

Working Paper 1:

Concepts and assumptions

Jane Battersby, Mercy Brown-Luthango, Issahaka Fuseini, Herry Gulabani, Gareth Haysom, Ben Jackson, Vrashali Khandelwal, Hayley MacGregor, Sudeshna Mitra, Nicholas Nisbett, Iromi Perera, Dolf Te Lintelo, Jodie Thorpe, and Percy Toriro



LIVING OFF-GRID
FOOD & INFRASTRUCTURE
COLLABORATION

The Institute of Development Studies (IDS) delivers world-class research, learning and teaching that transforms the knowledge, action and leadership needed for more equitable and sustainable development globally.

About the Living Off-Grid Food & Infrastructure Collaboration

The Living Off-Grid Food & Infrastructure Collaboration (LOGIC) is a UKRI Global Challenges Research (GCRF)-funded project which is designed to bring together our thinking on how infrastructure can shape the food and nutritional security of urban marginalised populations. LOGIC is a collaboration between the Institute of Development Studies; the African Centre for Cities, University of Cape Town; the Indian Institute of Human Settlements, Bangalore; Colombo Urban Lab and the University of Ghana, Accra and explores urban infrastructure in cities across Africa and Asia. The research focuses particularly on how the poorest residents of cities meet their basic needs and access infrastructure when they are living 'off-grid'.



LIVING OFF-GRID
FOOD & INFRASTRUCTURE
COLLABORATION

© Institute of Development Studies 2023

Living Off-Grid Food and Infrastructure Collaboration Working Paper 1

Concepts and assumptions

Jane Battersby, Mercy Brown-Luthango, Issahaka Fuseini, Herry Gulabani, Gareth Haysom, Ben Jackson, Vrashali Khandelwal, Hayley MacGregor, Sudeshna Mitra, Nicholas Nisbett, Iromi Perera, Dolf Te Lintelo, Jodie Thorpe, and Percy Toriro
May 2023

First published by the Institute of Development Studies in May 2023

DOI: [10.19088/LOGIC.2023.001](https://doi.org/10.19088/LOGIC.2023.001)

Suggested citation: Battersby, J.; Brown-Luthango, M.; Fuseini, I.; Gulabani, H.; Haysom, G.; Jackson, B.; Khandelwal, V.; MacGregor, H.; Mitra, S.; Nisbett, N.; Perera, I.; Te Lintelo, D.; Thorpe, J. and Toriro P. (2023) Living Off-Grid Food and Infrastructure Collaboration Working Paper 1: Concepts and assumptions, Brighton: Institute of Development Studies, DOI: [10.19088/LOGIC.2023.001](https://doi.org/10.19088/LOGIC.2023.001)



This is an Open Access paper distributed under the terms of the **Creative Commons Attribution 4.0 International licence** (CC BY), which permits unrestricted use, distribution, and reproduction in any medium, provided the original authors and source are credited and any modifications or adaptations are indicated.

Available from:

Institute of Development Studies, Library Road
Brighton, BN1 9RE, United Kingdom
+44 (0)1273 915637

Concepts and assumptions

Jane Battersby, Mercy Brown-Luthango, Issahaka Fuseini, Herry Gulabani, Gareth Haysom, Ben Jackson, Vrashali Khandelwal, Hayley MacGregor, Sudeshna Mitra, Nicholas Nisbett, Iromi Perera, Dolf Te Lintelo, Jodie Thorpe, and Percy Toriro

Abstract

This working paper is the product of the Living Off-Grid Food and Infrastructure Collaboration. It is designed to bring together our thinking on how infrastructure can shape the food and nutritional security of urban marginalised populations.

Infrastructure assemblages include the material (physical and technological), as well as the political and systemic factors that 'govern' how infrastructure is developed and used. Urban food systems are made up of public and private actors, and market and governance processes that shape the cost and availability of food in different urban contexts. At the intersection of urban food systems and infrastructure assemblages lies the food and nutrition security of urban dwellers.

The framing of contemporary debates and policy priorities with respect to both nutrition and infrastructure are heavily conditioned by presumptions – in favour of formality and griddedness, for example, or of the need to raise agricultural productivity – which fail to reflect the reality of marginalised communities in Southern cities. For these communities, their experience is one of hybridity, with formal and informal infrastructures and economies central to their lives and livelihoods.

These hybrid arrangements are imbued with power structures and socio-political dynamics that are context specific and further condition communities' experiences. Together, these are the factors that condition or shape the possibilities for individuals and households pursuing different food strategies. However, there is a failure to reflect this reality in the conceptualisation of infrastructure challenges, leading to unworkable solutions and policies that end up perpetuating problems.

There is an urgent need to reframe problematic assumptions, starting first and foremost from the entry point of urban informal settlements in the global South. By taking food as a lens in this process, we illuminate these contexts, and how they relate to hybrid infrastructure arrangements and potential alternatives. This reformulation is vital at this critical juncture, when Southern cities need infrastructure development that meets the needs of rapidly changing demographics without locking cities and nations into unsustainable pathways.

Keywords

Food; malnutrition; infrastructure; assemblage; marginalisation

Authors

Jane Battersby,¹ Mercy Brown-Luthango,¹ Issahaka Fuseini,² Herry Gulabani,³ Gareth Haysom,¹ Ben Jackson,⁴ Vrashali Khandelwal,³ Hayley MacGregor,⁴ Sudeshna Mitra,³ Nicholas Nisbett,⁴ Iromi Perera,⁵ Dolf Te Linteloo,⁴ Jodie Thorpe,⁴ and Percy Toriro¹

Corresponding Author: Nicholas Nisbett, n.nisbett@ids.ac.uk

1 African Centre for Cities, University of Cape Town

2 University of Ghana, Accra

3 Indian Institute of Human Settlements, Bangalore

4 Institute of Development Studies, University of Sussex

5 Colombo Urban Lab

Contents

| | |
|--|-----------|
| Abstract | 3 |
| 1. Introduction | 7 |
| Interrelated demographic, nutritional and urban transitions | 10 |
| 2. Updating assumptions about infrastructure, planning and urban governance in African and Asian cities | 14 |
| Existing understandings of griddedness and towards new understandings of griddedness as a continuum | 15 |
| Examples of gridded continuums in formal infrastructure provisioning | 18 |
| 3. Infrastructural vulnerability and coping in relation to current and future stresses and shocks | 19 |
| The uneven terrain of politics, legal regimes and urban financialisation behind the gridded continuum and its precarity | 21 |
| Economic shocks and the precarity of migrant workers | 23 |
| 4. Food as a critical lens on urban infrastructure and why infrastructure matters for food | 25 |
| Food as a lens on Southern cities – from rural bias and ignorance to food environments, urban food systems and food as infrastructure | 26 |
| Spatial inequality and the continuum of informal and formal food infrastructure and provisioning | 29 |
| 5. Summary and concluding thoughts – exploring intersections between the ‘continuums’ of infrastructure and food | 31 |
| References | 34 |

Figures and Tables

| | |
|---------------------------------|-----------|
| Table 1. City Typologies | 11 |
|---------------------------------|-----------|

| | |
|--|-----------|
| Figure 1. When the street becomes the stove | 31 |
|--|-----------|

Acknowledgements

This paper is a product of the Living Off-Grid Food and Infrastructure Collaboration. We are grateful to UK Research and Innovation for its funding, grant # ES/T007958/1. We are also grateful to Lesli Hoey and to Annie Wilkinson for their comments on an earlier working paper.

1. Introduction

“In many cities in developing countries, hunger and malnutrition are common amongst the poor, even when food is relatively abundant. Over the past two decades, a considerable literature has accumulated on the problems associated with rapid urbanization in developing countries – a literature that for the most part has neglected the important dimension of urban food systems and how these link production and consumption networks at local, regional and global levels. Similarly, whilst there is a newly burgeoning literature on global food systems, the contextual role of the urbanization process is rarely addressed.”

(Smith 1998: 207)

“More than with any other of our biological needs, the choices we make about food affect the shape, style, pulse, smell, look, feel, health, economy, street life and infrastructure of our city... One way or another, these choices account for about 20% of all retail sales, 20% of all service jobs, ten percent of industrial jobs, 20% of all car trips, 20% of chronic diseases, 25% of fossil fuel energy and air pollution, 40% of all garbage, 80% of sewage... the list goes on. Given the overarching importance of food in urban life, planners need to put food closer to the top of their planning menu.”

(Roberts 2001: 4)

One of the underlying premises of the Living Off-Grid Food and Infrastructure Collaboration is that greater understanding of food and nutrition in relation to infrastructures¹ is essential to engage in effective urban food, urban governance and nutrition planning in Southern cities. This understanding needs to interrogate the range of material, structural and socio-political inadequacies in the urban environment that shape both food and other infrastructures, particularly if it is to be alive to the situation of marginalised urban residents. Analysis of how infrastructure and the food system intersect have not been the primary focus of urban research in the global South, so these questions have hitherto been ignored (Hunter-Adams, Battersby and Oni 2019; van der Valk and Viljoen 2014; Donovan, Larsen and McWhinnie 2011; Roberts 2001).

¹ Throughout the paper, ‘infrastructure’ has been used in reference to physical infrastructure, while ‘infrastructures’ has been used to refer to the social, material and political elements of service delivery, and their interactions.

These gaps are a persistent issue that was identified over 20 years ago, as the two quotes at the start of this section aptly illustrate. The first quote, by David Smith, succinctly highlights the contemporary challenges in most food and urban studies. As we go on to describe, food and the wider externalities produced by the food system largely remain the focus of rural and agrarian studies in Southern contexts. Urban planning policies focus on transport or sanitation infrastructure and other public services, paying little heed to food-specific concerns. Urban food responses that are evident take a variety of forms and operate at different scales. Many of these remain small and are largely project based, seldom engaging in wider food system or urban policy questions directly.

Meanwhile, in the Canadian context, the quote by Wayne Roberts also points to the importance of a food lens when considering urban infrastructures. Similarly, this offers a useful entry point into a discussion on the intersections between food and infrastructure: it shows how food systems influence city form and infrastructure use, and access to infrastructure influences food choices. Using food as a lens to understand these infrastructure connections is a way to expose the strategies and systemic trade-offs that are taking place around one particular urban flow, whose use and accessibility has a direct impact on the developmental trajectory of urban residents. As Steel (2008: 10) asserts: 'In order to understand cities properly, we need to look at them through food'.

In response, this paper reviews the literature and proposes a conceptual approach for a research project with the following primary research question: 'How is marginalised people's food and nutrition security shaped by urban infrastructure assemblages in a variety of 'off-grid' settings in Asian and African cities?' Our focus is not on traditional notions of physical infrastructure: by infrastructure assemblage, we mean multiple arrangements of meeting basic needs, determined not only by networks or flows of physical things, but the social and political relationships, and ideologies operating and influencing access at multiple city scales (Desai, McFarlane and Graham 2015; Redfield and Robins 2016).

Greater understanding is required of how such infrastructure assemblages interact in different ways and at different times to improve or burden poor people's lives. This also entails looking at different arrangements to access infrastructures.² Coutard (2010, cited in Jaglin 2014) defines a grid as 'a set of interconnected structures, centrally planned and managed by a single monopoly based public utility offering uniform service'. This reflects the classical technocratic imagination of infrastructures as material 'grids' supplied by the state.

2 At various points in this paper and in keeping with much of the literature in this area we use infrastructure as a shorthand for 'infrastructure assemblages', as defined in this paragraph. Where we mean to refer to traditional notions of infrastructure, we make this explicit, such as in the use of 'physical infrastructure'.

However, a growing body of work draws on examinations of infrastructure in cities of the global South, which Lawhon et al. (2018: 722) “summarise as ‘performative’ for its description and analysis of ‘what is there’. This work has importantly expanded the meanings and understandings of infrastructure, showing the myriad of technologies operating across the urban domain.’ Off-grid service delivery arrangements (Jaglin 2014) can make everyday forms of coping possible for many urban residents and sometimes offer more sustainable solutions to particular urban growth patterns. However, they are often associated with disproportionately high time and cost burdens, inadequate quality and quantity of services, and vulnerability to political, social and environmental disruptions (McFarlane 2010).

Such variations and contestations of the infrastructures that marginalised residents of Southern cities use can have significant consequences for food and nutritional wellbeing. Inadequacies in access and supply to infrastructures can undermine the ability to safely cook, clean, store, supply, manufacture and grow food, and dispose of or reuse food waste (Sibanda and von Blottnitz 2019; Morgan and Sonnino 2010; Morgan 2009).

