GCRO RESEARCH REPORT
NO. 12

IN PURSUIT OF JUST SUSTAINABILITY

NOVEMBER 2021
Edited by
Christina Culwick Fatti
Contributions by
Christina Culwick Fatti, Brett Cohen, Gail Jennings, Lisa Kane, Margot Rubin and Emily Tyler

GCRO Gauteng City-Region Observatory

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IN PURSUIT OF JUST SUSTAINABILITY

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Photograph by Gracious Nyoni

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Photograph by Clive Hassall

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Chapter 6: Lisa Kane | **ResearchGate** https://www.researchgate.net/profile/Lisa-Kane-3
Lisa is an honorary research associate with the University of Cape Town, with over 25 years' experience as a researcher in the politics of roads. Her current project is a book titled *Curious: A woman in roads,* which draws on Science and Technology Studies as well as her own experience. It aims to simplify and popularise some of the least well-understood concepts in traffic and road engineering.

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Photograph by Christina Culwick Fatti

Chapter 1

In pursuit of just sustainability

CHRISTINA CULWICK FATTI

1.1 Contextualising just sustainability

Environmental crises and urbanisation are two key features of our current age (Elmqvist et al., 2021; Parnell, 2018). There is growing evidence that human impacts have significantly affected the Earth system and that the associated consequences for society are becoming increasingly evident (Allen et al., 2018; Steffen et al., 2015). Concurrently, the balance has tipped globally, with more people living in urban rather than rural areas, and by 2050 some 60% of the world's population will live in cities (United Nations, 2014). In addition, the size of the global population is growing at unprecedented rates (Allen et al., 2018), and this growth is taking place largely in cities in the global South. Africa will be more than 50% urbanised by 2030, and although slightly behind the global average in percentage terms, it has the fastest urban population growth rate (OECD/Sahel and West Africa Club, 2020; Dodman et al., 2017).

In the context of climate change and the planetary boundaries that we are approaching, it is critical for society to improve resource efficiency, shift towards low-carbon development, minimise harmful waste and protect critical ecosystems (Allen et al., 2018). Urban areas play a necessary role in achieving these objectives (Revi et al., 2014), and the way cities develop will fundamentally shape space, society and the environmental systems on which life depends (IRR, 2018; Pieterse and Parnell, 2014). Cities in the South needing to provide services and opportunities to their growing populations are now under additional pressure to develop in new ways that do not entrench environmental degradation or inequality. In essence, what is being called for is a transition towards just sustainability.

Ideas around just sustainability have become increasingly prevalent in both global policy and literature. Roy et al. (2018) argue that there is a bi-directional relationship between climate change and sustainable development, highlighting that decisive action to address environmental crises is critical for social and economic development. Despite assertions that it is possible to develop in a way that is concurrently socially just and environmentally sustainable, in reality, achieving this alignment has proved difficult (e.g. Patel, 2006). Ciplet and Harrison (2020) argue that the aspirational rhetoric associated with commitments to just sustainability can undermine critical engagement with this composite goal and thus the tensions that arise within just sustainability remain hidden. In this volume, we argue that to make progress towards just sustainability in practice, it is necessary to engage with the complex interactions between social justice and environmental sustainability.

This volume presents empirical case study research from a range of sectors, perspectives and approaches to advance just sustainability theory and inform practice. A range of case studies is presented that interrogate the complex interaction between social justice and environmental considerations across several sectors within the Gauteng City-Region (GCR). These case studies reveal complexity rather than neat alignment between environmental and social imperatives. For example, reducing water consumption is necessary to protect scarce water resources in Gauteng and ensure everyone

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has access to sufficient water. However, lower consumption translates to lower municipal revenue, which in turn constrains municipalities' ability to provide water to the poor. This demonstrates how advances in one domain can undermine advances in another.

The case studies in this volume draw on a diverse set of approaches and come to conclusions that extend existing framings around how environmental sustainability and social justice interact. They provide an opportunity to refine the theorisation of just sustainability, and hopefully narrow the gap between theory and practice.

This introductory chapter lays out the justification for this volume, beginning with the role of case studies in furthering robust theory, followed by an overview of the GCR, the broad focus area of this volume. The chapter then goes on to describe the evolution and logic of this research collection, and ends with some reflections on the volume's relevance in furthering just sustainability in both theory and practice.

1.2 Exploring just sustainability through case studies

> [T]o craft a useful theory of justice, we must develop our ideas not in the abstract but through observing the non-ideal, imperfect world in which we live, with all of its tremendous inequalities, relations of oppression, and resource scarcity. (Ciplet and Harrison, 2020, p. 440)

Southern scholars have highlighted the significant value in case study methodology for building knowledge and nuance about cities and urban dynamics in a way that is most useful for urban planning (e.g. Schindler, 2017; Duminy et al., 2014; Roy, 2009; Venter et al., 2004; Watson, 2003). Case studies provide a way to link descriptive analytical ways of understanding 'what is' with the normative position of 'what should be' (Duminy et al., 2014). Furthermore, case studies engage meaningfully with complexity and, depending on how they are presented, can provide an effective way of changing perceptions and unpicking dominant assumptions (Duminy et al., 2014). This contributes to the development of theory of the 'urban' that is not limited to a 'single story', and highlights the role of local stories and knowledge from the global South to push the boundaries of current theory.

The challenge of shifting current trajectories towards just sustainability is inherently interdisciplinary, and thus requires input and engagement from a wide range of perspectives across social, environmental, economic and governance sectors (Sovacool et al., 2016). In the context of complex and diverse urban systems, a single perspective, or relying on only one interpretation of an issue, could not only leave gaps in understanding, but lead to dangerous and inappropriate recommendations. Jaglin (2014, p. 437) argues that the diversity within urban systems

> requires thinking about urban conditions in the plural by detailing their socio-material, historical and geographical depth, and identifying what, analytically, unites and divides this broad ensemble in order to draw concrete conclusions regarding the implications of this diversity of conditions for the co-evolution of technology and social practice.

Drawing on a range of perspectives and different forms of knowledge opens opportunities for consensus building and the potential for multi-scalar governance that is necessary to initiate the systemic shifts towards reducing inequality and ensuring environmental sustainability.

