations that underpin them) are unable to keep pace with the need for services, affordable service delivery, ensuring progress towards the various global sustainability metrics – such as the 1.5 degree world – or delivering on the targets outlined in the Sustainable Development Goals (SDGs). Africa is a long way off from achieving the SDGs that pertain to access to basic services, especially in the sprawling informal settlements that mark urban landscapes and peri-urban zones.

Scale matters for investments in infrastructure. Owing to the incredible need, infrastructure investment programmes tend to focus on large-scale infrastructure. For example, the papers show that industrial energy generation, transnational logistics corridors, or undersea cables are the core focus areas of donors and lenders. These are essential parts of infrastructure systems, supporting economic development and ensuring that the backbone of large networks are in place. However, the lack of focus on distribution, and connection – the last mile of service delivery to homes and small firms – has resulted in significant gaps and fractures in infrastructure systems at the local level. The outcome is that many areas in cities are not serviced by the grid. As noted in the sanitation paper, most African cities are not covered by networked sanitation and are using on-site services instead. In some cities, the entire city uses on-site sanitation solutions. Even where large-scale treatment has been developed, few are connected to it and the plants function at a fraction of their capacity. Moreover, even in places where bulk capacity has been extended and connections made, service provision may be inconsistent or unaffordable. This is the case across infrastructure sectors. As shown in the papers, these overburdened and poorly maintained systems leave urban dwellers with clogged toilets (sanitation), rolling blackouts (energy) or insufferable commute times (mobility). There are also vital interdependencies. When the electricity grid is unstable and prone to power cuts, it impacts the operational efficacy of water treatment plants, exacerbating the negative health impacts of limited or poor sanitation services. Energy-related challenges can disrupt data network services and mobility systems.

Off-grid, private and informal provision methods fill gaps. The limitations of the network – particularly its breakdown at the last mile of delivery – have given rise to makeshift and informal solutions. Demand for services still exists, even where the network cannot supply. From home generators to pit latrines, economies for the delivery of services to individual businesses and households have evolved over decades to fill the gaps in formal and State-driven delivery systems. In some African cities, states themselves - realising that they cannot provide key services – have encouraged decentralised solutions, such as mini-grids or community-scale sanitation treatment. However, generally, makeshift solutions have been tolerated and framed as interim solutions. These vernacular service delivery systems 'work' as they are flexible and responsive. They rarely require large outlays of capital and can circumvent cumbersome bureaucracies.

Nevertheless, they are costly, consequently making everyday life expensive and small-scale businesses less efficient. They do not benefit from economies of scale or enable large capital costs to be spread over many generations of users. Mini-grid tariffs, for example, tend to be much higher than utility provided services. Diesel home generators are even more costly per unit and in terms of their environmental impact. These diverse service systems dominate delivery, particularly for the urban poor. It raises the possibility that so-called decentralised sustainable technologies can be more expensive per unit cost than network infrastructure systems.

The development sector is driving new technologies. While the substance and scale of these diverse service systems are poorly documented, the reality of their costs and risks are acknowledged by the development sector. Donors and lenders have become increasingly interested in technologies that are more flexible, dynamic and responsive. From 'BRT-lite', to high-tech on-site sanitation systems, to e-mobility, a whole plethora of technologies are being imported and tested in African cities. A key part of this technology push is a drive for digitisation and 'smart services', such as smart meters or smart batteries. Some of these technologies have the potential to address key environmental risks and sustainability challenges. However, it is important to ensure that excitement over new technologies, especially digital ones, do not militate against robust engagement with the social, political, privacy and environmental implications of their deployment.

Ensuring diverse investments that create real long-term value requires strong institutional skills and coordination. Careful governance of these complex infrastructural systems – made up of large networks, informal gap filling, and new technologies – is required. However, the existing intergovernmental arrangements that structure infrastructure planning and delivery are messy and inefficient. The role of local governments vis-à-vis utility companies, private operators and development finance providers is generally weak. Different actors respond to their own plans, incentives and log frames, with little coherence or explicit vision for the future infrastructure systems of cities. There is even less consideration for the overall spatial development and form of the city. This is one of the contributing factors to the ineffectiveness of urban master plans in most African cities. The sectoral nature of infrastructure planning and its disconnect from spatial planning is a recipe for contestation and stagnation.