Infrastructural gaps thus become long-term stressors that contribute to the burden of enteric (gut) infection, affecting long-term wellbeing (Hunter-Adams et al. 2019), health and productivity of people in poor settlements, and impact child growth and maternal health, in particular (ibid.; Ahmed et al. 2015). Moreover, gaps in local authorities’ knowledge and assumptions about the relationship between infrastructure and food (including how people meet their needs at the interstices of ‘on-’ and ‘off-grid’, along a continuum of different provisioning – see below) can either undermine (Battersby and Muwowo 2019; Steyn et al. 2013; Mboganie Mwangi et al. 2002) or criminalise existing provision, such as street vending (Skinner 2016; Bénit-Gbaffou 2016; Roy 2005), adding to the precarity of food supply, health and poor people’s livelihoods.

Diet-related non-communicable diseases are increasingly prevalent in low- and middle-income countries. This can be attributed in part to urban diets, which are shaped by responses of both food system actors and consumers to lived experiences of infrastructure. Assumptions of health authorities that non-communicable diseases are to be addressed at the level of individual consumption, and ‘lifestyle’ and dietary ‘risk factors’, ignores the wider infrastructural factors and their interlinkages, which determine, for example, what food people can choose, afford and cook. Because of this dependence on a range of infrastructures, food and nutrition security (food access, availability, use and stability) provides a useful lens to interrogate infrastructure assemblages, as well as being a fundamental marker of urban wellbeing.

In this paper, we build our conceptual approach through engaging with three interrelated bodies of literature. The first section focuses on the concept of infrastructure, or multiple and hybrid infrastructures encompassing socio-natural and socio-material arrangements, which differ from the formal conception of the ‘grid’, as introduced above. We outline the political economy of such infrastructure and the need to think of ‘griddedness’ along a continuum, rather than a binary of ‘on-’ or ‘off-’ grid.

Given that such relationships are precarious and subject to shocks, particularly for the poorest and most marginalised urban residents, the second section reviews various forms of infrastructural precarity, which include those in relation to the financialisation of the city and its infrastructures, but also the wider range of socio-natural and socio-political shocks and pressures, from floods and drought, to disease outbreaks and responses, and price rises, power outages and political disturbances.

The final section then focuses on the relationship between urban food systems and infrastructure. Here we review food and nutrition's infrastructural dependencies; but also how dominant conceptualisations of the urban food system, and more formal treatments of infrastructure and assumptions of fixity, miss important daily improvisations and a dynamic situation of negotiations all urban residents undertake in relation to food infrastructures and their interactions with other infrastructures.

As context for this paper, the following subsections in this introduction set the scene for the interrelated demographic, nutritional and urban transitions residents of the cities in our study experience; and what we mean to achieve by focusing on the most marginalised people experiencing intersecting – food, infrastructure and other – inequities.

Interrelated demographic, nutritional and urban transitions

This study encompasses five cities in South Asia and sub-Saharan Africa, which represent a range of different city typologies (Table 1) located in countries that are all undergoing significant and rapid demographic and dietary change (India, Sri Lanka, South Africa, Zimbabwe and Ghana). It is possible to contextualise these changes as a set of interrelated transitions, which form the backdrop of this research and wider policy exigencies faced by municipal and national actors and which the wider literature suggests are occurring across much of South Asia and Sub-Saharan Africa, albeit at different speeds and from different starting points.

Table 1. City typologies (drawn from typology framings applied by Roberts (2014))

| City, country (population) | City typology | Level of formality in food and infrastructure access, and other factors |
|--|---|---|
| Bangalore, India (8.4m) | High-growth service centre and draw for internal migration, transition from a manufacturing/public sector enterprise/defence research history | <ul style="list-style-type: none"> Mixed, but with expansive hybrid uses High – and growing – inequality Hybrid grid |
| Colombo, Sri Lanka (753,000) | Capital city, trunk ³ /trade (through regional port) and financial centre | <ul style="list-style-type: none"> More developed grid, but mixed use Extensive relocation of low-rise traditional and informal settlements to public high-rises; mass movement of people to this new-built environment |
| Mossel Bay, South Africa (100,000) | Resource city (natural gas) expecting significant infrastructure development | <ul style="list-style-type: none"> More developed grid, but scales or grades of grid use Mass rollout of ‘housing opportunities’ planned, but failing/contested |
| Tamale, Ghana (167,000) | Trunk/transport city | <ul style="list-style-type: none"> Mixed grid, with much private off-grid adoption Dual-governance grid |
| Epworth (and Harare), Zimbabwe (223,000) | Satellite city (Epworth) and/or capital city (Harare) facing severe grid stress | <ul style="list-style-type: none"> Failed grid with multiple off-grid approaches Some infrastructural assemblages operating between Epworth and Harare |

Source: All population figures from 2011 national censuses except Tamale (2010 national census)

It is possible to contextualise these changes as a set of interrelated transitions that form the backdrop of this research and wider policy exigencies that municipal and national actors face, and which the wider literature suggests are occurring across much of South Asia and sub-Saharan Africa, albeit at different speeds and from different starting points. The first is a continuing demographic transition, with the combined populations of sub-Saharan African countries expected to reach 2.1 billion by 2050 and those of south and central Asian countries 2.6 billion (UN DESA 2022). This is also an urban transition: 1.56 billion more people will be living in cities by 2040 compared to 2020; with 52 per cent of this growth in Asia and 30 per cent in sub-Saharan Africa (UN DESA 2018, cited in Satterthwaite 2020).

3 Trunk’ refers to a trunk route, which is a strategic road is a major road, usually connecting two or more cities, ports, airports, and other places, which is the recommended route for long-distance and freight traffic (Roberts 2014)

Related to this rapid expansion of Southern cities, informed by shifting geopolitics, investment objectives and a general development trajectory, there is a concerted drive to invest heavily in urban infrastructure. In turn, urban governance processes influence and direct national development and political processes. As Pieterse, Parnell and Haysom (2018: 151) have argued in the context of Africa:

“this scalar recalibration assumes greater urgency for Africa... because the urban transition of the next few decades will be formative of future developmental opportunities... the demographic clock is ticking and the next two to three decades will define the urban transition.”

Avoiding a path dependency embedded in unsustainable physical and social infrastructures requires urgent theoretical and policy engagement. There is uncertainty over how Southern countries and cities will figure out different approaches to ensure that the basic needs of their citizens are met, while simultaneously creating infrastructural platforms for growth, but within the context of significant climate and ecological limits.

Related to this demographic and urban transition is a nutritional transition. The population of food- and nutrition-insecure urban residents is growing in absolute terms in many cities in South Asia and sub-Saharan Africa (Hawkes and Fanzo 2017; Ruel et al. 2017; Crush, Frayne and Pendleton 2012; Popkin, Adair and Ng 2012) and is accelerating faster in informal and marginalised urban settlements (Huey et al. 2019; Crush and Frayne 2010).

The globalisation and industrialisation of many urban and national food systems has led to longer and more complex food value chains reaching the cities of the global South, as basic ingredients undergo multiple transformations that result in increasingly more complex and processed food products (Gillespie and van den Bold 2017). While processing can reduce food losses (e.g. spoilage or wastage due to unpalatability) and the likelihood of food-borne illnesses, especially where storage, refrigeration, energy and water and sanitation infrastructures are inadequate, it can also lead to increased consumption of ultra-processed foods (UPFs) high in saturated fats, sugar and salt (GOPAN 2016; IFPRI 2017; HLPE 2017).

These consumption patterns are also influenced by the intensification of advertising and marketing of comparably cheap industrialised products. Data from six countries in sub-Saharan Africa shows that over 30 per cent of purchases of those living on less than US\$2 per day are highly processed foods in urban areas, which contribute calories but not micronutrients to people's diets (GOPAN 2016), influenced by poor availability and limited affordability of healthier options.

Marginalised populations

We define marginalised populations as those socioeconomically poorest groups in the city who, because of other dimensions of exclusion, find accessing formal infrastructure (publicly provided or by a state-contracted provider) particularly difficult. These dimensions of exclusion can include physical settlement type and location (e.g. informal slum or shack dwellings and the range of associated tenures, or resettlement schemes), which intersect with forms of identity-based or embodied discrimination; for example, on the basis of gender, age, caste, ethnicity, sexuality or disability, or identities pertaining to legal status or place of origin (e.g. 'migrant', 'rural').

By focusing on populations that exhibit different on- and off-grid relationships to infrastructure in a range of urban contexts, we expose a range of material, structural and socio-political inadequacies of provision that affect their food and nutrition security, and wider wellbeing (Hunter-Adams et al. 2019; van der Valk and Viljoen 2014; Donovan et al. 2011; Roberts 2001). Gaining connections to urban infrastructures in the first place and ensuring their maintenance and repair (Graham and Thrift 2007) depend on a complex set of interpersonal relationships that people must navigate (often imperfectly) in situations of high marginality – with a variety of actors such as kin, local fixers, politicians, private vendors, public servants, police and legal authorities.

Moreover, residents in neighbourhoods with grid coverage may also experience access unequally, with marginalisation mediating different experiences of infrastructure. Women, for example, already experience this precarity to a higher degree: they may face greater barriers to economic and social mobility; have reduced access to infrastructure and services, such as transport or sanitation; and bear the brunt of inadequate infrastructure provision as they spend time on water and fuel collection and waste disposal due to the unequal distribution of care tasks (OECD/SWAC 2020; Parikh et al. 2015; Floro and Swain 2013; Mitra and Rao 2019). Marginalisation on account of gender is also dependent on and intersects with other forms of exclusion.

2. Updating assumptions about infrastructure, planning and urban governance in African and Asian cities

For urban planners and urban governance actors, the development of food systems and the infrastructure that supports them is often assumed – and then subsequently envisioned in formal planning – to involve increasing formalisation of food trade; and, in parallel, the development of gridded infrastructure connections (roads, information, water and electricity). However, the Southern urban reality is quite different. With infrastructure network priorities often following real estate development potential in cities, many economically and socially depressed areas continue to remain off-grid despite new capital expenditure.

In some cases, such service denial and resulting perpetuation of informal settlements might be deliberate, to enable more profitable forms of development in the future (Graham and Marvin 2002; Cabannes, Yafai and Johnson 2010; Roy 2005; Swilling 2011). Formal infrastructure grids for basic services often only cater to a small proportion of the urban population, and official plans are often not fully or equally implemented across inhabited urban spaces.

In the absence of the fixed grids formal planning envisages, hybrid assemblages of infrastructure provisioning by individuals and private players fill the gap, often at high prices and/or of low quality (Jaglin 2014; Graham and McFarlane 2014). These might include jerry rigged electricity connections, communal areas for open defecation, water trucks, privately owned bore wells or generators, retail networks for kerosene and gas canisters, and use of solar panels. Such arrangements are a reality for people from a range of socioeconomic backgrounds.

Urban populations, including marginalised households and informal traders, may thus be 'off grid' in multiple and shifting ways; for example, having limited or no access to formal physical infrastructure grids of water, energy and sanitation, as well as limited or no connections to intangible but official 'grids' of government records, information systems and public communications associated with public provisioning of key services and support (Bayat 2000).

A formal gridded approach to planning that attempts to sweep away such other forms of infrastructure may pose unanticipated risks to the most marginalised people, who are often the last to – or never do – access formal provision. While

formal planning policy can assume progressive realisation of 'grid access' in the form of greater inclusion in state provision, factors such as reliability (Schulman and Roe 2016) and stability of existing formal or informal systems may be more important to build on.

In effect, in many rapidly urbanising cities in low- and middle-income countries, the gap is widening between official plans for spatial and infrastructural planning (and their partial implementation), and on-the-ground infrastructure arrangements, some of which may refer to formal grid and official plans, but do not comply with them fully.⁴ This translates to limited official capacities to improve and regulate on-the-ground arrangements. Urban planners' modernist approach to planning, which has produced plans detached from people's lived experience, has perhaps compounded the marginalisation and penalisation of urban residents. Worse, most urban planners working in these impoverished environments are blind to food matters, despite wielding authority over land use and infrastructure provision (Toriro 2019).