The challenge of shifting current trajectories is inherently interdisciplinary, requiring engagement from a wide range of perspectives

Rather than focusing on what can be gained from specialised technical skills and deep interrogation within a single field, this collection explores what is revealed when different types of knowledge and perspectives are brought together. Although there is general appreciation for the value of deep and specialised knowledge, there is a growing emphasis on the role of transdisciplinary approaches and multiple forms of knowledge in addressing contemporary wicked problems (Culwick and Patel, 2017; Vogel et al., 2016). No individual or single entity is able to see, comprehend or govern the entire urban system, and thus it is critical to draw on multiple approaches and forms of knowledge. By allowing complex interactions to emerge through deliberately exploring how issues play out at different sectors and scales, and by reading situations from different perspectives, it is possible to gain a better understanding of the system under study.

This volume argues that revealing the complexity within a particular case can enable a better understanding of how real progress towards just sustainability can be made more generally. Importantly, unravelling conflicts and contestations can contribute towards a better understanding of the interactions between social justice and environmental sustainability, which in turn opens up opportunities to avoid systemic lock-in to unjust and unsustainable trajectories. Empirical evidence from the GCR context provides rich opportunities to engage with the multiple and sometimes competing goals of economic growth, social justice and environmental sustainability.

Exposing the complex interactions between environmental sustainability and social justice is the focus of this volume, rather than attempting to rationalise or untangle them into straightforward conclusions. Although deliberately revealing complex interactions might seem counterproductive in the overall intention of building towards 'just sustainability', it is understanding the nuance and particularity of issues that protects against implementing 'solutions' that fail and reveals opportunities to avoid systemic lock-in or further entrench existing patterns.

Locating the case study in the GCR

Gauteng is South Africa's most densely populated region. Despite its small land area, it contributes more than a third to the country's GDP. Three of the country's most populous municipalities – Ekurhuleni, Johannesburg and Tshwane – comprise the core of the city-region. The city-region extends beyond the provincial boundary and includes urban nodes in the surrounding provinces, such as Potchefstroom, Sasolburg and Emalahleni (Figure 1.1).

The city-region has great mineral wealth, and in particular rich gold deposits. Although small urban settlements existed in the area before the discovery of gold, this mineral wealth was the primary reason for the enormous urban development of the GCR. Following the initial dominance of mining in driving economic development and employment, the 20th century saw the growth of the industrial sector, and over the past few decades there has been a shift towards the tertiary service sector, and financial services in particular (Mabin, 2013).

Although the region has rich mineral resources, natural resources such as water are limited. Gauteng depends on an extensive water transfer scheme which brings water hundreds of kilometres from Lesotho to provide for the region's water demands. Gauteng, like much of the rest of South Africa, relies on coal-powered electricity, which according to a 2019 Greenpeace study, is responsible for the Highveld[1]/Mpumalanga region (immediately adjacent to Gauteng) being one of the world's worst pollution hotspots (Myllyvirta, 2019). Gauteng also faces the environmental consequences of the mining industry, with toxic waste sites coursing through the city-region.

In recent years, the limits of natural resources and the negative impacts of past urban developments in Gauteng have become

1 The Highveld region comprises an area in the central plateau of South Africa, with a relatively high altitude, north west of the Drakensberg mountain range.

Figure 1.1: Map depicting the Gauteng City-Region with the Gauteng province at its centre and the urban land cover footprint of the city-region that extends into the surrounding provinces

DATA SOURCE: GeoTerraImage (2013)

increasingly evident. The province has experienced water shortages resulting from a recent drought, electricity 'load shedding' when demand has outstripped supply, over-stretched wastewater treatment plants, and air pollution that exceeds global health standards. Natural resource constraints in Gauteng relate both to the limitations of existing infrastructure and the overall availability of resources. These resource limitations play an important role in the long-term sustainability of Gauteng's development as well as the ability to meet the demand for basic services. The potential for achieving and sustaining a high quality of life in Gauteng is undermined by the inequality and unsustainability entrenched in the form and function of the city-region, which is a consequence of both apartheid planning and post-apartheid development.

Apartheid's injustices have left lasting impacts on South Africa, and some of these are evident in Gauteng's spatial form and social fabric. The apartheid government instituted laws that deliberately created spatial separation between racial groups, which undermined black people's ability to access services and economic opportunities. These laws had a fundamental impact on the development of cities, and have resulted in structural inequality, poverty and unemployment. These policies have had a lasting impact on Gauteng, which has one of the highest levels of inequality in the world and where unemployment remains a chronic problem. Furthermore, apartheid spatial planning resulted in cities with sprawling suburbs and great distances between residential and economic areas, necessitating long vehicle-based commutes (van Wyk, 2015). This urban form has persisted long after the end of apartheid due to the path dependencies of urban form and inertia within dominant development approaches (Mohamed, 2019). Consequently, Gauteng has high resource consumption and battles many negative environmental and social consequences of inefficient spatial form.

Despite the lowest fertility rate in the country, Gauteng is the fastest growing province. Population growth in the province is driven primarily by the inflow of migrants, most of whom are from within South Africa, with natural growth playing a smaller role (StatsSA, 2020). The GCR attracts people from across the country, continent and around the world because of the comparative availability of opportunities and services. Like many other Southern cities, urban population growth has increased the demand for shelter, basic services and resources, all of which Gauteng has struggled to keep pace with. This has compounded the historical backlogs in housing and basic service provision, and has resulted in a significant number of people living in inadequate conditions. Official statistics reveal that some 18% of households in the province reside in informal dwellings, and many people do not have access to safe drinking water (7%) or electricity (10%) (StatsSA, 2016).

In Gauteng, the juxtaposition of rich mineral wealth and resource scarcity, as well as extreme socio-economic inequality magnifies the tensions and trade-offs between social, environmental and economic objectives. This research focuses on the challenge of ensuring equitable distribution of resources, opportunities and burdens in the context of existing inequality and resource constraints. The GCR context makes for a relevant case study for interrogating the localised dynamics of planetary boundaries, global resource limits and climate change alongside issues of reducing poverty and inequality.

1.3 Evolution and logic of this research

This volume is the product of a research collective that brought together researchers from different backgrounds to explore just sustainability in Gauteng. This research collective, which was initiated by the volume's editor, emerged out of a desire to explore from a range of perspectives those instances where social justice and environmental sustainability are not neatly aligned. The aim of such an exploration is to refine how just sustainability is conceptualised and put into practice.

The research collective set out to:

- Unravel the sets of agendas, power relations and decision-making processes that influence how trade-offs are made and why particular decisions are reached within the context of the respective case studies;
- Reveal the nuance in the GCR context by using different analytical lenses or perspectives; and
- Lay a basis for reaching a more nuanced understanding that supports more informed and engaged decision-making by drawing on a range of knowledge types.