3 SECTOR CONTRIBUTIONS

The sector papers each provide unique and diverse insights.

ICT investment in Africa is growing quickly. While mobility and energy have long been central to urban service debates, ICT investment is a relatively new addition to this conversation. Leading voices in the infrastructure debates now argue that ICT investment has the potential of leapfrogging African economies into rapidly reconfiguring global and regional economic circuits. As shown in this report, investments in the ICT value chains include, among other things, undersea and terrestrial cables, data centers and software systems. ICT investment across this value chain is rapidly expanding access to and the quality of digital services in Africa, particularly in cities. In contrast to most other infrastructures covered in this series, the private sector is central to ICT delivery. Private telecommunication companies (such as Huawei or MTN), tower companies and the data centre industry play a central role. Cities are often favoured geographically because of reliable energy infrastructure, a more accessible customer base and their potential for hosting tech hubs and accelerator programmes. The ICT sector and those interested in sustainable infrastructure investment need to consider several vital sustainability issues. The very diverse risk and profitability profiles across the value chain result in the perpetuation of digital divides through profit-driven financial patterns. The systemic environmental footprint of digital infrastructure, for example, energy consumption for data centres, mining for metals used in batteries and handsets, and e-waste, needs to be considered. Personal data protection and data sovereignty will only become more pressing as ICT and digitisation become ubiquitous; Africa needs to get ahead of these data issues, as suggested by the Smart Africa initiative (https://smartafrica.org). There is a severe need to evaluate the impact of artificial intelligence and digital services more broadly on the future of work and employment in Africa.

Energy underpins most development objectives. It is central to mobility, ICT and many other sectors. However, prevailing electricity services across the continent, especially in sub-Saharan Africa (SSA), are inadequate, expensive and unreliable, with many implications. Truncated generation, transmission, distribution and electricity access results in a low-level equilibrium in which investment in electricity does not catalyse the type of sustained economic growth that lifts people out of poverty, and low per-capita incomes. When these dynamics are coupled with low levels of tariff collection, it undermines the ability to invest in additional electricity. Similar to other infrastructures, there is no shortage of calls or programmes seeking to address the electricity deficit. Moreover, there are significant levels of so-called 'green finance' aimed specifically at the energy challenge. However, there are many reasons why financing sustainable energy and achieving universal access remains so challenging. These include the co-evolution of centralised political power, the operating assumptions of finance providers and the technocratic characteristics of electric power systems as key barriers. Despite this inertia and blockages, a confluence of shifts at global, regional and local scales is identified in the paper, making it easier to extend sustainable electricity finance in Africa. These include technological progress that enables a shift away from large, long-lived sunk investments, innovations in renewable energy, digitalised payment systems, and the urbanisation of SSA's population.

Mobility links cities to regions, supporting economies and everyday life in cities. Similar to energy, mobility is central to economic development. The movement of people and goods – commuting and logistics – requires functional mobility systems. Despite widespread attention being given to new public transport technologies, such as the BRT, most donor and development investment is concentrated in the more traditional sectors, for example, highways and roads. Linking cities to regional and global networks, corridor development – aligning roads, rail and ports – is reshaping and reinforcing logistical networks on the continent. This is driving urban change, often with little attention being paid to the sustainability impacts on cities. The building of bankable

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transport projects has generally focused on logistics. In terms of key sustainability, mobility investments need to maximise the interface between cities, regions and global economies through the use of multi-modal technologies, strong planning and intergovernmental cooperation. In addition, sustainable investment in mobility needs to consider low carbon transitions and fossil fuel dependency, the need to build resilient and adaptive systems that can respond to changing movement demands, the importance of being socially inclusive by prioritising affordable technologies and just value chains that reposition African cities in global systems.