Critical work on planning has therefore focused on recognising forms of 'rationality' in infrastructure use that may be different for poor people (Watson 2003), searching for new workable modes of service consumption (Jaglin 2014) in off-grid areas of informal settlements (Swilling 2016); and breaking power regimes that have corrupted efforts to create universal affordable service coverage (Cirolia 2020). Only by studying a variety of these arrangements will we begin to understand the political economy, socio-material dynamism (making, repairing and rejigging) and decentring of agency that characterises the various arrangements for infrastructure access for urban residents in cities of the global South, especially marginalised people.

Existing understandings of griddedness and towards new understandings of griddedness as a continuum

The limitations of 'gridded' conceptions of infrastructure in the global South have been a recurrent theme among urban scholars (Skinner and Watson 2017; Leck 2012). Furlong (2014) critiques the notion of universal access to services and the idea of a single infrastructure network, which characterise service delivery in the global North and dominate theoretical approaches, including in science and technology studies. She argues that in cities in the global South infrastructure access is characterised by the coexistence of various different configurations of socio-technical systems (e.g. in terms of electricity access, these might include power sharing, off-grid solutions such as electricity generators, etc.).

Other authors agree that formal grids have limited coverage and reach among the urban population (Jaglin 2014; Graham and McFarlane 2014; Bayat 2000; Schulman and Roe 2016). Anand (2015) uses leakages in Mumbai's water grid to illustrate one type of 'grid' limitation and how marginalised residents of a predominantly Muslim settlement navigate politically around the physical

⁴ Such processes are referred to by Silver (2014) as incremental urbanisation and by Caldeira (2017) as peripheral urbanisation.

infrastructure provision of pipes and pumps.

Echoes of these debates between technocratic and more critical, hybridised visions can be seen in the field of energy infrastructure and use. Technical approaches argue for a hierarchical notion of what is ideal; for example, proposing processes such as the energy ladder (Masera, Saatkamp and Kammen 2000; Sovacool 2012), where users in this case switch from one form of energy use to a better (or cleaner) alternative form energy in a hierarchical migration (De Groot et al. 2017).

However, with respect to the example of energy, transitions from traditional energy sources to modern ones are far from linear in empirical contexts (Masera et al. 2000; Akpalu, Dasmani and Aglobitse 2011; Sovacool 2012). Musango (2014), for example, found that households in South Africa used traditional energy sources alongside electricity for economic reasons, despite increased electrification.

Cultural and taste factors also influence energy use; for example, continued preference for traditional heating fuels in some cases (White et al. 2022); or the use or non-use of particular appliances being shaped by gender relations (Meintjes 2001). The notion of energy stacking (Shankar et al. 2020), the layering of different types of energy, as progression in an upward direction to cleaner or preferred energy uses, rather than a linear ladder, is at times used to illustrate the multiple choices and strategies applied in respect of energy use.

While perhaps illustrative, concepts such as ladders or stacking still retain a distinct technical focus, often used to engage energy transitions to greener, cleaner energy. Within and outside of the energy sector, similar technical and economic approaches can often miss the material and the everyday, where choices are contingent on a variety of factors and might shift frequently depending on priorities at a given moment. These processes remain poorly understood, not just in terms of energy, but multiple other grids.

The reality in many Southern cities is a more hybridised approach to infrastructure, where various types of infrastructure (at various steps on the infrastructure ladder as conceptualised by planners) may be used by the same household or enterprise. The strategic decision to use one infrastructure grid over another at a specific point in time is contingent on a variety of intersecting and often poorly understood (or appreciated) decisions. These decisions often come with trade-offs and compromises.

Lawhon et al. (2018: 722) propose the concept of 'heterogeneous infrastructure configurations'. They argue that this enables a clearer analysis of infrastructural artefacts not as individual objects but as parts of geographically distributed socio-technological configurations, which might involve many different kinds of technologies, relations, capacities and operations, entailing different risks and power relations.

The concept:

“means recognising people and their movements and connectivities as well as conditions of precarity. It means accepting that sometimes [infrastructures] will not be working, but also that working and not working is not a binary but a multifaceted, constrained decision-making process. It means recognising that [infrastructures] are enrolled in dynamic networks of power that shape not just permission to use, or cost of use, but the possibilities for intervention; there are social norms that construct a toilet’s usability but that usability is always in relation to what other options exist.”

(*ibid.*: 729)

Other studies include but are not limited to descriptions of arrangements as hybrid (Furlong 2014; Larkin 2008), incremental (Silver 2014) and post-networked (Coutard and Rutherford 2011; Monstadt and Schramm 2017), as well as peopled and lived (Graham and McFarlane 2014; Simone 2004). Silver (2014) puts forward the concept of ‘incremental infrastructures’ to demonstrate the significance of everyday, sometimes ad hoc actions and collaborative strategies that residents in low-income settlements use to connect to electricity networks in Accra, Ghana. He argues that ‘incrementalism is produced and subsequently secured and scaled through material configurations that seek to test and prefigure new forms of infrastructure and accompanying resource flows’, and also speaks to the importance of improvisation in the process of generating incremental infrastructures (*ibid.*: 788). This can be set off against the structured, planned and ordered nature of the grid.

Similarly, Rateau and Jaglin (2022), with reference to cities in Benin and Nigeria, show how many different actors and different configurations of technologies are implicated in the co production of access to electricity services at both household and city scales. They argue for a multi-scale perspective (from the household scale to the urban scale) to understand the socio-technical and spatial dimension of co-production arrangements to enable access to electricity. Baptista (2018), referring to work in Mozambique on access to electricity, particularly the repair and maintenance of electricity infrastructure, argues that infrastructures are always precarious achievements and that service delivery is always a process in the making.

Drawing on such critiques of formal grid and planning assumptions, we adopted the concept of a ‘gridded continuum’ of infrastructure to frame our own research. In addition to incorporating insights from the literature discussed above, the idea of a continuum captures our interest in the full range of shifting and fluid arrangements, moving between formal and informal, while also enabling understanding of the agency and relationships that lie along the on-/off-grid spectrum, and which animate infrastructure in cities of the global South.

In approaching the lived complexities of infrastructure through the nomenclature of a gridded continuum, we are acknowledging that state-defined urban plans, as well as much national and international funding for infrastructure, continue to prioritise gridded infrastructure systems and direct financial and institutional means towards their progressive realisation. Pathways of change need to acknowledge these regulatory and fiscal structurings, and find ways to expand

or move beyond them.

Examples of gridded continuums in formal infrastructure provisioning

Several examples illustrate the idea of a gridded continuum beyond the binary of on- or off-grid. This includes the related assumption that networked griddedness relates to more formal provision, while off-griddedness is predominantly a failure of this formal provision and is made manifest by a set of informal relations. Indeed, such continuums are increasingly featured within the ambit of formal systems in cities of the global South.

An example of a formalised, state-enabled, at-scale, off-grid arrangement for infrastructure is in the state of Tamil Nadu. The state government is shifting its focus to arrangements for managing seepage (waste matter from septic tanks) that are not physically connected, but still networked by assemblages of rules, ideas and the materials used in their construction. These formalised arrangements include detailed rules and bylaws for the construction, operation and maintenance of sanitary septage structures (i.e. those that are off grid) to maintain quality and health. There are training programmes for builders, contractors and masons to construct septic tanks, contract management guidelines for private transporters to run tank-cleaning services, and partnerships have been constituted with private operators for treatment.

Another illustrative case is that of 'water ATMs'⁵ in India. These ATMs are installed by political or civil society actors, financed by corporate and international philanthropy, and/or discretionary local budgets, and have state support. The flexible placements act both as extensions to the city's networked infrastructure and as an independent 'pop-up infrastructure' (Schmidt 2020). Hybrid financing gives the state some control over the placement and pricing of water ATMs'. Similarly, in Bengaluru the urban local government partners with waste-pickers' collective Hasiru Dala on solid waste management, not only for collection and sorting, but also in setting up dry waste collection centres.

Such considerations also extend to the power sector in India, where there is formal recognition of the need to move towards decentralised electricity distribution. The current system of centralised generation and grid-based distribution is expensive and fails to reach two-thirds of the population (CSE 2016; Bhushan and Kumarankandath 2016). From diesel generators to renewable energy solutions (including portable solar or kerosene lanterns), a wide spectrum of residents – from the city's professional middle class to residents of informal settlements – use off grid arrangements (Castán Broto and Sudhira 2019). Jaglin (2008) conceives of the diversity and inter-relational hybridity of these on-/off-grid systems as an 'ordered plurality', critical to maintaining an equitable level of service delivery.

In South Africa, state subsidies inadvertently drive the use of multiple grids, with the state therefore acting in different categories as provider, regulator

5 Named after automated teller machines (cash dispensers) – implicit in the name is the idea that services can replicate the flows of cash in a financialised society

and promoter. The state provides a measure of access to ‘free basic services’, specifically water and energy. Supply of these services is mediated through technical tools to dispense the allocated ‘free’ service. Here, formal grids are actively used. This is evident in the use of pre-paid electricity meters in homes, or water management devices (referred to locally as a chokes or WMDs) to regulate water supply (Enqvist et al. 2022). When supply through these devices stops, as a result of having consumed the allocated free supply, people switch to other means and therefore alternative grid uses come into effect.

Formal infrastructure systems may also have both gridded and non-gridded service delivery arrangements, which in turn may coexist with private non-gridded arrangements. For example, in Bengaluru the formal public water supply comprises piped connections, water tankers, standposts and handpumps (Enqvist et al. 2016; Grönwall et al. 2010), along with private tankers and borewells, and street vendors with water pots mounted on cycles. Together, these combine to fill the gap of water provisioning (Ranganathan 2014) in areas unserved or underserved by piped water supply. Civil society organisations or private sector companies (through corporate social responsibility funds) often construct shared community toilets.

Similarly, formal arrangements for road sweeping, garbage collection and disposal, maintenance of drains and toilets, repair functions and leakage detection include contracts with small private players (Smitha and Sangita 2008).

3. Infrastructural vulnerability and coping in relation to current and future stresses and shocks

Throughout cities in sub-Saharan Africa and South Asia, most marginalised urban residents live everyday lives of multiple and intersectional conditions of vulnerability – including with regard to work, housing, access to basic services, access to food, levels of health and sanitation and so on. (Battersby and Watson 2019). Poor people’s experience of infrastructure is also one of precarity – access and availability for the poorest and most socially marginalised people is finely balanced in ‘normal’ periods of chronic stress, but can be tipped into non coping forms by a range of social, political and natural events, as well as other acute and chronic shocks and pressures in relation to food, nutrition, health and disease.

Water stresses represent a classic example of infrastructural precarities that have been studied extensively in terms of urban infrastructures, and which have obvious links to several aspects of food, from production, processing and retail to home preparation, cooking and waste disposal. Broader stresses in the urban environment and on ecosystem services can lead to wealthier urban residents, industry and others extracting more water (Lemanski 2021), increasing the expenditure and time incurred accessing alternatives for poorer and more socially marginalised people.

Similarly, the risks incurred by individuals' and families' increased reliance on contaminated supplies can have knock-on effects that push them beyond their normal range of coping. In many cases, this can lead to whole parts of the city that might be formally considered as being on grid, but living with arrangements that are in flux or progressively drawing away from formal grid provision, challenging the teleology of many planning assumptions (including on-/off-grid or working/not-working binaries that we have problematised here).

These conditions of vulnerability continue to worsen as the result of urbanisation in many parts of the world is associated with uncontrolled sprawl; in-migration from rural areas triggered by economic, social and political distress; and endogenous growth in cities that grew during earlier migratory phases; as well as increasing spatial, social and economic inequalities in urban areas. This is further complicated by trends where multiple households live on the same site. The site might be listed as being formally connected to a grid, but different households might have very different infrastructure use profiles (Lemanski 2020).

Everyday vulnerabilities are further exacerbated when cities, as dense nodes of human populations, are disproportionately affected by external shocks, such as disasters, disease outbreaks, political conflicts, economic downturns and so on. With climate change imminently threatening both rural and urban settlement patterns, it has become critically important to research the emergent spatial geographies of vulnerability in urban areas, to design interventions and build capacities to facilitate urban resilience.

In areas of high water stress, everyday access to water can depend on structures outside the control of many individuals. Infrequent access to water during the day, or perhaps being dependent on proximity to the supply or socio-political connections, means that even the use of water for cooking is precarious and can change in an instant. Reliance on contaminated water supplies can lead to health risks that have knock-on effects, especially when it exacerbates already existing gender inequalities where familial roles are pre-defined (Borie et al. 2019; Harris, Chu and Ziervogel 2018).