The researchers who were involved in this collective span a range of disciplinary backgrounds, which enabled rich dialogue and the cross-pollination of ideas from different theoretical and methodological approaches. Each researcher focused on a different case study in which tensions exist between justice and sustainability. These were primarily based on individual research interest and expertise. This group of researchers came together for two workshops over the course of 2017 and 2018. These workshops created space to debate and unpack the theoretical and practical challenges of just sustainability in Gauteng. They also helped to refine the overarching theoretical framework of this research (as presented in Chapter 2) and provided an opportunity for each chapter to be presented and discussed in conversation with the overall framing. Each respective case study was also presented in a two-part panel at the African Centre for Cities (ACC) International Urban Conference (February 2018). This provided an opportunity for external feedback on the various pieces and the overall framing as they were evolving.

Each author takes a different analytical approach to examine their case study, thereby revealing the complex interplay between and within justice and sustainability. These cases each examine different ways in which justice and sustainability interact and how alignment between these imperatives cannot be taken for granted. This demonstrates the relevance and necessity of research that deepens the understanding of just sustainability in both theory and practice. The collection is designed to show how just sustainability plays out across different sectors within a single geographical context – the GCR.

This volume does not attempt to smooth out the different approaches; rather, their juxtaposition highlights how different readings reveal new insights and how a range of forms of knowledge can bring richness to debates. The research deliberately engages with how different perspectives and rationalities influence assessments and outcomes related to just sustainability. The case studies grapple with what is 'fair' and 'just' – positions that are influenced by individual perspectives, values and belief systems. Subjectivity shapes decision-making processes as well as the analysis and assessment thereof.

Positioning the authors

The case studies in this volume engage directly with how different standpoints affect what conclusions are made about just sustainability, and in so doing surface tensions between and within justice and sustainability. Furthermore, the case studies emerged primarily out of the respective authors' existing research interests. For these reasons, the positionality of the respective authors is a critical consideration in the reading of each case study, and this volume as a whole. Each author is profiled below to give a sense of their positionality and to provide a background for the respective case studies.

Christina Culwick Fatti, the editor and an author of this volume, is a geographer with a focus on the boundary space between social and environmental systems within cities. She is a senior researcher at the Gauteng City-Region Observatory (GCRO), an organisation set up to straddle the boundaries of research and practice. She is both personally and intellectually motivated by the contemporary crises around inequality and global environmental change, and the role of transdisciplinary research for informing decision-making. Her theoretical contribution (Chapter 2) and empirical study (Chapter 5) have been developed in tandem with her PhD research, which explores social justice and environmental sustainability of government housing projects in Gauteng.

Emily Tyler and Brett Cohen, in Chapter 3, present a case study that they argue is positioned 'in-between' (policy levels, provinces, disciplines and fields), and as such, they emphasise the necessity to situate themselves as authors. They are both climate mitigation policy practitioners and researchers who focus on policy development at the national level. As is typical in their field (Tyler and Cohen, 2017), Cohen is an engineer and Tyler an economist. Their chapter is an extension of Tyler's transdisciplinary doctoral research into climate mitigation policy and complexity theory in the South African context.

Margot Rubin is an associate professor at the University of the Witwatersrand in the South African Research Chair in Spatial Analysis and City Planning, with interests in housing, urban development and urban governance. She was motivated to explore the dynamics of Parkhurst going off grid (Chapter 4) as she had noted particular dynamics at play in the media and was interested in engaging with how this micro case study could affect urban governance issues, including broader energy transition governance.

Lisa Kane is a freelance academic writer, researcher and activist whose focus lies in the politics of streets. Her work has centred on understanding the socio-political elements (both tacit and overt) of engineering and planning practices that shape urban roads. She has a particular interest in the human side of road infrastructure and planning, and socio-technical change. Her e-tolls exposition (Chapter 6) draws on her research and experience in road engineering within South Africa.

Gail Jennings has a background in sustainable transport and has strong interests in equity and social justice. She works as an independent researcher, and is currently working towards her PhD, which is focused on utility cycling (cycling as a means of transport rather than leisure) in South Africa. Her contribution (Chapter 7) draws together her interest in transport systems and the underlying dynamics related to ideologies and behavioural change.

Volume structure

This volume sets out to examine the interactions between social justice and environmental sustainability using the GCR as the case study context. The first substantive chapter in this collection (Chapter 2) provides a theoretical contribution to understanding just sustainability and proposes a set of considerations for applying it in practice. This chapter is followed by five empirical case studies, two focused on the energy sector (Chapters 3 and 4), one on housing and urban form (Chapter 5) and the final two cases concentrate on the transport sector (Chapters 6 and 7). The transport and energy sectors are relevant subjects for this research as they are two of the main contributors to greenhouse gas emissions globally and, by extension, to climate change. Urban housing is important as a case study given its role in ensuring access to services and opportunities for growing urban

Photograph by Mark Lewis

populations, and the associated environmental sustainability implications.

The theoretical chapter (Chapter 2) explores the interaction between social justice and environmental sustainability, and how just sustainability could be conceptualised. This is followed by an interrogation of some of the practical challenges in building just and sustainable cities, and an assessment of the interactions between justice and sustainability across social, spatial and temporal scales that can be generative in surfacing tensions and conflicting rationalities. This chapter posits that to make real progress towards just sustainability, it is necessary to move beyond conceptualising justice and sustainability as either opposing or interdependent. Rather, a more complex and nuanced understanding of just sustainability is more likely to facilitate engaged decision-making and multi-scalar governance, which are both critical for systemic shifts away from our current unsustainable and unjust development trajectory.

The first two case studies focus on one of the key domains in which just sustainability is being tackled explicitly in South Africa – the just energy transition. South Africa is a significant contributor to global carbon emissions, in a large part due to its dependence on highly polluting coal-based electricity. South Africa undertook what became a globally acclaimed Renewable Energy Independent Power Procurement Programme (launched in 2011), which has led to innovation, price reduction and significant private sector investment in utility-scale renewable energy projects. The programme has demonstrated the real potential of shifting to sustainable electricity generation. However, ensuring that this transition is just (affordable and accessible for all consumers, and protecting against job losses in the coal-related sectors) remains a key challenge with multiple considerations (Swilling, 2020).

These two case studies are juxtaposed to reveal contrasting contexts, with the Parkhurst off-grid case (Chapter 4) claiming the primary intention is to make electricity more sustainable; the Khanyisa project (Chapter 3) is framed primarily as an attempt to support broad economic development. These cases also each focus on a very different scale – one at the regional or national level and the other at the suburb or community level.