Of all urban services, sanitation is notoriously difficult to fund and finance in African cities. A significant lack of data in tracking sanitation progress in African countries makes it difficult to get a clear picture of urban sanitation. In crude terms, in SSA cities, 65%-100% of sanitation access is provided through on-site technologies, rather than through large-scale networked systems. The service chain for sanitation can be complicated, particularly when viewed through a financing lens. In contrast to sewerage networks, which are generally provided by water and sanitation utility companies, large parts of the off-site economy are often the preserve of private and informal providers. This divide mirrors other infrastructures such as energy. Across Africa, households fund most sanitation expenditure; households are reluctant to cover the costs of treatment and safe disposal, leading to corners being cut and the environment suffering. To address this, in recent years, hybrid approaches to providing sanitation have increasingly become the recognised way of conducting business, whether by multinational donors or international non-governmental organisations. City-Wide Inclusive Sanitation is one of the frameworks used to operationalise this commitment to hybridity, aimed at combining centralised networked infrastructure with approaches that embrace and transform existing, often informal decentralised approaches to providing sanitation.

4 FROM THE STATUS QUO TO MAINSTREAMING SUSTAINABLE INFRASTRUCTURE

It is irrefutable that African city governments face a near-impossible task. On the one hand, there is a dire need to address basic services and land access for existing populations, most of whom do not occupy formal jobs. On the other, city governments need to address the implications of rapid future growth and plan for emergent city developments.

This tension between meeting existing backlogs and getting ahead of the curve is exacerbated by limited urban mandates, combined with scarce fiscal resources. The partial and fragmented nature of decentralised urban functions makes integrated urban investment a major challenge. It is for this reason that infrastructure planning, city management and sustainable financing are so important. Together, these provide a concrete opportunity to strategically address intersecting, dynamic and critical development priorities. Put differently, SI provides a framework and investment agenda to achieve the vision of infrastructure as a catalyst for transformation, as promoted in the SDGs, the Paris Climate Agreement and Agenda 2063.

Sustainable infrastructure is the physical operating system that allows the built environment to become the driver of the transition to a green economy, which in turn is defined by these features, namely being low carbon, resource-efficient through circularity, digitally enabled, labour-intensive, and through its design and deployment, contributes to socially inclusive and spatially integrated development.

The following operational principles of SI can be identified:

- *Decentralisation and interoperability between technologies and scales*. SI requires a reconsideration of the value chain components and connections of infrastructure sectors. Achieving circularity often requires thinking about neighbourhood-scale operational models for the design and provision of services such as energy or sanitation. However, decentralised systems need to be interoperable with operational logics that function at a city-wide and/or bioregional scale as well. The next principle addresses that imperative.
- *Integrated and aligned through data-driven coordination tools*. Given the performance features of SI, it is necessary to deploy technologically driven data collection and analysis systems to understand whether operations of a given infrastructure is optimised within the operating logic of the sector (for example, energy or mobility) and potential synergies between sectors are harnessed (for example, between waste and energy).
- *Designed and operated through appropriate co-production.* Due to the localised and modular nature of SI modalities, it will require much more active engagement with organisations that represent urban residents, especially in informal settlements. Furthermore, community members enrolled in the infrastructure value chain will have to be trained to fulfill such functions. The staff of utilities and local authorities will have to be trained to work in a respectful and productive manner with community organisations. Careful consideration must go into the design of these service delivery processes, their operationalisation and ongoing monitoring to ensure learning and adaptation.
- *Affordable*. Given the low and variable incomes of poor households who live in informal settlements, it is critical to ensure that the SI service offering is within the means of households and the rhythms of income and expenditure. Sweat equity will have to form part of the operational model for neighbourhood-scale implementation of service delivery systems to make the cost of the service more viable. The affordability imperative underscores the importance of co-production as communities will have to resolve the level of service they are willing to accept with an understanding that the offering can evolve and expand over time. Affordability also requires an explicitly intra-city cross-subsidisation model that must be developed and must be transparent.

- *Culturally appropriate.* As SI is more modular and decentralised, it implies a greater degree of citizen engagement in the deployment of services. Communities are heterogeneous and unique, and this specificity has to be taken into account. As an example, often patriarchal norms pervade in popular culture, which could translate into preferences that only men in communities should be enrolled in service delivery processes. This has to be engaged with so that regressive norms are challenged, but in a manner that allows for such dynamics to be surfaced and addressed. There may also be cultural norms related to waste and pollution that has to be understood before an SI technology and operating procedure is deployed.