Access to health care can incur high costs, or require travel that takes away from people's ability to work or care for their wider family. Thus, reliance on a contaminated water supply is a sign of precarity as the ramifications can create shocks and stresses that leave individuals or families vulnerable. Contaminated water is not just an example of environmental stress, but can also have economic, political and social elements. Within Indian and Sri Lankan cities there have been examples of how projects, in the guise of development, have led to water being redistributed from poorer communities to wealthier new-build

developments (Björkman 2015), or forcing poorer communities to formally access the grid, thereby making it unaffordable to access water as they did previously through public taps and other common infrastructure. In this case, access is not about physical infrastructure but about the idea of different forms of distribution and 'cost recovery'.

Electricity, like water, is also an area where we see precarity around access in many Southern cities. This precarity is amplified during particular temporal disruptions such as rolling blackouts or 'load shedding'. Proximity, socio-political connections and financial security play a role in how much access individuals, families and communities have to electricity and when.

In his study of the Ga Mashie district of Accra, Silver (2014) looks at how material improvisation and social collaboration are used to overcome this issue. Residents of Ga Mashie were involved in establishing clandestine connections to the electricity network, often with the support of electricians who were sympathetic to households' needs and helped them connect or, once connected, adjusted meters to stop them measuring electricity use. Communities in Ga Mashie also collaborated to share electricity meters to keep costs down. Getting help from an electrician or sharing electricity meters were by no means long-lasting solutions and resulted in communities engaging in illegal activities as defined by the state, which Silver argues highlighted the precarious nature of life in Ga Mashie (*ibid.*). Ga Mashie's communities' experience of attempting to access the grid shows that even those working for the 'grid' can be involved in helping people navigate precarity, as well as the importance of the role communities play in supporting each other when it comes to access.

The uneven terrain of politics, legal regimes and urban financialisation behind the gridded continuum and its precarity

While such vulnerability can be associated with socio-natural phenomenon such as water stresses and shortages, new degrees of precarity have been added to some of the cities in our study as part of their exposure to rampant land speculation and other forms of neoliberal, market-driven orientations to city planning and governance. Given lack of formal tenure, zoning violations, lack of planning permissions and so on, areas and residents with tenuous legal claims to land and housing often or receive partial or limited services from public grids, or are bypassed completely (Ranganathan, Kamath and Baidur 2009).

Hybrid forms of infrastructure provisioning by individuals and private players fill the need gap, often at high prices and low quality (Jaglin 2014; Graham and McFarlane 2014), with uneven levels of service and access (Bhan 2013; Amin and Cirolia 2017). Here, infrastructure access is continually mediated by an uneven terrain of politics and power dictated by neoliberal governmentalities (Benjamin 2008; Anand 2015; Von Schnitzler 2016; Cirolia and Scheba 2019; Castán Broto et al. 2021).

Some authors argue that off-grid arrangements made in response to a lack of provision emerge in relation to infrastructure network priorities that often follow

real estate development potential in cities. In such situations, service denial might be deliberate to enable future development, as many economically and socially depressed areas continue to remain off-grid despite large new capital expenditure commitments across cities as a whole (Graham and Marvin 2002; Swilling 2011).

Conversely, local governments can use urban planning and laying down road and sanitation grids to steer development and incentivise subsequent autoconstruction by residents who move into such serviced areas (van Noorloos et al. 2020). Some authors conceptualise these on-/off-grid hybridities as manifestations of autoconstruction and transversal logics (Caldeira 2017) that highlight a decentring of agency in the city, especially as a coping strategy to deal with the types of marginality and vulnerability that are frequently caused by resettlement and other forms of displacement.

Liberalisation, privatisation and increasing constraints on urban local government funding and capacities, also engender formal, state-enabled mechanisms that incorporate on-/off-grid hybridities. Combined with allocation of land to high-end developments, the privatisation and corporatisation of public utilities – including grid construction and management – in many cities of the South (Shatkin 2008; Balakrishnan 2017; Idiculla 2017) have encouraged uneven geographies of infrastructure, as cost recoupment logics have gained priority in decisions regarding coverage and levels of service (Reddy 2013).

In addition, many metropolitan cities of the South are characterised by developmental sprawl – including where gated, elite peri-urban residential and commercial projects dominate, and where private developers prefer to build exclusive infrastructure trunk lines and grids for their projects, rather than waiting for public grids to be extended to these areas (Graham and Marvin 2002; Swilling 2011). The oft-repeated vision of creating a ‘world-class city’ and the removal of communities from one piece of (high-value) land to a new area to create gated communities or new commercial developments lead not only to precarity around tenure, but also long-lived struggles to adjust to newly built environments. Despite residents having built their houses and inhabited settlements for decades, the value of the land when realised in new development zoning or wider city masterplans can trump the rights and interests of these communities (Nagaraj 2016).

Other development processes, including upgrades to large-scale infrastructure, such as metro lines and highways, have also led to mass dispossession across cities, cutting off people’s access not only to the grid, but also to their livelihoods and kinship networks (Abeyasekera et al. 2019). During their time living in these areas, communities will have created mechanisms by which they can access electricity, water and food, as well as allowing them to deal with shocks and stresses that result from living there. Relocation means that, if new areas do not have adequate access to water or electricity, communities will have to discover new mechanisms by which to access the grid.

In some instances, relocation is not viable for communities as their location – and with it, access to livelihoods, schooling and other networks – is as crucial as their housing and tenure. This can then lead to forced displacement by the

authorities or even demolition (Silver 2014; Nagaraj 2016). In her study on Mumbai, for example, Björkman (2015) discovered that despite state officials assurances' that water access would be provided upon moving into new apartments, some individuals and families were relocated in 2004 but water was not provided until 2007.

In the case of poor working-class communities in Colombo, state and community investment in housing and infrastructure over several decades allowed poor urban communities to access the grid while incrementally developing their homes (Abeyasekera et al. 2019). City wide dispossession for urban regeneration and beautification of the city led to the relocation of thousands of families to government-built high-rise housing, in theory connecting them to the grid and a 'modern' way of life; however, such shifts to unfamiliar built environments bring with them new types of infrastructural vulnerabilities, and shocks and stressors.

Lack of access in resettlement areas and older settlements alike can also be down to bureaucracy and not having the correct 'paperwork' to prove one's rights. Being undocumented or accessing the grid without registering exacerbate precarity around world-class city generation. In the eyes of the state, upgrading water and electricity access will be done taking into consideration those who are registered users of the grid.

Yet, as Björkman's study in Mumbai highlights, this can produce a shock for those who are unregistered. In 2014, a plan to transfer users of an old network to a newer upgraded grid led to estimations that the number of unregistered users of the old grid was equal to the number of registered users (Björkman 2018). The unregistered users had found ways to access the grid informally without having to register. They would have lost this access if there had been a transfer to the new network and the old network had been switched off.

Economic shocks and the precarity of migrant workers

Economic shocks can exacerbate loss of access to the grid due to the precarity of urban labour markets. The Covid-19 pandemic was a prime example of this, with lockdowns and public health restrictions globally adversely impacting those who work in the informal economy.

Migrant workers in India left cities on masse due to lack of work, returning to their rural homes where they were then reliant on government handouts to combat food insecurity (Sinha 2020). Even those in urban areas who relied on the labour market were dependent on these handouts. However, to be eligible, documentation was required, which many poor people did not have, meaning they were left out of this scheme (ibid.). The Covid-19 pandemic as an economic shock exacerbated existing situations of precarity regarding access to the grid.

In the case of labour migrants, the experience of infrastructural vulnerability is closely tied to their experience of precarity in the labour market, housing insecurity and exclusion from state led welfare programmes. A large proportion of labour migrants (whether seasonal, short term or long term) engage in

informal work in the construction sector, domestic work, garment factories, manufacturing and services, among others. Work in these sectors tends to be temporary, without formal contracts and social security (Srivastava 2019).

Precarity in working conditions, which is usually measured in terms of low wages, long hours of work, and exposure to environmental hazards, is also reflected in migrant housing arrangements. Depending on the sector, and their duration of stay and work in the city, migrants may live in worksite housing provided by their employer or contractor; in self-built homes in open spaces, which is viewed as squatting; or in rental accommodation in unregulated and informal housing markets (Aajeevika Bureau 2020). A common feature of these housing types is that they are unregulated and informal, with no security of tenure. Consequently, they lack infrastructure or formal grids that operate mostly in neighbourhoods that have some form of legal authorisation. Instead, access to basic services is mediated by contractors, the private market or local landlords, who often monetise these hyper-localised infrastructural facilities.

A large proportion of labour migrants in India belong to historically marginalised groups. In the destination region, as migrants they are excluded from state-led welfare programmes, which tend to have a sedentary bias (Desai 2017). In the absence of proof of identity, such as labour registration cards, or proof of address, migrants to cities are unable to access government programmes such as subsidised food under the Public Distribution System, or nutrition and health programmes under Integrated Child Development Services. In settings where resources such as water or subsidised commodities such as food and cooking gas are not available in the immediate vicinity, the burden of collection falls disproportionately on women, who already encounter the triple burden of paid work, domestic chores and care work.

Consequently, any shock in the informal labour market has a direct impact on workers' ability to sustain life in the city. As seen during the Covid-19 economic lockdown, when workspaces were abruptly shut down, migrants could no longer afford to pay rent or for food, water and electricity among other services. Even in cities where relief was given in the form of food packages or cash transfers, migrants were excluded or were the last to receive them. Following loss of employment, which is considered to be their most important link to the city, tens of millions of migrants were forced to undertake arduous journeys back home.

4. Food as a critical lens on urban infrastructure and why infrastructure matters for food

The quotes by David Smith and Wayne Roberts that open this paper make a significant argument for linking food and infrastructure. But in the 10–20 years since they wrote those statements, what progress has been made on this agenda? Focusing specifically on food and the food system, public health nutrition acknowledges the role of infrastructure in food and nutrition outcomes, aligned to the utilisation dimension, one of six necessary dimensions, that comprise food security (HLPE, 2020).

According to Kennedy et al. (2004: 21): ‘The provision of infrastructure, including roads and electricity, and education and health-care systems, is a basic prerequisite to allow citizens to avail themselves of greater economic opportunities created through market liberalisation and increased foreign investment’. But while infrastructure and food or public health outcomes are often linked, the framing of this is often problematic. Frequently, the provision of infrastructure is seen as completely separate and removed from how food and infrastructure connect – if anything, the framing of the relationships is around economic growth and economic opportunity enabling ‘access’ to more nutritious food.

This framing is flawed on a number of levels. First, can such economic growth be enabled given the various drivers limiting such growth, its distribution and accessibility along the different dimensions of marginalisation we highlight at the beginning? Second, it puts the responsibility for food access, and as a result optimal nutrition and health, on the household income earner, missing wider systemic challenges. Finally, this approach to food and infrastructure is agnostic about the governance of food systems that is in place. It misses questions of how contextually informed governance processes should enable access to food and nutrition. It also insulates the political class from all responsibilities other than making markets work.

Of vital interest to food and nutrition scholars – but potentially missing from work on food and infrastructure – are questions located at the intersection between urbanisation and the nutrition transition, specifically the increased availability of UPFs and associated drivers in the commercial food market, or the ‘commercial determinants’ of poor nutrition. How are infrastructure deficits combining with accelerations in food system globalisation to drive convergence in diets towards unhealthy UPF consumption?

Traditional nutrition transition framings, located in notions of a desire for Western

diets and sedentary lifestyles, overlook the critical role that infrastructure plays in determining food choices; but, more importantly, how infrastructure deficiencies drive demand for UPFs. The materiality of household choices, which are highly strategic and rational, counters views of poor people as passive – even ignorant or feckless – consumers who disregard the health consequences associated with their choices. Rather, this demonstrates agency and strategic planning, where people make choices as a result of multiple trade-offs across the socio-material grid.

Food as a lens on Southern cities – from rural bias and ignorance to food environments, urban food systems and food as infrastructure

The use of food as a lens through which to examine the contemporary Southern city and the concept of a gridded continuum in infrastructure access facilitate a rich, thick and robust enquiry into Southern urban infrastructure challenges and emergent responses and politics, not just on questions of food, but also in considering multiple urban challenges. Yet, to a large extent, enquiry into urban food systems and proposed responses have been informed by limited perspectives, as well as assumptions emerging from Northern cities and processes.