The Khanyisa project (a project within the Coal Baseload Independent Power Producer Procurement Programme) was part of government's response to the load-shedding crisis and the need to increase capacity in the national grid. In this chapter (Chapter 3), Tyler and Cohen unpack the programme's environmental and social impacts, including *inter alia* local air quality, water, employment and local economic implications, and health. Their study shows how the entanglement of environmental sustainability and social justice can be interrogated through engaging a complexity lens. They argue that the process of simplification, while useful to influence high-level political agendas and policies, is unhelpful at the project scale and can in fact be used to undermine real progress towards just sustainability. In some cases, invoking environmental sustainability and social justice can be performative and mask underlying agendas. This is particularly effective where there is a paucity of data. In their case, poor data opened opportunities for those with vested interests to make claims about the benefits of the proposed projects that could not be refuted (or supported). However, the case also highlights how access to data was used by community groups to exert influence over decision-making processes – and in their case to oppose the coal projects.

Rubin (Chapter 4) explores Parkhurst's attempt to go off grid as the community-level response for trying to withdraw from government services because of the instability of the national grid. This case demonstrates how the elite suburb's intentions to transition towards sustainable electricity supply were motivated by the increasing affordability of solar technology and a desire to secede from government-provided services due to frustration with electricity supply interruptions. The consequences of this move, while improving the suburb's environmental footprint, undermine the City's ability to cross-subsidise poorer households – thus entrenching inequality in resource distribution. Furthermore, reducing municipal revenue reduces the financial resources available to the City to pursue more sustainable energy options at the municipal scale. Rubin further explores the complex

interplay between considerations across different types of justice – namely procedural, spatial and distributive justice. The case shows how the strong social cohesion, inclusivity and participation at the community scale can perpetuate privilege and access to quality resources, and undermine inclusion across broader society. The study highlights (although not explicitly) the risk of a transition towards environmental sustainability that maintains middle-class lifestyles and further perpetuates inequality in South Africa – in effect, the potential for an unjust transition towards environmental sustainability.

Culwick Fatti's chapter (Chapter 5) presents an empirical analysis of government housing in Gauteng, and explores a range of factors that influence social justice and environmental sustainability outcomes. The chapter interrogates different interpretations or elements of social justice and environmental sustainability as related to government housing developments. She argues that the conclusions around whether government housing developments foster just sustainability depend on the variables and criteria that are assessed. Her study highlights that terms such as 'well-located' and 'compact urban form' – which are assumed to align social justice and environmental sustainability – are not singular concepts and can be interpreted in various ways, each leading to different conclusions. For example, although the study shows that commuting distance is correlated with higher employment levels, broader quality of life does not seem to improve with proximity to economic opportunities. The chapter argues that decision-makers can be influenced by different interpretations and measures of social justice and environmental sustainability. By showing conflicts between different interpretations of justice, she argues that real progress towards just sustainability requires a complex and nuanced understanding that considers a range of outcomes across temporal and spatial scales.

In Chapter 6, Kane presents the history, justifications and motivations around Gauteng's freeway upgrading project and associated e-tolling scheme between 2007 and 2017. Through this exposition, she argues that although the project was based on international evidence and could in theory be argued as furthering environmental sustainability and social justice goals, the particularity of the post-apartheid context rendered the scheme neither just nor sustainable. Kane introduces the idea of 'conceptual smoothing', which is valuable for the volume as a whole. She argues that terms that might seem neutral or static in meaning, like 'roads', in practice signify different things in different contexts, because they embody socio-political components in addition to the physical infrastructure. Through the case study, she argues that by looking at different scales, different conclusions can be drawn, and she emphasises the importance of interrogating 'sustainability' and 'justice' for whom and to what end. She concludes that although 'just sustainability' is an important call to action, as an analytical frame it does more to hide than illuminate.

Jennings, in Chapter 7, lays out the entanglement of motivations and rhetoric around utility cycling and the investment in bicycle infrastructure in Johannesburg. She highlights that the related decision-making processes were influenced by funding, political agendas and international framing rather than local perspectives. On paper, utility cycling and investing in bicycle infrastructure furthers both sustainability and justice imperatives; however, Jennings argues that the City of Johannesburg's bicycle programme achieved neither of these objectives. She highlights how there has been a muddling of justifications between social justice and environmental sustainability outcomes that has undermined the broader acceptance of the programme. This case study highlights how when complex urban spaces like the GCR confront uncertainties such

To make real progress, it is necessary to move beyond conceptualising justice and sustainability as either opposing or interdependent

as climate change, and demographic and economic uncertainty, a complex political/technical context is created in which normative decision-making is impractical. This chapter highlights how different interpretations of what is important reflect conflicting rationalities that play out to undermine the potential of bicycle mobility to contribute towards just sustainability.

1.4 Conclusion

We are confronted with the challenge of developing cities and societies that respond to the key challenges of our age – climate change, resource scarcity, poverty and inequality. This volume furthers the discourse on just sustainability and demonstrates that, while a crucial objective, building environmentally sustainable and socially just societies is neither simple nor straightforward.