It is clear that SI implies a fundamentally different institutional model than conventional centralised network infrastructure systems. In reality, cities will not be able to transition from one system to another but the two will co-evolve through a clearly mapped transition process. The enlarged function of infrastructure planning has to be to conduct such mapping with an explicit risk analysis so that the transition does not delay the provision of basic services, but rather serve to accelerate and expand. In the following section, practical steps are briefly considered that will need to be followed to embed a commitment to SI in governance processes at the city level and how it interfaces with regional/provincial and national scales.

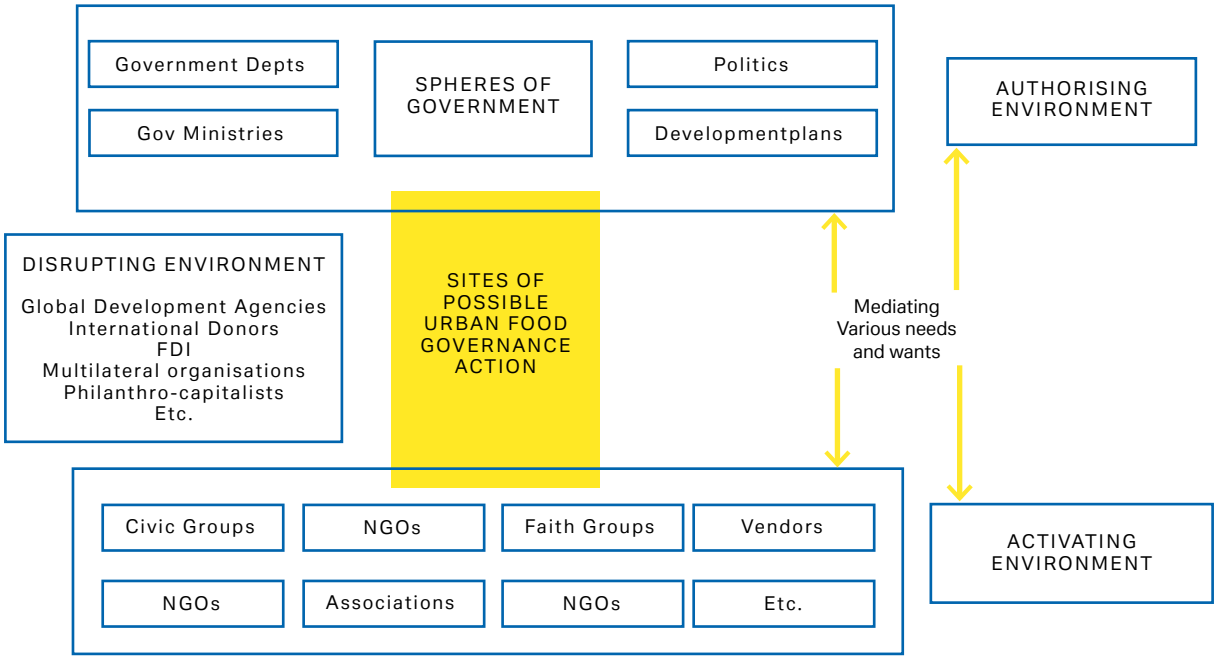
5 PRACTICAL STEPS TO EMBED SI TRANSITIONS

The most important task is to develop a comprehensive understanding of the status quo, namely how each infrastructure sector is organised; the various actors involved in the full value chain from planning, investment, construction, maintenance and repair; service provision into different kinds of communities and for different categories of client; and monitoring service delivery performance and structured points of accounting to political fora, attorneys-general and the public. Practically, this means producing a comprehensive infrastructure map comprising –

- formal infrastructure investment plans, their spatial footprint and expansion over time;
- self-enumeration maps produced by residents and their organisations (for example, Port Harcourt) that can reveal the makeshift and informal systems of infrastructure and service provision; and
- a synthesis analysis on how these systems interrelate and the opportunities for system change.

An important overlay is an institutional analysis that seeks to define two zones of organisational interaction and governance: the nature of "authorising environment" and "activating environment". Figure 1 illustrates what such an analysis might cover by looking at the urban food system in an African city. 2019).