Equally, and aligned to this, the reframing of food security that emerged subsequent to Sen (1981)'s work on entitlements (which created greater nuance and policy perspectives on multiple dimensions of food security and yet also in some ways privileged an economic view of individual capabilities) have reverted to a focus on producing more food. This shift in policy approaches and actions was driven by global governance institutions and large donor organisations. It followed the 2007 food and financial crises, reinforcing rural, agrarian production and, arguably, staple food-dominated paradigms.

These policy approaches are the domain of national agricultural departments, not city governments and urban planners. They ask how agricultural value chains can be designed and adapted to solve nutritional challenges, focusing on agricultural production and food processing, as well as consumer awareness and education (Le Cuziat and Mattinen 2011; Gelli et al. 2015). They disregard urban food-related questions, where food governance and food access are largely left to the functioning and actions of the market. Such considerations call for a significant reframing of theoretical positions on urban food systems, with a specific Southern entry point. With respect to the food and nutrition security of urban dwellers, they call for an approach that puts multiple challenges into the context of broader urban food environments, as we describe below.

Over the past few years, there has been a transition towards thinking about food in its totality, moving towards an understanding of food as a complex system with multiple interlinking parts and feedback loops, connecting the food supply chain, the food environment and individual behaviour (Berkum, Dengerink, & Ruben 2018; HLPE 2017). In this food system approach, there has been a movement away from linear conceptualisations of agricultural value chains bringing food from farm to fork, to thinking in terms of processes and

interactions in which environmental, technological, political, economic, social and demographic factors shape food environments, which eventually influence diet quality (HLPE 2017). In this understanding, material flows and market exchanges are still important, but are conditioned by technologies, information and infrastructure, as well as formal and informal governance processes, and their inherent power dynamics.

This food system perspective has been accompanied by a burgeoning literature on food environments within the fields of public health and geography (Holdsworth and Landais 2019; Pitt et al. 2017; Osei-Kwasi et al. 2021; Turner et al. 2018), which has focused on how food environments, in conjunction with individual choices, shape food and nutrition outcomes. Findings emphasise the importance of understanding food environments in a nuanced way, taking into account individual, social, physical and macro environments; and, armed with this knowledge, of shaping policy with a view to modifying those environments in ways that improve nutrition outcomes.

Within the physical environment, there is significant focus on food sources, locations where households consume or purchase food, and how these influence the accessibility and availability of different foods (Holdsworth and Landais 2019; Turner et al. 2018). Within urban settings, these food sources are diverse; thus, food access reflects our earlier concept of a continuum, with a mixture of public and private provision, dependent both on natural and material – but also social and bureaucratic – assemblages. Households access food through food kiosks, wet markets, convenience stores, street vendors, fast food outlets and, among more affluent people, supermarkets. However, forms of retail that are most readily accessible in informal settlements are characterised by low dietary diversity (Smit 2016; Battersby and Crush 2014). Despite the rural bias in agriculture noted earlier, some small-scale food production (agriculture, livestock, aquaculture) also takes place in urban and peri-urban areas, with products either self-consumed, sold directly to consumers or to local processors (Sibanda and von Blottnitz 2019).⁶

Reflecting the notion of food as (essential, public) infrastructure, much literature also considers public provisioning of food alongside the broad range of retail and market outlets. Different forms of social protection also intersect with food and infrastructure in different ways and at times influence the nature of infrastructure used. In South Africa, for example, since democratisation social assistance has expanded significantly, with nearly 18 million recipients (or nearly one in every three South Africans) as of 2019/20, at a cost of 3.4 per cent of gross domestic product (SASSA 2020). Importantly, these grants are paid out via a bank card that allows recipients to directly spend in more formalised food retail outlets (Haysom and Fuseini 2017). Food research in Cape Town found that households with access to formal housing had better levels of food security

6 The extent to which people rely on urban agriculture can be overstated. While it can be a good source of commodities such as vegetables or eggs in some contexts, in other areas its contribution to the diets of the poorest people is minimal. There is debate over whether this is the result of policy bias or neglect (see also Zezza and Tasciotti 2010).

compared with those residing in informal homes (Battersby 2011). The national government provides subsidised housing for those who meet a means test; however, as of 2015 South Africa has an estimated backlog of 2 million more homes, leaving some 12 million people in dire need of housing (Harsch n.d.).

In India, government support programmes aim to ensure food access and nutrient intake support to households in need. These include the Public Distribution System, one of the largest food-based social programmes in India, providing grains at a subsidised price to around 800 million households (Dreze et al. 2018) via a network of 'fair price shops' or 'ration shops', which are also present in urban areas. Other examples include the Midday Meal Scheme, which provides cooked meals to primary school children in government schools (Khera 2006; FAO 2022). Many such public provisioning programmes exist in other regions of the world; for example, Fome Zero and related programmes in Brazil (Santarelli, Marques Vieira and Constantine 2018).

Beyond these specific instances of public provisioning, however, food access has largely been left to the market. Public health research on food environments has not yet engaged substantively with broader processes of food processing, distribution, storage and wholesaling within urban settings, including multiple and often hybrid forms of informal sector provision. These are either considered to be within the food system but outside the food environment (Turner et al. 2018), or to fall within the macro environment (Holdsworth and Landais 2019). In either case, the framing fails to reflect systemic factors, including infrastructure and governance, which condition these activities in ways that influence the cost and availability of foods in informal settlements (Humphrey and Robinson 2015; Maestre et al. 2017; Thorpe and Reed 2016).

With respect to the processing sector, for example, there is considerable and justifiable concern about increasing access to energy-dense and nutrient-poor processed foods at low prices in urban settlements (Holdsworth and Landais 2019; Osei-Kwasi et al. 2021). However, processing plays a more nuanced role in food outcomes, with the potential to improve the shelf life of food where cold storage is inadequate, or reduce time and energy costs where cooking infrastructure is limited (Ericksen 2008). The processing sector itself is diverse in terms of its location, scale and level of formality, features which condition how it intersects with urban infrastructure assemblages. One study in Ghana found that 26 per cent of processed products sold within Tamale were also manufactured there (Andam et al. 2018: 239). Informal processors range from small grain millers in Tanzania (Humphrey and Robinson 2015); to oil packers in Bangladesh (Ebata et al. 2021); to 'kitchen enterprises' producing complementary foods (foods suitable for children aged over six months) in Ghana (Anim-Somuah et al. 2013); and traders producing pre-cooked beans in Zimbabwe (Sibanda and von Blottnitz 2019).

In each case, infrastructures such as sanitary facilities, clean water and storage affect food quality and safety (Hayombe, Owino and Awuor 2019), while other infrastructures including storage, transport and electricity affect cost and affordability. Regulatory infrastructures can also be key to shaping the economic activity of such small enterprises and their ability to produce safe, healthy food products.

Distribution is another element that shapes what food is available, and where and when within urban settings (Ericksen 2008), as well as its cost. Distribution is shaped by the availability of transport and storage infrastructure, and the degree to which this infrastructure meets the requirements of foods that are available for distribution. A wide variety of transportation is used for food distribution within cities. For example, food transport in Kisumu, Kenya, ranges from large, motorised vehicles that cater to supermarkets, to foot transportation, and a variety of formal and informal forms of public transport, as well as bicycles, motorbikes and tricycles (Hayombe et al. 2019). Transportation infrastructure plays an obvious and vital role.

Spatial inequality and the continuum of informal and formal food infrastructure and provisioning

Cities are often viewed simply as recipients of food flows, not as active agents in food systems at different scales. Equally, urban residents are often viewed as the key food system decision makers, in part as a result of Sen (1981)'s entitlements framing). But without context, a view of active individual and household agency driving food system outcomes can be prejudicial, putting the blame on poor people for making bad decisions, and for not exerting the relevant voice and agency 'when they should know better'. A more radical vision sees the current urban food system as the result of deep historical structuring, aligned to both the dispossession and marginalisation of communities, cultures and workers. The design of earlier industrial processes that shaped the global South's food system always kept in mind feeding and maintaining a peaceful urban workforce (Duminy 2018).

Spatial inequality across cities also dictates the type of employment people have access to, affecting not only household income but also household care provision including food preparation, fuel and water collection. Households are thus connected to the street and the informal economy. The informal economy and urban residents become mutually co dependant, but at the same time, mutually supportive of one another. Moreover, informal street traders are likely to share the same predicaments as marginalised urban residents.

Street foods offer a low-cost, convenient and attractive source of ready-made food for urban residents, especially among smaller and poorer urban families, though food safety and quality are concerns. Street foods make up a significant part of the diet of select groups; for example, in Nairobi, Kenya, 51 per cent of men in one low-income neighbourhood and 72 per cent in another regularly purchased street food for lunch, which contributed 23 per cent and 70 per cent of their daily energy intake, respectively (van't Riet, den Hartog and van Staveren 2002: 516). In Nigeria, adolescents obtain 40–70 per cent of their food from street vendors, supplying 20–30 percent of their daily energy intake (Oguntona and Kanye, 1995). However, food consumption away from home is not captured well by consumption surveys in the global South.

In this urban food system, it is not a matter of individual choice: people's choices are informed by food environments embodied within the wider urban system, and their dependency on a wide range of material, social and natural

infrastructures. These dependencies are illustrated in the following vignette, which draws on previous fieldwork experience that illustrates how people navigate the vagaries of service access, which in turn shape choices about food options:

VIGNETTE

A mother wanting to feed her child before school in a settlement in Cape Town might wake up early to ensure that food is prepared and the child has bathed before the choke is activated, cutting off their household water supply at around 5am. While this dwelling may be recorded as having access to water, access to electricity connections, access to sewerage connections, or a variation thereof, this grid use varies through the day. Once the child is at school, the mother then visits a friend and does her ablutions there. Different forms of energy are used – again, following highly strategic decisions – for heating, cooking and lighting. At times, when gas is not available for cooking, dinner might be purchased from a local street vendor as the basic free electricity needs to be conserved and is needed to ensure homework is done.

This vignette illustrates how the food choices urban residents make are thus informed not only or primarily by individual choices, but in fact by infrastructure assemblages that condition deeply strategic decisions household food providers make. These decisions also then inform – and are transferred – to the informal economy. In the context of limited resources and deep structural marginalisation, households make strategic decisions about household assets and how these relate to food. Spatial inequality in the city can affect such decisions. If the tenure of a dwelling is precarious, and fixed costs related to rent, transport and school fees are non negotiable, then it makes little sense to invest in costly household appliances such as an oven or refrigerator. The street and wider food environments thus perform the role of culinary apparatus otherwise fulfilled by a kitchen.

Figure 1. When the street is the stove



Source: Samantha Reinders for the Nourished Child Project (African Centre for Cities, 2022)

5. Summary and concluding thoughts – exploring intersections between the ‘continuums’ of infrastructure and food

The Living Off-Grid Food and Infrastructure Collaboration is a research partnership that was initially convened to answer the following question: ‘How is marginalised people’s food and nutrition security shaped by urban infrastructure assemblages in a variety of “off-grid” settings in Asian and African cities?’ The conceptual approach outlined here links literatures on urban food governance, urban systems and infrastructure assemblages, focusing on the interactions of such assemblages in the lives of marginalised people, with implications for food.

Much of this work – whether on food or on separate infrastructures – has been done in siloes. Extending it to look more concretely at how food is implicated within infrastructure assemblages, we have drawn on urban political ecology and other critical studies of urban systems to understand how such urban infrastructures and their associated assemblages function, examining the

everyday improvisations, negotiations and contestations around key forms of urban infrastructure in relation to food. This is based on the premise that people's food and nutrition situations are both dependent on infrastructure and indicative of wider wellbeing in urban contexts, including broader infrastructural or societal health. This paper has accordingly provided working definitions of infrastructure assemblages, marginalisation, our conception of 'gridded continuums', and multiple relationships between food and infrastructure to provide a thorough theoretical and empirical grounding for the work ahead.

The concept of a gridded continuum builds on the work on infrastructure of many authors who have discussed hybridity and heterogeneity in infrastructure provision. In particular, we have discussed the need to move beyond the assumption that gridded arrangements are associated with public and formal provision and that non-gridded arrangements are associated with private and informal provision. We discuss many examples of informal and formal (state-supplied) grid arrangements.

In reality, urban residents experience not only hybrids of these arrangements but a great deal of spatial and temporal variation, hence a continuum. Our use of the word continuum suggests the fluidity or lack of fixity in the arrangements that people experience, as opposed to the assumed fixity of the grid. And while a continuum should not suggest 'continuous' supply, we note the many agentful ways that marginalised people work (with attendant financial, time and equity costs) to ensure at least some systemic 'redundancy' (i.e. to ensure continuity of/resilience of supply). But because of these everyday costs, we caution against an overly optimistic picture associated with the constant juggling and improvisations that marginalised people have to undertake.