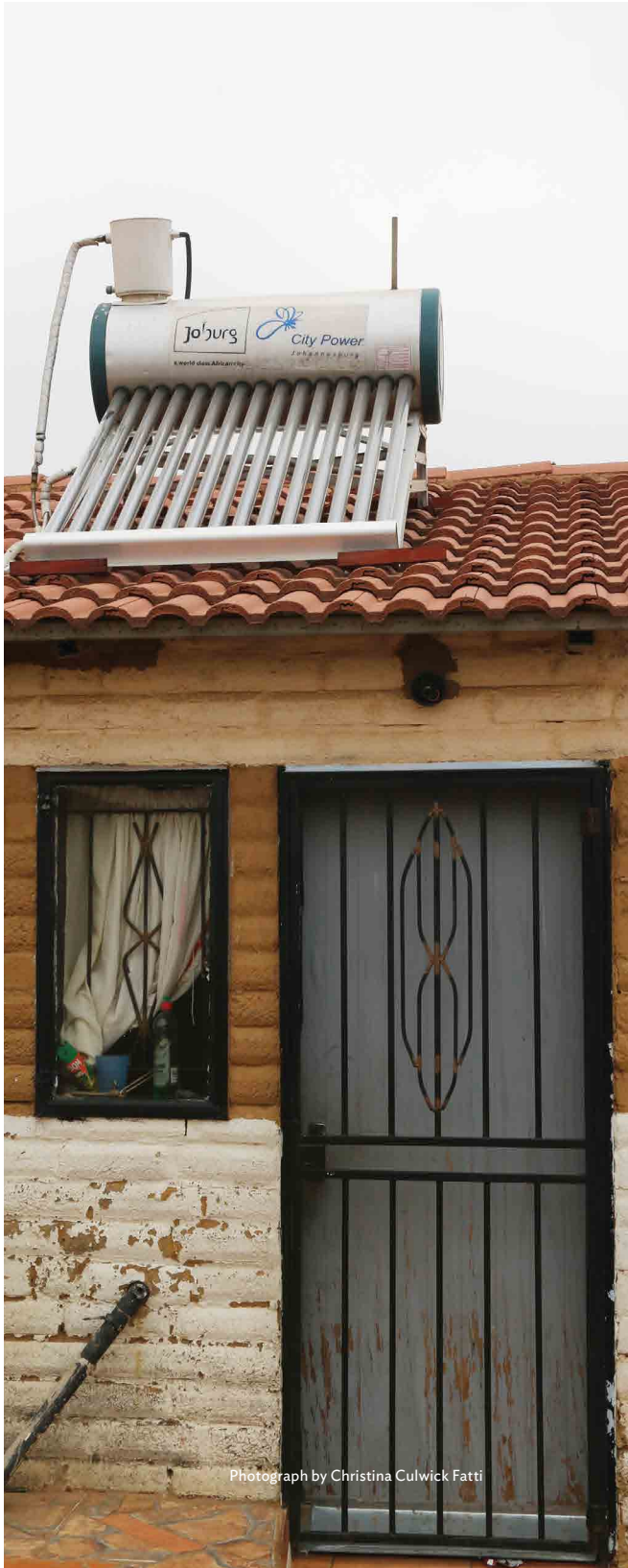
This volume draws on existing theorisation around the intersection between justice and sustainability. Although this contemporary theory is useful in delineating the interaction between social justice and environmental sustainability, it is arguably insufficient in providing a full understanding of the dynamic interaction between justice and sustainability. Although this volume aims to further ideas around just sustainability, it concurrently questions the usefulness of a single overarching concept to reconcile social justice and environmental sustainability in practice given the complex interactions between the two. The various case studies presented in the following chapters demonstrate that although terms such as 'just sustainability' can be useful in mobilising support and buy-in at a conceptual level, they have the potential to hide or smooth over the complexity inherent in translating these concepts into practice. This volume argues against narrow interpretations and approaches that have the potential to undermine real progress towards just sustainability. The attention that this volume pays to complexity, nuance, subjectivity and contradiction is critical in the South African context, given the need to avoid lock-in and accommodate socio-economic diversity within policies, planning and practice. Furthermore, these elements have the potential to facilitate better multi-actor governance, which is critical for the systemic changes required to respond to contemporary challenges.

The case studies in this volume each highlight a complex set of challenges that decision-makers are confronted with in trying to marry environmental sustainability and social justice. Each chapter works actively against simplifying concepts – which Kane (Chapter 6) terms 'conceptual smoothing'. Although there are potential gains from rationalising issues into 'clear' outcomes, things are also lost in the process. The case studies raise further questions which are key to understanding the interactions between environmental sustainability and social justice, to surfacing the barriers and opportunities for managing trade-offs, and to bringing justice and sustainability into closer alignment.

Gauteng provides an appropriate focus for examining interconnections between social justice and environmental sustainability because of the clear just sustainability conundrums that play out across society, space and time within the city-region. It is one of the world's most unequal societies, where wealth inequality strongly correlates with resource consumption and who bears the burden of the environmental ills. The historical legacy of apartheid has entrenched patterns of inequality along racial lines and translated these spatially across the urban landscapes, where marginalised and disadvantaged groups bear the brunt of environmental ills (Roberts, 2003). Post-apartheid development has not only exacerbated the locational disadvantage of the poor, black majority, but it has also exacerbated sprawl and inefficient urban form, which has implications across society, including for the wealthy elite, and contributes to a range of environmentally unsustainable consequences. The city-region faces an array of environmental resource constraints that play against the need to extend access to basic services to currently underserved groups and the growing urban populous.

The diversity and complexity within this urban system can coalesce and exacerbate the contradictions and trade-offs between justice and sustainability. Therefore a focus on a city-region like the GCR provides fertile ground to deepen understanding of interaction between justice and sustainability. While these challenges have a particular context in the GCR, the environmental sustainability and social justice conundrums are emblematic of the challenges faced by many urban centres around the world. This research does not argue for the uniqueness of the GCR in this regard, but rather that the large number of relevant examples in just one small corner of the world clearly demonstrates the significant need to engage issues of just sustainability in a deeper and more robust way.

The intention of this volume is to open up the debate and ignite deeper engagement around the complexity of concurrently building towards social justice and environmental sustainability. To do this, it is necessary to move beyond the current understanding of what is 'just' or 'sustainable' and challenge simplified conclusions that place environmental sustainability and social justice either in complete alignment or in opposition. It calls for moving beyond the normative assumptions about justice and sustainability with the intention of re-orienting understandings around decision-making and knowledge. This is critical for cities to shift away from the current systems and path dependent trajectories that lead us in unsustainable and/or unjust directions.



Photograph by Christina Culwick Fatti

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Chapter 2

Just sustainability in cities

CHRISTINA CULWICK FATTI

Abstract

The idea of 'just sustainability' is based on the premise that environmental and social challenges are interconnected, where efforts to stay within planetary boundaries are influenced by actions to improve quality of life for the poor and reduce inequality, and vice versa. However, despite policy commitments and scholarly assertions that with sufficient care, environmental sustainability and social justice can be achieved simultaneously, in reality, there is a much more complex relationship between and within these imperatives. This chapter provides the conceptual basis for the subsequent case studies in this volume by examining social justice, environmental sustainability, and the interaction of these two – identifying ways in which just sustainability can be conceptualised. The chapter then focuses on the practical challenge of building cities that are both socially just and environmentally sustainable, and uses 'society', 'space' and 'time' as lenses through which to surface the multidimensional interactions between justice and sustainability. The chapter argues that to further just sustainability in the context of approaching planetary boundaries and the current levels of poverty and inequality, robust engagement with complex interactions between just sustainability and pushing back against simplification is necessary. By exploring just sustainability from different perspectives, and engaging with both the tension and alignment between justice and sustainability, a rich, nuanced and complex understanding can be found, which is critical for urban decision-making for transformative change.