FIGURE 1: INSTITUTIONAL ANALYSIS OF AN URBAN FOOD SYSTEM IN AN AFRICAN CITY AND A SIMILAR INSTITUTIONAL MAP CAN BE PRODUCED FOR EVERY INFRASTRUCTURE SECTOR.



A similar institutional map can be produced for every infrastructure sector.

It is unrealistic to expect a city government department or a utility company to produce this kind of analysis. Ideally, an Infrastructure Living Lab (sometimes called a 'social lab', 'action lab' or 'city-lab') will be established under the auspices of an academic institution or network (to ensure independence and data integrity) to organise the data collection and analysis in close consultation with government, the private sector and civil society partners. In addition to producing the comprehensive infrastructure map, as specified above, the lab will also formulate criteria to identify pockets of experimentation or innovation in the existing

systems, or at least identify which actors in the systems may be open to experimenting with SI modalities. The lab can facilitate a process with all interested parties to design projects to more intentionally experiment with alternative approaches for the purpose of learning, and eventually, institutional mainstreaming.

After this phase, the lab can develop detailed business plans for the in-depth exploration of sites to experiment with alternative SI technologies and processes. Once the detailed proposal and resourcing strategy has been formulated, resource mobilisation and political champions must be identified. International and national infrastructure financing partners can play an important role in ensuring that these business plans are implemented. Integral to these business plans must be the identification of learning and feedback mechanisms to progressively amend formal annual infrastructure plans as the learning from the experimentation sites come through. A number of considerations will need to be taken into account to ensure mainstreaming and the lab will have to remain attentive to identifying those.

Thus far, we have anticipated how transformation may happen in a given infrastructure sector. Over and above this foundational work, there is also a need to connect the dots through a dedicated sub-lab of the Infrastructure Living Lab. Its focus will be to scan for and identify nexus opportunities to strengthen interdependencies between infrastructure sectors, for example, a food-water-energy nexus. A very similar process of diagnostic and business planning will have to be undertaken as well.

Lastly, the Infrastructure Living Lab will have to proactively identify opportunities and mechanisms to plug into learning networks and platforms to document innovations and create an open-source framework for Africa. We anticipate that various institutions with a pan-African development mandate to give effect to Agenda 2063 are well placed to finance and support such networks.

6 FURTHER RESEARCH AND DIALOGUE

These papers are a call to action for researchers, practitioners and activists who are concerned with the infrastructures needed to support the ecosystems, communities and economies of Africa's growing cities. The papers, at a very high level, articulate the current models of infrastructure delivery, the gaps in these models, and the material and political implications of these gaps. At the same time, the papers point to the need to fill these gaps, not with more of the same, but with different types of investment. Investments that have urban multipliers – building back degraded ecosystems, creating jobs for urban dwellers, and reducing waste and pollution. However, much more work is needed to understand what this sustainable infrastructure agenda might mean for different geographical contexts, for the various actors (from investors to local government) tasked with doing infrastructure differently, and for those directly affected by these investments every day.

Conventional models of research, even those that incorporate participatory practices, have often fallen short of truly engaging with the contested power dynamics that entrench the status quo or predetermine and homogenise green agendas in the infrastructure space. These models have not worked to adequately capacitate decision-makers who must sift through reams of offerings, from new technologies to financial products. The decisions made today will have opportunity costs and long-term implications for cities and regions. They lock in future resource pathways and circumscribe urban management systems. It is imperative that future work strengthens the ecosystems that support decision-makers and enhances debate, building pipelines of projects that truly reflect the priorities and ideals of African cities.

Changing large technical systems requires work and time. It is a slow and negotiated process of reconfiguring systems (material, financial and operational) that have been built over decades. It requires a careful balance between radical intervention and incremental manoeuvres. While the sustainable infrastructure challenge in Africa requires scaled action (large pots of funding, sizable investments and institutional reform across scale), so too does it require bespoke contextualisation, interaction and determination. This requires ensuring that sustainable infrastructure and infrastructure transition processes are not imposed from above, but co-created with those implicated by these important changes.