We thus return to the fact that behind these continuums lies an uneven terrain of linked politics, planning, legal and financialisation regimes that, in many cases, have driven further fragmentation and precarity. A wide range of precarity exists for every form of infrastructural provision and relates not only to location and housing type, but also to legal frameworks and various regimes or assemblages of documentation necessary to access different levels of infrastructure. This combines with other shocks, such as those driving or preventing migration (including recent Covid-19 movement restrictions), which not only displaced people, but curtailed certain urban residents' rights to particular infrastructures and other forms of state welfare provision, such as food or fuel subsidies, particularly when these rights are reliant on certain conceptions of citizenship or assumptions about the stability of people's domiciles and their infrastructure needs.

We argue that food is a natural starting point from which to consider infrastructure, but has largely been ignored in many urban and infrastructural studies. Given its reliance on a range of different socio-material infrastructures, and because food can itself be considered as part of the essential infrastructure needed to support people's basic needs, we find this a key omission in both theoretical and policy-oriented work. While earlier framings of food security and food were embedded in a distinct production paradigm, we review more recent work on food systems and food environments, which are more cognisant of physical environments. But there are gaps in the literature linking

the infrastructural approaches we outline here with wider conceptions of city systems rooted in the realities of Southern cities.

The list of food and infrastructure dependencies is long and complex and relates to all parts of the food system; this complexity cannot be used as an excuse for ignorance of these infrastructural dependencies. Simply trying to chart urban systems separately can lead to top down visions of and responses to urban issues. Instead, our planned work will foreground the everyday contestations and experience of food within infrastructure assemblages, and we draw on a view of urban systems rooted in everyday realities (Anderson and McFarlane 2011). However, in focusing on everyday practices we remain attentive to wider structures (e.g. provisioning systems, policy, etc.), the interactions between such top-down forces, and the adaptations and negotiations that arise in response to these. Our planned work will provide insight useful for re imagining urban planning and food systems that are more sensitive to the needs and lives of the most marginalised people.

References

- Aajeevika Bureau (2020) ***Unlocking the Urban: Reimagining Migrant Lives in Cities Post Covid***, Udaipur: Aajeevika Bureau
- Abeyasekera, A.; Maqsood, A.; Perera, I.; Sajjad, F. and Spencer, J. (2019) **'Discipline in Sri Lanka, Punish in Pakistan: Neoliberalism, Governance, and Housing Compared'**, *Journal of the British Academy*, 7.s2: 215–44. DOI: 10.5871/jba/007s2.215
- Ahmed, S.; Simiyu, E.; Githiri, G.; Sverdlik, A. and Mbaka, S. (2015) **'Cooking up a Storm, Community-led Mapping and Advocacy with Food Vendors in Nairobi's Informal Settlements'**, *IIED Working Paper*, London: International Institute for Environment and Development (IIED)
- Akpalu, W.; Dasmani, I. and Aglobitse, P.B. (2011) **'Demand for Cooking Fuels in a Developing Country: To What Extent do Taste and Preferences Matter?'**, *Energy Policy*, 39.1: 6525–31. DOI: 10.1016/j.enpol.2011.07.054
- Amin, A. and Cirolia, L.R. (2017) **'Politics/matter: Governing Cape Town's Informal Settlements'**, *Urban Studies*, 55.2:274–95. DOI: 10.1177/0042098017694133
- Anand, N. (2015) **'Leaky States: Water Audits, Ignorance, and the Politics of Infrastructure'**, *Public Culture*, 27.2: 305–30. DOI: 10.1215/08992363-2841880
- Andam, K.S.; Tschirley, D.; Asante, S.B.; Al-Hassan, R.M. and Diao, X. (2018) **'The Transformation of Urban Food Systems in Ghana: Findings From Inventories of Processed Products'**, *Outlook on Agriculture*, 47.3: 233–43. DOI: 10.1177/2F0030727018785918
- Anderson, B. and McFarlane, C. (2011) **'Assemblage and Geography'**, *Area*, 43.2: 124–27. DOI: 10.1111/j.1475-4762.2011.01004.x
- Anim-Somuah, H.; Henson, S.; Humphrey, J. and Robinson, E. (2013) **'Strengthening Agri food Value Chains for Nutrition: Mapping Value Chains for Nutrient-dense Foods in Ghana'**, *Evidence Report 2*, Brighton: Institute of Development Studies
- Balakrishnan, S. (2017) **'Land-based Financing for Infrastructure: What is New about India's Land Conflicts?'**, in R. Nagaraj and S. Motiram (eds), *Political Economy of Contemporary India*, Cambridge: Cambridge University Press. DOI: 10.1017/9781316691373.012
- Baptista, I. (2018) **'Electricity Services Always in the Making: Informality and the Work of Infrastructure Maintenance and Repair in an African City'**, *Urban Studies*, 56.3: 510–25. DOI: 10.1177/2F0042098018776921
- Battersby, J. (2011) **'Urban Food Insecurity in Cape Town, South Africa: An Alternative Approach to Food Access'**, *Development Southern Africa*, 28.4: 545–61. DOI: 10.1080/0376835X.2011.605572
- Battersby, J. (2017) **'Food System transformation in the Absence of Food System Planning: The Case of Supermarket and Shopping Mall Retail Expansion in Cape Town, South Africa'**, *Built Environment*, 43.3: 417–30. DOI: 10.2148/benv.43.3.417
- Battersby, J. and Crush, J. (2014) **'Africa's Urban Food Deserts'**, *Urban Forum*, 25: 143–51. DOI: 10.1007/s12132-014-9225-5
- Battersby, J. and Muwowo, F. (2019) **'Planning and Governance of Food Systems in**

- Kitwe, Zambia: A Case Study of Food Retail Space**, in J. Battersby and V. Watson (eds), *Urban Food Systems Governance and Poverty in African Cities*, Abingdon and New York: Routledge
- Battersby, J. and Watson, V. (2019) **'The Planned "City-Region" in the New Urban Agenda: An Appropriate Framing for Urban Food Security'**, *Town Planning Review*, 90.5: 497–518. DOI: 10.3828/tpr.2019.32
- Bayat, A. (2000) **"From Dangerous Classes" to "Quiet Rebels": Politics of the Urban Subaltern in the Global South**, *International Sociology*, 15.3: 533–57. DOI: 10.1177/2F026858000015003005
- Bénit-Gbaffou, C. (2016) **'Do Street Traders Have the 'Right to the City'? The Politics of Street Trader Organisations in Inner City Johannesburg, Post-Operation Clean Sweep'**, *Third World Quarterly*, 37.6: 1102–29. DOI: 10.1080/01436597.2016.1141660
- Benjamin, S. (2008) **'Occupancy Urbanism: Radicalizing Politics and Economy Beyond Policy and Programs'**, *International Journal of Urban and Regional Research*, 32.3: 719–29. DOI: 10.1111/j.1468-2427.2008.00809.x
- Bhan, G. (2013) **'Planned Illegalities: Housing and the "Failure" of Planning in Delhi: 1947–2010'**, *Economic and Political Weekly*, 48.24: 58–70. DOI: 10.1177/2F026858000015003005
- Bhushan, C. and Kumarankandath, A. (2016) **Mini Grids: Electricity for All**, New Delhi: Centre for Science and Environment
- Björkman, L. (2018) **'The Engineer and the Plumber: Mediating Mumbai's Conflicting Infrastructural Imaginaries'**, *International Journal of Urban and Regional Research*, 42.2: 276–94. DOI: 10.1111/1468-2427.12526
- Björkman, L. (2015) **Pipe Politics, Contested Waters: Embedded Infrastructures of Millennial Mumbai**, Durham, NC: Duke University Press
- Borie, M.; Pelling, M.; Ziervogel, G. and Hyams, K. (2019) **'Mapping Narratives of Urban Resilience in the Global South'**, *Global Environmental Change*, 54: 203–13. DOI: 10.1016/j.gloenvcha.2019.01.001
- Cabannes, Y.; Yafai, S.G. and Johnson, C. (2010) **How People Face Evictions**, London: Development Planning Unit, University College London
- Caldeira, T.P. (2017) **'Peripheral Urbanization: Autoconstruction, Transversal Logics, and Politics in Cities of the Global South'**, *Environment and Planning D: Society and Space*, 35.1: 3–20, DOI: 10.1177/2F0263775816658479
- Carswell, G. and De Neve, G. (2020) **'Paperwork, patronage, and Citizenship: The Materiality of Everyday Interactions with Bureaucracy in Tamil Nadu, India'**, *Journal of the Royal Anthropological Institute*, 26.3: 495–514. DOI: 10.1111/1467-9655.13311
- Castán Broto, V. and Sudhira, H. (2019) **'Engineering Modernity: Water, Electricity and the Infrastructure Landscapes of Bangalore, India'**, *Urban Studies*, 56.11: 2261–2279. DOI: 10.1177/0042098018815600
- Castán Broto, V.; Sudhira, H.S. and Unnikrishnan, H. (2021) **'Walk the Pipeline: Urban Infrastructure Landscapes in Bengaluru's Long Twentieth Century'**, *International Journal of Urban and Regional Research*, 45.4: 696–715. DOI: 10.1111/1468-2427.12985
- CSE (2016) **2016 Annual State of India's Environment Report (SOE)**, New Delhi: Centre for Science and Environment (CSE)

- Cirolia, L.R. (2020) **'Fractured Fiscal Authority and Fragmented Infrastructures: Financing Sustainable Urban Development in Sub-Saharan Africa'**, *Habitat International*, 104, 102233. DOI: 10.1016/j.habitatint.2020.102233
- Cirolia, L.R. and Scheba, S. (2019) **'Towards a Multi-scalar Reading of Informality in Delft, South Africa: Weaving the "Everyday" with Wider Structural Tracings'**, *Urban Studies*, 56.3: 594–611. DOI: 10.1177/2F0042098017753326
- Coutard, O. and Rutherford, J. (2011) **'Ecologies And Sociotechnologies Of Post-Networked Cities'**, The Distinctiveness of Cities: Modes of Re-Production, International Conference, 15–17 June 2011, Darmstadt
- Crush, J. and Frayne, B. (2010) **'The Invisible Crisis: Urban Food Security in Southern Africa'**, *Urban Food Security Series No.1*, Cape Town: The African Food Security Network.
- Crush, J.; Frayne, B. and Pendleton, W. (2012) **'The Crisis of Food Insecurity in African Cities'**, *Journal of Hunger and Environment Nutrition*, 7.2–3: 271–92. DOI: 10.1080/19320248.2012.702448
- de Groot, J., Mohlakoana, N., Knox, A., & Bressers, H. (2017) **'Fuelling women's empowerment? An exploration of the linkages between gender, entrepreneurship and access to energy in the informal food sector'**, *Energy Research & Social Science*, 28, 86–97. DOI: 10.1016/j.erss.2017.04.004
- Desai, R. (2017) **'Entitlements of Seasonal Migrant Construction Workers to Housing, Basic Services and Social Infrastructure in Gujarat's Cities: Background Policy Paper'**, *CUE Working Paper 35*, May
- Desai, R.; McFarlane, C. and Graham, S. (2015) **'The Politics of Open Defecation: Informality, Body, and Infrastructure in Mumbai'**, *Antipode*, 47.1: 98–120. DOI: 10.1111/anti.12117
- Donovan, J.; Larsen, K. and McWhinnie, J. (2011) **'Food Sensitive Planning and Urban Design: A Conceptual Framework for Achieving a Sustainable and Healthy Food System'**, report commissioned by the National Heart Foundation of Australia, Victoria Division, Melbourne
- Dreze, J.; Gupta, P.; Khera, R. and Pimenta, I. (2018) **'Casting the Net: India's Public Distribution System after the Food Security Act'**, Mumbai: Sameeksha Trust
- Duminy, J. (2018) **'Ecologizing Regions; Securing Food: Governing Scarcity, Population and Territory in British East and Southern Africa'**, *Territory, Politics, Governance*, 6.4: 429–46. DOI: 10.1080/21622671.2017.1306457
- Ebata, A.; Thorpe, J.; Islam, A.; Sultana, S. and Mbuya, M.N.N. (2021) **'Understanding Drivers of Private-Sector Compliance to Large-Scale Food Fortification: A Case Study on Edible Oil Value Chains in Bangladesh'**, *Food Policy*, 104. DOI: 10.1016/j.foodpol.2021.102127
- Enqvist, J.; Tengö, M. and Boonstra, W.J. (2016) **'Against the Current: Rewiring Rigidity Trap Dynamics in Urban Water Governance Through Civic Engagement'**, *Sustainability Science*, 11: 919–33. DOI 10.1007/s11625-016-0377-1
- Enqvist, J.; Ziervogel, G.; Metelerkamp, L.; van Breda, J.; Dondi, N.; Lusithi, T.; Mdunyelwa, A.; Mgwigwi, Z.; Mhalisi, M.; Myeza, S.; Nomela, G.; October, A.; Rangana, W. and Yalabi, M. (2022) **'Informality and Water Justice: Community Perspectives on Water Issues in Cape Town's Low-Income Neighbourhoods'**, *International Journal of Water Resources Development*, 38.1: 108–29. DOI: 10.1080/07900627.2020.1841605
- Ericksen, P.J. (2008) **'Conceptualizing Food Systems for Global Environmental**