2.1 Introduction

In recent years, South Africa has witnessed behavioural shifts in water consumption, which have in part been shaped by devastating drought conditions. This shift towards more environmentally sustainable resource consumption is both necessary and important, particularly in the context of broader resource scarcity and global environmental change. However, more efficient resource use in South African cities has placed pressure on municipal finances, as they depend on the revenue generated from utilities to provide infrastructure and services to residents. Importantly, high water users cross-subsidise poor households. Due to reduced revenue from lower resource consumption, many metropolitan municipalities, including Johannesburg, have suspended the provision of 6 kl of free basic water for all households in favour of providing free water only to registered indigent households. Cities have justified this tariff restructuring as necessary to increase revenue and enable infrastructure provision to communities without access to basic services (Dagada, 2017).

This case reveals a complex relationship between issues of social justice and environmental sustainability. On one hand, increasing resource efficiency is not only environmentally sustainable,

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it also enables wider and more equitable distribution of a scarce natural resource; on the other, reducing resource consumption undermines the capacity of cities to provide infrastructure and services to the poor. Furthermore, while tariff restructuring protects access to water for the poorest groups, poor households that do not qualify as indigent bear the brunt of more sustainable water consumption. This further highlights the 'contestation of ethics between [...] equally valid but competing goods' (Götz, 2018) and the associated challenge of building just and sustainable cities in the current age.

Increasingly, resource limits (at both local and global scales) and planetary boundaries are significant concerns for the continued ability of the Earth to sustain human society (Steffen et al., 2018; Steffen et al., 2015; Rockström et al., 2009). The concept of planetary boundaries is based on the idea that there are biophysical thresholds within the Earth system that, if breached, could cause 'unacceptable' catastrophic, non-linear change (Rockström et al., 2009). Climate change is one of the thresholds within the Earth system. Concurrently, inequality and poverty are critical focal points in global commitments such as the Sustainable Development Goals (UN-Habitat, 2016). Not only do these global issues manifest at the local level, but cities – and particularly rapidly growing cities in the global South – can play a critical role in reducing poverty and inequality while minimising and/or reducing resource use and environmental impacts (IRP, 2018; Westphal et al., 2017; Campbell, 2016; Davis, 2010; Rockström et al., 2009).

The idea of a 'just sustainability' is based on the premise that environmental and social challenges are interconnected, where efforts to stay within planetary boundaries are influenced by actions to improve quality of life for the poor and reduce inequality, and vice versa (Roy et al., 2018). Recent global agreements acknowledge this dual challenge and countries across the globe have committed to pursuing development that is both socially just and environmentally sustainable (Ziervogel et al., 2021; UN-Habitat, 2016). These commitments explicitly target past development that has led to inequality, unemployment, climate change and environmental degradation, ensuring that future development does not further entrench these negative consequences.

However, despite policy commitments and scholarly assertions that, with sufficient care, environmental sustainability and social justice can be achieved simultaneously (i.e. just sustainability), in reality, there is a much more complex relationship between and within these imperatives (Ciplet and Harrison, 2020; Culwick and Patel, 2020). The difficulty in translating just sustainability into practice suggests that there remains a muddy terrain where trade-offs must be made between social justice and environmental sustainability (Ciplet and Harrison, 2020; Culwick, 2015). However, this challenge does not necessarily reflect a need for greater commitment or effort; rather, it reflects a need for greater engagement with complexity, and a need for considering how justice and sustainability interact at different temporal, social and spatial scales. The challenge of bringing about social justice and environmental sustainability is not only practical but also conceptual.

This volume explores instances where the goals of social justice and environmental sustainability intersect but do not necessarily 'co-determine each other' (Heynen, 2013, p. 1). The idea of 'just sustainability', although potentially useful in focusing policies and high-level commitments, can hide the complexity associated with building more socially just and environmentally sustainable cities (see Chapters 3 and 6). This research challenges simplified framings and conclusions through carefully interrogating the interaction between and within social justice and environmental sustainability from various perspectives.

This chapter provides the conceptual basis for the subsequent case studies presented in this volume. First, the chapter engages with ideas around environmental sustainability and social justice, and explores how their interaction can be conceptualised, including the potential for a 'just sustainability' framing. Second, the chapter focuses on the practical challenge of building cities that are both socially just and environmentally sustainable, and demonstrates how considering justice and

sustainability across society, space and time can be useful in surfacing multidimensional interactions. Third, the chapter concludes that building complex understanding around just sustainability is critical for navigating decision-making towards transformative change.

2.2 The theoretical challenge of conceptualising just sustainability

There is now widespread consensus that human activity has fundamentally changed the Earth system (Allen et al., 2018). Climate change is one of the numerous consequences of the way in which societies have developed, consumed resources and modified ecological systems. In addition to climate change, scientific evidence suggests that the Earth system is beginning to exceed the planetary boundaries that contain the 'safe operating space' in which society can thrive (Steffen et al., 2015). In other words, the extent of *inter alia* pollution, land-use change and biodiversity loss caused by society is threatening the ability of the Earth system to ensure the availability of fresh water, clean air, a stable climate and other elements that are critical for human survival (Steffen et al., 2015; Rockström et al., 2009). Scientists increasingly highlight the urgency for taking the action required to remain within the limits of the Earth system (Allen et al., 2018).

Although significant damage has already been done, if society shifts its current practices and modes of development, scientists signal that it is possible to stay within the identified planetary boundaries (Roy et al., 2018; Steffen et al., 2018; Steffen et al., 2015), and by so doing ensure environmental sustainability. Environmental sustainability requires that ecological systems are conserved, land-use change and degradation are minimised, resources are used sparingly and efficiently, and waste products are minimised and discarded in ways that do not damage ecological systems (IPCC, 2019; Steffen et al., 2018). The climate change discourse has raised global awareness around the need to reduce greenhouse gas emissions, and has elevated environmental considerations into decision-making at all scales – from neighbourhood and city scales all the way up to national and regional.

However, actions to ensure environmental sustainability have to consider the equally valid pursuits of addressing poverty and inequality. Swilling and Annecke (2012, p. xiii) contend that

> what is at stake is not simply a transition to a mode of production and consumption that is not dependent on resource depletion and environmental degradation, but as important is the challenge of a just transition that addresses the widening inequalities between the approximately one billion people who live on or below the poverty line and the billion or so who are responsible for over 80 per cent of consumption expenditure.

Davis (2010) argues that both the causes and impacts of climate change are unjust, where those who are likely to be worst affected have not only contributed to and benefited the least from the causative development and resource consumption, but they also have limited influence over decisions that affect future impacts. Increasingly, issues of justice are being emphasised by scholars as critical for effective environmental sustainability responses (e.g. Westman and Castan Broto, 2021; Hughes and Hoffmann, 2020).