- Change Research**', *Global Environmental Change*, 18.1: 234–45. DOI: 10.1016/j.gloenvcha.2007.09.002
- FAO (2022) **Urban Food System and Nutrition Assessment in Pune, Maharashtra, India**, Rome: Food and Agriculture Organization (FAO)
- Floro, M.S. and Swain, R.B. (2013) **'Food Security, Gender, and Occupational Choice Among Urban Low-Income Households'**, *World Development*, 42: 89–99. DOI: 10.1016/j.worlddev.2012.08.005
- Furlong, K (2014) **'STS Beyond the 'Modern Infrastructure Ideal': Extending Theory by Engaging with Infrastructure Challenges in the South'**, *Technology in Society*, 38: 139–47. DOI: 10.1016/j.techsoc.2014.04.001
- Gelli, A.; Hawkes, C.; Donovan, J.; Harris, J.; Allen, S.; de Brauw, A.; Henson, S.; Johnson, N.; Garrett, J. and Ryckembusch, D. (2015) **'Value Chains and Nutrition: A Framework to Support the Identification, Design and Evaluation of Interventions'**, *IFPRI Discussion Paper 01413*, Washington, DC: International Food Policy Research Institute IFPRI
- Gillespie, S. and van den Bold, M. (2017) **'Agriculture, Food Systems, and Nutrition: Meeting the Challenge'**, *Global Challenges*, 1, 1600002. DOI: 10.1002/gch2.201600002
- GOPAN (2016) **Food Systems and Diets: Facing the Challenges of the 21st Century**, London: Global Panel on Agriculture and Food Systems for Nutrition (GOPAN)
- Graham, S. and Marvin, S. (2002) **Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition**, London: Routledge
- Graham, S. and McFarlane, C. (2014) **Infrastructural Lives: Urban Infrastructure in Context**, London: Routledge
- Graham, S. and Thrift, N. (2007) **'Out of Order: Understanding Repair and Maintenance'**, *Theory, Culture and Society*, 24.3: 1–25. DOI: 10.1177/2F0263276407075954
- Grönwall, J.; Mulenga, M. and McGranahan, G. (2010) **Groundwater, Self-supply and Poor Urban Dwellers – A Review with Case Studies of Bangalore and Lusaka UPGro: Unlocking the Potential of Groundwater for the Poor View Project**, London: International Institute for Environment and Development
- Harris, L.M.; Chu, E.K. and Ziervogel, G. (2018) **'Negotiated Resilience'**, *Resilience*, 63: 196–214. DOI: 10.1080/21693293.2017.1353196
- Harsch, E. (n.d.) **'Winding Path to Decent Housing for South Africa's Poor'**, *Africa Renewal*
- Hayombe, P.O.; Owino, F.O. and Awuor, F.O. (2019) **'Planning and Governance of Food Systems in Kisumu City'**, in J. Battersby and V. Watson (eds) *Urban Food Systems Governance and Poverty in African Cities*, Abingdon and New York: Routledge
- Haysom, G. and Fuseini, I. (2017) **'Urban Social Protection and Food Systems: Lessons from South Africa'**, in B. Frayne, J. Crush and C. McCordic (eds), *Food and Nutrition Security in Southern African Cities*, London: Routledge
- Hawkes, C. and Fanzo, J. (2017) **Nourishing the SDGs: Global Nutrition Report 2017**, Bristol: Development Initiatives Poverty Research Ltd
- HLPE (2017) **Nutrition and Food Systems. A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security**, High Level Panel of experts (HLPE), Rome: Food and Agriculture Organization

- HLPE (2018) **Food security and nutrition: building a global narrative towards 2030. A report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, High Level Panel of experts (HLPE)**, Rome: Food and Agriculture Organization
- Holdsworth, M. and Landais, E. (2019) **'Urban Food Environments in Africa: Implications for Policy and Research'**, *Proceedings of the Nutrition Society*, 78.4: 513–25. DOI: doi:10.1017/S0029665118002938
- Huey, S.; Finkelstein, J.; Venkatramanan, S.; Udipi, S.; Ghugre, P.; Thakker, V.; Thorat, A.; Potdar, R.; Chopra, H.; Kurpad, A.; Haas, J.D. and Mehta, S. (2019) **'Prevalence and Correlates of Undernutrition in Young Children Living in Urban Slums of Mumbai, India: A Cross Sectional Study'**, *Frontiers in Public Health*, 7: 191. DOI: 10.3389/fpubh.2019.00191
- Humphrey, J. and Robinson, E. (2015) **'Markets for Nutrient-Rich Foods: Policy Synthesis from Three Country Studies'**, *IDS Evidence Report 161*, Brighton: IDS
- Hunter-Adams, J.; Battersby, J. and Oni, T. (2019) **'Food Insecurity In Relation to Obesity in Peri-urban Cape Town, South Africa: Implications for Diet-related Non-communicable Disease'**, *Appetite*, 137: 244–49. DOI: 10.1016/j.appet.2019.03.012
- Idiculla, M. (2017) **'Who Governs the City? The Powerlessness of City Governments and the Transformation of Governance in Bangalore'**, paper presented at RC21 International Conference on 'The Ideal City: Between Myth and Reality. Representations, Policies: Contradictions and Challenges for Tomorrow's Urban Life', Urbino, Italy: 27–29 August 2015
- IFPR (2017) **2017 Global Food Policy Report**, Washington, DC: International Food Policy Research Institute (IFPRI)
- Jaglin, S. (2014) **'Regulating Service Delivery in Southern Cities: Rethinking Urban Heterogeneity'**, in S. Parnell and S. Oldfield (eds), *The Routledge Handbook on Cities of the Global South*, 1st ed., London: Routledge
- Jaglin, S. (2008) **'Differentiating Networked Services in Cape Town: Echoes of Splintering Urbanism?'**, *Geoforum*, 39: 1897–906. DOI: 10.1016/j.geoforum.2008.04.010
- Kennedy, G.; Nantel, G. and Shetty, P. (2004) **Globalization of Food Systems in Developing Countries: A Synthesis of Country Case Studies**, Rome: Food and Agriculture Organization
- Khera, R. (2006) **'Mid-day Meals in Primary Schools: Achievements and Challenges'**, *Economic and Political Weekly*, 41.46: 4742–50
- Larkin, B. (2008) **Signal and Noise**, Durham, NC: Duke University Press
- Lawhon, M.; Nilsson, D.; Silver, J.; Ernstson, H. and Lwasa, S. (2018) **'Thinking Through Heterogeneous Infrastructure Configurations'**, *Urban Studies*, 55.4: 720–32. DOI: 10.1177/2F0042098017720149
- Le Cuziat, G. and Mattinen, H. (2011) **Maximising the Nutritional Impact of Food Security and Livelihoods Interventions: A Manual for Field Workers**, New York: ACF International
- Leck, H. (2012) **Rising to the Adaptation Challenge?: Responding to Global Environmental Change in eThekweni and Ugu Municipalities, South Africa**, PhD dissertation, London: Royal Holloway, University of London
- Lemanski, C. (2020) **'Infrastructural Citizenship: The Everyday Citizenships of Adapting and/or Destroying Public Infrastructure in Cape Town, South Africa'**, *Transactions of*

the Institute of British Geographers, 45.3: 589–605. DOI: doi.org/10.1111/tran.12370

Lemanski, C. (2021) **'Broadening the Landscape of Post-network Cities: A Call to Research the Off-grid Infrastructure Transitions of the Non-poor'**, *Landscape Research*, 48.2, 174–186. DOI: 10.1080/01426397.2021.1972952

Maestre, M.; Poole, N. and Henson, S. (2017) **'Assessing Food Value Chain Pathways, Linkages and Impacts for Better Nutrition of Vulnerable Groups'**, *Food Policy*, 68: 31–9. DOI: 10.1016/j.foodpol.2016.12.007

Masera, O.R.; Saatkamp, B.D. and Kammen, D.M. (2000) **'From Linear Fuel Switching to Multiple Cooking Strategies: A Critique and Alternative to the Energy Ladder Model'**, *World Development*, 28.12: 2083–103. DOI: 10.1016/S0305-750X(00)00076-0

Mboganie Mwangi, A.; Den Hartog, A.; Mwadime, R.; Van Staveren, W. and Foeken, D. (2002) **'Do Street Food Vendors Sell a Sufficient Variety of Foods for a Healthful Diet? The Case of Nairobi'**, *Food and Nutrition Bulletin*, 23.1: 48–56. DOI: 10.1177/2F156482650202300107

McFarlane, C. (2010) **'The Comparative City: Knowledge, Learning, Urbanism'**, *International Journal of Urban and Regional Research*, 34.4: 725–42. DOI: 10.1111/j.1468-2427.2010.00917.x

Meintjes, H. (2001) **'"Washing Machines Make Lazy Women": Domestic Appliances and the Negotiation of Women's Propriety in Soweto'**, *Journal of Material Culture*, 6.3: 345–63. DOI: 10.1177/2F135918350100600304

Mitra, A. and Rao, N. (2019) **'Gender, Water and Nutrition in India: An Intersectional Perspective'**, *Water Alternatives*, 12.3: 930–52

Monstadt, J. and Schramm, S. (2017) **'Toward the Networked City? Translating Technological ideals and Planning Models in Water and Sanitation Systems in Dar es Salaam'**, *International Journal of Urban and Regional Research*, 41.1: 104–25. DOI: 10.1111/1468-2427.12436

Morgan, K. (2009) **'Feeding the City: The Challenge of Urban Food Planning'**, *International Planning Studies*, 14.4: 341–48. DOI: 10.1080/13563471003642852

Morgan, K. and Sonnino, R. (2010) **'The Urban Foodscape: World Cities and the New Food Equation'**, *Cambridge Journal of Regions, Economy and Society*, 3.2: 209–24. DOI: 10.1093/cjres/rsq007

Musango, J.K. (2014) **'Household Electricity Access and Consumption Behaviour in an Urban Environment: The case of Gauteng in South Africa'**, *Energy for Sustainable Development*, 23: 305–16. DOI: 10.1016/j.esd.2014.06.003

Nagaraj, V.K. (2016) **'From Smokestacks to Luxury Condos: The Housing Rights Struggle of the Millworkers of Mayura Pace, Colombo'**, *Contemporary South Asia*, 24.4: 429–43. DOI: 10.1080/09584935.2016.1244173

OECD/SWAC (2020) **Africa's Urbanisation Dynamics 2020: Africapolis, Mapping a New Urban Geography, West African Studies**, Organisation for Economic Co-operation and Development (OECD)/Sahel and West Africa Club (SWAC), Paris: OECD Publishing. DOI: 10.1787/2074353x

Oguntona, C. R., & Kanye, O. (1995). **'Contribution of street foods to nutrient intakes by Nigerian adolescents'**, *Nutrition and Health*, 10.2: 165–171. DOI: 10.1177/026010609501000206

Osei-Kwasi, H. A.; Laar, A.; Zotor, F.; Pradeilles, R.; Aryeetey, R.; Green, G. and Griffiths, P.; Akparibo, R.; Njeri Wanjohi, M.; Rousham, E.; Barnes, A.; Booth, A.; Mensah, K.; Asiki,