Social justice focuses on principles of equity and fairness – the desire to enhance overall well-being by addressing existing or inherited inequality, rather than by treating all people the same regardless of differences in their original starting positions (Leach et al., 2018). There are different elements

Actions to ensure environmental sustainability have to address poverty and inequality

or considerations within social justice, including distributive, procedural and recognitional justice (Ciplet and Harrison, 2020; Menton et al., 2020; Leach et al., 2018). Distributive justice refers to the equitable distribution of resources (including both benefits and costs) that works towards reducing or redressing existing inequitable distribution. Procedural justice refers to the decision-making and conflict resolution processes, and to ensuring that the means by which an outcome is reached or conflicts are resolved are fair. Procedural justice tends to be synonymous with inclusive and democratic processes that include adequate participation, particularly with those most affected by the decision under consideration. Recognitional justice acknowledges individual identities and values, and reacts against cultural or political discrimination. While acknowledging that recognitional justice is a necessary component of overall social justice, particular emphasis in this volume is placed on distributive justice and procedural justice.

Rawls (1971, in Duclos, 2006, p. 4) posits a definition of justice that takes into account both procedural and distributive justice, where '[a]ll social primary goods – liberty and opportunity, income and wealth, and the bases of self-respect – are to be distributed equally unless an unequal distribution of any or all of these goods is to the advantage of the least favored'. Campbell (1996) suggests that social justice, with regards to sustainable development, refers to the striving towards a fair or equitable distribution of resources, and the benefits and costs of development, while taking into account the natural resource implications and limits.

While these definitions are useful in bounding what is referred to by social justice, not only are these ideas contested, there are many interpretations of what is just in reality (Davies, 2011; Harvey, 2003). Different ontological perspectives or world views provide different assessments of what is right, good, fair or just. Some of these differences relate to questions of justice for whom and in terms of what, while others arise from whether equality in the process or outcome is more important (Harvey, 2003).

Although there are instances where procedural and distributional (in)justice align – for example, the communities who are most likely to bear the worst consequences of climate change have not only contributed the least to its causes but they also have limited influence over related decision-making processes (i.e. an unfair process resulting in an unfair outcome) – it is possible for a just process to result in distributional injustice, or for an unjust process to result in just distribution. Where there is misalignment between process and outcome, assessing the 'most' just or fair position can be very difficult (Campbell, 1996). This challenge is complicated where ensuring justice for some undermines the ability to deliver justice for others. Competition over resources, particularly where scarcity exists, is likely to lead to unjust outcomes, where processes are influenced by power and vested interests (Menton et al., 2020). Harvey (2003) cautions against uncritical views of justice, as these 'ideals' can hide vested interests and attempts to maintain existing systems that contribute to unjust systems.

Photograph by Clive Hassall

Bringing justice and sustainability together

The boundary between justice and sustainability has been conceptualised in various ways over time, and these vary across different disciplines and sectors. Sustainable development has been and remains the dominant concept that tries to align human and environmental outcomes, and has been widely incorporated into global plans and policies (Mohamed, 2019). Ideas around sustainable development were established in the 1987 Brundtland Commission report, *Our common future*, and centre around the principle that current generations should develop and consume resources in such a way that not only meets the current social and economic needs but protects environmental systems, ensuring that future generations can also meet their needs. In this framing, the ideals of economic growth, social justice and ecological protection are brought together as mutually attainable and interdependent (World Commission on Environment and Development, 1987).

Since the emergence of the idea of sustainable development in the 1980s, there has been increasing acknowledgement that social, environmental and economic systems are interconnected. Some argue that the environmental crisis and social injustices are both consequences of the dominant socio-economic-political system that prioritises individual interests and wealth accumulation over ensuring equitable distribution and environmental stewardship (Swilling, 2011; Roberts, 2003).

Although the fundamental principles of sustainable development have been widely endorsed, the emphasis on protecting resources for future generations has been perceived as unjust for the current generation. Scholars argue that this tension between acting in the interests of the current versus future generations is one of the reasons why implementing sustainable development has been so difficult (Jasanoff, 2010; Agyeman et al., 2002). The idea that decisions need to be made in favour of an abstract group of people (i.e. future generations) over those who are currently facing poverty and poor quality of life has contributed to the notion that environmental sustainability (future focus) and social justice (present focus) are oppositional. This has also motivated scholars and activists to pursue environmental justice (Agyeman, 2005).

Environmental justice draws direct links between environmental ills (e.g. pollution and environmental degradation) and the uneven distribution of these ills across society, which tend to be disproportionately borne by the poor (Menton et al., 2020; Roberts, 2003). In essence, the environmental justice movement argues, through case studies (typically local cases), that development which results in environmental ills contributes directly to social injustices. In many of these cases, addressing the environmental ill will consequently address the associated injustice. For example, cleaning a polluted river along which a community lives not only addresses the environmental issues associated with pollution such as damaged aquatic ecosystems, but it also improves the quality of life for the community and lowers the chance of their becoming ill from the contaminated water.

Cases such as this, which highlight the intersection between environmental ills and social injustices, suggest that simply solving the environmental ills will improve the quality of life for the least advantaged in society – a socially just outcome (Schwarz et al., 2015; Davis, 2010). However, scholars warn that although there are indeed cases where social justice and environmental sustainability align to produce a just and sustainable outcome, tensions between these imperatives could result in a just but unsustainable outcome, or an unjust sustainable outcome (Ciplet and Harrison, 2020). Swilling argues that an unjust sustainable transition is a strong possibility (Swilling, 2019). This could happen if a transition to environmental sustainability occurred in a way that maintained or entrenched existing systems of capital accumulation and inequality. For example, if wealthy consumers and businesses shifted to off-grid renewable energy sources, this could result in public electricity utilities being left with insufficient revenue to ensure electricity access for the poor. In this context, Hallowes and Munnik (2019) call for expanded imaginaries around potential future outcomes that are based on the utopian goal of a just transition.

Many of the visions and commitments at global, national and local levels are based on utopian ideals and assumptions that social justice and environmental sustainability can be aligned and are potentially mutually attainable. A key example

of this is Raworth's (2012) doughnut model, which has been used widely within scholarly and policy documents (Raworth, 2017). This model depicts the area of commonality between environmental sustainability and social justice in the form of a doughnut. This model is based on the rose plots used in the planetary boundary literature (see Steffen et al., 2015; Rockström et al., 2009), where resource use and environmental impact increase from the circle's centre point (Pasgaard and Dawson, 2019). The doughnut, as Raworth (2012, 2017) describes, is the 'sweet spot' where an acceptable level of quality of life is secured for all people (requiring a minimum 'social foundation' of resource consumption), without exceeding planetary boundaries – the 'ecological ceiling' (Raworth, 2017, p. e48). This model posits that a 'safe *and just* operating space for humanity' (Raworth, 2012, emphasis added) could be achieved with sufficient commitment to realigning economic, governance and socio-ecological systems.