- G.; Kimani-Murage, E.; Bricas, N. and Holdsworth, M. (2021) **'The African Urban Food Environment Framework for Creating Healthy Nutrition Policy and Interventions in Urban Africa'**, *PLoS One*, 16.4: e0249621. DOI: 10.1371/journal.pone.0249621
- Parikh, P.; Fu, K.; Parikh, H.; McRobie, A. and George, G. (2015) **'Infrastructure Provision, Gender, and Poverty in Indian Slums'**, *World Development*, 66: 468–86. DOI: 10.1016/j.worlddev.2014.09.014
- Pieterse, E.; Parnell, S. and Haysom, G. (2018) **'African Dreams: Locating Urban Infrastructure in the 2030 Sustainable Developmental Agenda'**, *Area Development and Policy*, 3.2: 149–69. DOI: 10.1080/23792949.2018.1428111
- Pitt, E.; Gallegos, D.; Comans, T.; Cameron, C. and Thornton, L. (2017) **'Exploring the Influence of Local Food Environments on Food Behaviours: A Systematic Review of Qualitative Literature'**, *Public Health Nutrition*, 20.13: 2393–405. DOI: 10.1017/S1368980017001069
- Popkin, B.; Adair, L.S. and Ng, S.W. (2012) **'Global Nutrition Transition and the Pandemic of Obesity in Developing Countries'**, *Nutrition Reviews*, 70.1: 3–21. DOI: 10.1111/j.1753-4887.2011.00456.x
- Pothukuchi, K. and Kaufman, J.L. (1999) 'Placing the Food System on the Urban Agenda: The Role of Municipal Institutions in Food Systems Planning', *Agriculture and Human Values*, 16.2: 213–24. 10.1023/A:1007558805953
- Ranganathan, M. (2014) **"Mafias" in the Waterscape: Urban Informality and Everyday Public Authority in Bangalore'**, *Water Alternatives*, 7.1: 89–105
- Ranganathan, M.; Kamath, L. and Baindur, V. (2009) **'Piped Water Supply to Greater Bangalore: Putting the Cart before the Horse?'**, *Economic and Political Weekly*, 44.33: 53–62
- Rateau, M. and Jaglin, S. (2022) **'Co-production of Access and Hybridisation of Configurations: A Socio-technical Approach to Urban Electricity in Cotonou and Ibadan'**, *International Journal of Urban Sustainable Development*, 14.1: 1–16. DOI: 10.1080/19463138.2020.1780241
- Reddy, R.N. (2013) **'Revitalising Economies of Disassembly: Informal Recyclers, Development Experts and E-Waste Reforms in Bangalore'**, *Economic and Political Weekly*, 48.13: 62–70
- Redfield, P. and Robins, S. (2016) **'An Index of Waste: Humanitarian Design, 'Dignified Living' and the Politics of Infrastructure in Cape Town'**, *Anthropology of Southern Africa*, 39.2: 145–62. DOI: 10.1080/23323256.2016.1172942
- Roberts, W. (2001) **'The Way to a City's Heart is Through its Stomach: Putting Food Security on the Urban Planning Menu'**, *Crackerbarrel Philosophy Series*, Toronto: Toronto Food Policy Council
- Roy, A. (2005) **'Urban Informality: Toward an Epistemology of Planning'**, *Journal of the American Planning Association*, 71.2: 147–58. DOI: 10.1080/01944360508976689
- Ruel, M.; Garrett, J.; Yosef, S. and Olivier, M. (2017) **'Urbanization, Food Security and Nutrition'**, in S. de Pee, D. Taren and M. Bloem (eds), *Nutrition and Health in a Developing World*, Cham: Humana Press
- Santarelli, M.; Marques Vieira, L. and Constantine, J. (2018) **Learning from Brazil's Food and Nutrition Security Policies**, Institute of Development Studies and the Food Foundation

- SASSA (2020) **SASSA Sends Lifeline to Rejected Covid-19 Grant Applicants**, 30 June, South African Social Security Agency's (SASSA)
- Satterthwaite, D (2020) **An Urbanising World**, IIED blog, 9 April, International Institute for Environment and Development (IIED)
- Schmidt, J.J. (2020) **'Pop-up Infrastructure: Water ATMs and New Delivery Networks in India'**, *Water Alternatives*, 13.1: 119–140
- Schulman, P.R. and Roe, E. (2016) **Reliability and Risk: The Challenge of Managing Interconnected Infrastructures**, Stanford: Stanford University Press
- Sen, A. (1981) **'Ingredients of Famine Analysis: Availability and Entitlements'**, *The Quarterly Journal of Economics*, 96.3: 433–64. DOI: 10.2307/1882681
- Shankar, A.V.; Quinn, A.K.; Dickinson, K.L.; Williams, K.N.; Maser, O.; Charron, D.; Jack, D.; Hyman, J.; Pillarisetti, A.; Balis, R.; Kumar, P.; Ruiz-Mercado, I. and Rosenthal, J.P. (2020) **'Everybody Stacks: Lessons from Household Energy Case Studies to Inform Design Principles for Clean Energy Transitions'**, *Energy Policy*, 141.111468. DOI: 10.1016/j.enpol.2020.111468
- Shatkin, G. (2008) **'The City and the Bottom Line: Urban Megaprojects and the Privatization of Planning in Southeast Asia'**, *Environment and Planning A: Economy and Space*, 40.2: 383–401. DOI: 10.1068/a38439
- Sibanda, L. and von Blottnitz, H. (2019) **'Food Value Chains in Kisumu, Kitwe, and Epworth Environmental and Social Hotspots'**, in J. Battersby, and V. Watson (eds), *Urban Food Systems Governance and Poverty in African Cities*, Abingdon and New York: Routledge
- Silver, J. (2014) **'Incremental Infrastructures: Material Improvisation and Social Collaboration Across Post-colonial Accra'**, *Urban Geography*, 35.6: 788–804. DOI: 10.1080/02723638.2014.933605
- Simone, A. (2004) **'People as infrastructure: Intersecting fragments in Johannesburg'**, *Public Culture*, 16.3: 407–429.
- Sinha, D. (2020) **'Hunger and Food Security in the Times of Covid-19'**, *Journal of Social and Economic Development*, 23: 320–31. DOI: 10.1007/s40847-020-00124-y
- Skinner, C. (2016) **'Informal Food Retail in Africa: A Review of Evidence'**, *Consuming Urban Poverty Project Working Paper No. 2*, African Centre for Cities, Cape Town: University of Cape Town
- Skinner, C. and Watson, V. (2017) **'The Informal Economy in Cities of the Global South: Challenges to the Planning Lexicon'**, in G. Bhan, S. Srinivas and V. Watson (eds), *The Routledge Companion to Planning in the Global South*, London: Routledge
- Smit, W. (2016) **'Urban governance and urban food systems in Africa: Examining the linkages'**, *Cities*, 58: 80–86. DOI: 10.1016/j.cities.2016.05.001
- Smith, D. W. (1998) **'Urban Food Systems and the Poor in Developing Countries'**, *Transactions of the Institute of British Geographers*, 23.2: 207–19. DOI: 10.1111/j.0020-2754.1998.00207.x
- Smitha, K.C. and Sangita, S.N. (2008) **'Urban Governance and Service Delivery In Bangalore: Public-Private Partnership'**, *Working Paper 189*, Institute for Social and Economic Change
- Sovacool, B.K. (2012) **'The Political Economy of Energy Poverty: A Review of Key**

Challenges, *Energy for Sustainable Development*, 16.3: 272–82. DOI: 10.1016/j.esd.2012.05.006

Srivastava, R. (2019) **'Emerging dynamics of labour market inequality in India: Migration, informality, segmentation and social discrimination'**, *The Indian Journal of Labour Economics*, 62.2: 147–71. DOI: 10.1007/s41027-019-00178-5

Steel, C. (2008) *Hungry City: How Food Shapes our Lives*, London: Chatto and Windus

Steyn, N.; Mchiza, Z.; Hill, J.; Davids, Y.; Venter, I.; Hinrichsen, E.; Opperman, M.; Rumbelow, J. and Jacobs, P. (2013) **'Nutritional Contribution of Street Foods to the Diet of People in Developing Countries: A Systematic Review'**, *Public Health Nutrition*, 17.6: 1363–74. DOI: 10.1017/S1368980013001158

Swilling, M. (2011) **'Reconceptualising Urbanism, Ecology and Networked Infrastructures'**, *Social Dynamics*, 37.1: 78–95. DOI: 10.1080/02533952.2011.569997

Swilling, M. (2016) **'Africa's Game Changers and the Catalysts of Social and System Innovation'**, *Ecology and Society*, 21.1

Te Lintelo, D.J.H. (2017) **'Enrolling a Goddess for Delhi's Street Vendors: The Micro-politics of Policy Implementation Shaping Urban (In)formality'**, *Geoforum*, 84: 77–87. DOI: 10.1016/j.geoforum.2017.06.005

Thorpe, J. and Reed, P. (2016) **'Addressing Market Constraints to Providing Nutrient-Rich Foods: An Exploration of Market Systems Approaches'**, *IDS Evidence Report 172*, Brighton: Institute of Development Studies

Toriro, P. M. (2019). *Food production, processing and retailing through the lens of spatial planning legislation and regulations in Zimbabwe: evidence from Epworth*, PhD Dissertation, Cape Town: University of Cape Town

Turner, C.; Aggarwal, A.; Walls, H.; Herforth, A.; Drewnowski, A.; Coates, J.; Kalamatianou, S. and Kadiyala, S. (2018) **'Concepts and Critical Perspectives for Food Environment Research: A Global Framework with Implications for Action in Low- and Middle-income Countries'**, *Global Food Security*, 18: 93–101. DOI: 10.1016/j.gfs.2018.08.003

UN DESA (2022) *World Population Prospects 2022: Summary of Results*, United Nations Department of Economic and Social Affairs (UN DESA)

UN DESA (2018) *World Urbanization Prospects 2018*, United Nations Department of Economic and Social Affairs (UN DESA)

Van Berkum, S.; Dengerink, J. and Ruben, R. (2018) *The Food Systems Approach: Sustainable Solutions for a Sufficient Supply of Healthy Food*, The Hague: Wageningen Economic Research

Van der Valk, A. and Viljoen, A. (2014) **'AESOP's Thematic Groups – Part 3: The Sustainable Food Planning Thematic Group'**, *disP-The Planning Review*, 50.4: 78–82. DOI: 10.1080/02513625.2014.1007647

Van Noorloos, F.; Cirolia, L.R.; Friendly, A.; Jukur, S.; Schramm, S.; Steel, G. and Valenzuela (2020) **'Incremental Housing as a Node for Intersecting Flows of City-making: Rethinking the Housing Shortage in the Global South'**, *Environment and Urbanization*, 32.1: 37–54. DOI: 10.1177/2F0956247819887679

Von Schnitzler, A. (2016) *Democracy's Infrastructure*, Princeton: Princeton University Press

van't Riet, H., den Hartog, A. P., & van Staveren, W. A. (2002) **'Non-home prepared foods:**

contribution to energy and nutrient intake of consumers living in two low-income areas in Nairobi', *Public Health Nutrition*, 5.4: 515–522. DOI: 10.1079/PHN2001324

Watson, V. (2003) **'Conflicting Rationalities: Implications for Planning Theory and Ethics'**, *Planning Theory and Practice*, 4.4: 395–407. DOI: 10.1080/1464935032000146318

White, C.; Crankshaw, O.; Mafokoane, T. and Meintjies, H. (1998) ***Social Determinants of Energy Use in Low-income Metropolitan Households in Soweto***, Report No. EO9423, Pretoria: Department of Minerals and Energy

Zeza, A. and Tasciotti, L. (2010) **'Urban Agriculture, Poverty, and Food Security: Empirical Evidence From a Sample of Developing Countries'**, *Food Policy*, 35.4: 265–273. DOI: doi.org/10.1016/j.foodpol.2010.04.007



LIVING OFF-GRID
FOOD & INFRASTRUCTURE
COLLABORATION

The Living Off-Grid Food and Infrastructure Collaboration (LOGIC) is a project funded by UKRI's Global Challenges Research Fund, and is a collaboration between the Institute of Development Studies; the African Centre for Cities, University of Cape Town; the Indian Institute of Human Settlements, Bangalore; Colombo Urban Lab and the University of Ghana, Accra.

T +44 (0) 1273 606261

E n.nisbett@ids.ac.uk

W www.ids.ac.uk/projects/rethinking-the-off-grid-city

This work was supported by the UK Research and Innovation Global Challenges Research Fund [grant number ES/T007958/1]



Partners