Models and metaphors such as the one that Raworth (2012) devised are designed to visualise the interconnection between social justice and environmental sustainability to garner support for a just sustainability. However, the implicit assumption of many of these models is that social justice and environmental sustainability are mutually attainable through the 'win-win' of sustainable development (Campbell, 2016). Despite support for these models, there is little consensus around how environmental sustainability and social justice interact (Leach et al., 2018). Ideas around their interaction tend to fall along a spectrum where, on one side, scholars frame the two as interdependent, where equity is a precondition for attaining a truly sustainable society and vice versa (Heynen, 2013; Swilling and Annecke, 2012; Agyeman, 2005; Agyeman et al., 2002; McDonald, 2002). These scholars argue that because environmental resources and ecological systems are critical for human well-being, environmental sustainability is a precondition for social justice. On the other side of the spectrum, the two goals are considered as opposing (Patel, 2006; Marcuse, 1998). Leach et al. (2018) propose that a balance between these perspectives is needed, and that there is a dynamic zone of desirability, where sustainability and equity can be mutually attainable. They emphasise that while there might be some objective thresholds that bound this zone – in this way supporting Raworth's doughnut concept – there are many elements that are subjective and open to interpretation.

Ciplet and Harrison (2020) argue that although it is necessary to focus attention on the intersection between social justice and environmental sustainability, understanding the tensions that arise between different forms and interpretations of these imperatives is critical for making real progress towards just sustainability. Roberts (2003) argues that while it is important to further theoretical debates, it is also necessary to move beyond abstract ideals and into the practical challenge of moving towards just sustainability. The following section examines how justice and sustainability interact in practice, and how considering their interactions across different dimensions can be productive for both furthering the theoretical understanding of – and supporting action for – just sustainability.

2.3 The practical challenge of applying just sustainability

Building just and sustainable cities in practice requires progress towards the equitable distribution of resources as well as the benefits and costs of urban development. It requires that inequalities in distribution are reduced or redressed. The following section explores how distribution occurs across society, space and time. Examining how benefits and costs are distributed across these three dimensions can help build an understanding of how conflicts arise between sustainability and justice imperatives. This is particularly evident where achieving a sustainable or equitable distribution within one dimension undermines the ability to achieve a sustainable or equitable distribution across another. Reframing just sustainability along these three dimensions allows for an easier assessment of how social justice and environmental sustainability considerations interact and whether feedbacks across space and time influence the potential for just sustainability (Leach et al., 2018).

Sustainable and equitable distribution across society, space and time

The benefits and burdens (both social and environmental) of development are distributed unevenly across the dimensions of society, space and time, and this is the basis for concerns around distributional justice. Although these dimensions can be considered in isolation, they are often linked. For example, the apartheid government used locational disadvantage to create unjust spatial form and thus oppress particular groups within society. This has had not only significant environmental consequences, but these past decisions have locked the current and future generations into a developmental trajectory that is both environmentally unsustainable and socially unjust (Budlender, 2016; Haferburg, 2013; Mubiwa and Annegarn, 2013).

Guibrunet and Broto (2016, p. 163) posit that 'the production of social inequality is correlated to the use of resources', where increased wealth is typically associated with increased resource consumption. For example, water consumption is higher in wealthier households because they can afford water-dependent luxuries such as swimming pools and large gardens that require irrigating, whereas poorer households consume less water (both in absolute terms and per capita) because of the costs associated with water consumption. A greater level of access to resources creates an advantage that further perpetuates inequality. Agyeman and Evans (2004) highlight that by the very nature of society, the least advantaged will bear the burden of the negative impacts of urban development and those who hold power and wealth will ensure that they are not subjected to these burdens. This is particularly evident in examples of spatial injustice and many case studies within environmental justice literature.

Locational disadvantage and advantage are influenced by existing landscapes as well as the uneven distribution across space of the benefits and costs of development. Environmental justice is often considered to be closely tied to locational injustice with respect to environmental ills (Holifield et al., 2009). For example, toxic waste disposal sites (landfills, mine dumps, etc.) can lead to contaminated air, soil and water in the surrounding areas, with consequent health issues for adjacent communities. The communities who live alongside these sites tend to be poor and marginalised, without the means to live elsewhere. These communities also tend to have limited influence over decision-making processes that guide the establishment and management of these sites. In many of these cases, communities suffer poor quality of life because they bear the burden of resource consumption that has raised the quality of life of more advantaged groups. Cock (2019) argues that environmental ills perpetuate existing inequality, and in the South African case are highly racialised and gendered, with women and black Africans bearing disproportionate burdens.

Davis (2010) argues that, given resource constraints, committing to just sustainability requires a broad focus on improving overall quality of life across society rather than enabling the concentration of wealth or quality of life in a small proportion of the population. In other words, facilitating a more equal distribution of finite resources means not only that the least advantaged should receive greater access to resources, it also requires that those people or groups who have enjoyed disproportionately more resources in the past must use fewer resources and lower their consumption. There is an undeniable trade-off between ensuring equitable access to resources and overall resource consumption. Some argue that ensuring access to services for poor and underserved groups will have a minimal impact on overall resource consumption as they consume small quantities of resources compared to wealthy groups (Goebel, 2007). However, current resource consumption patterns are already unsustainable and thus it is critical to reduce overall consumption to enable access for those with

Environmental ills perpetuate existing inequality and are highly racialised and gendered in South Africa

inadequate access, without overshooting planetary boundaries. It is only through reducing overall resource consumption and improving resource efficiency that there will be sufficient resources available for everyone in this generation, as well as in the future.

Sustainable development places particular emphasis on intergenerational justice (Menton et al., 2020). This flags the importance of minimising the negative consequences of development (resource consumption and waste production) so that future generations have sufficient resources to meet their needs and are not unjustly burdened by the negative consequences of current actions, such as an Earth system that is unable to support society (Steffen et al., 2015). Many early sustainability advocates bemoaned the tendency to externalise costs of development onto future generations (Campbell, 2016). However, Patel (2014) argues that in the face of multiple stressors, the focus tends to shift to more immediate issues, often linked to social justice imperatives, over the longer-term environmental sustainability concerns. While there is a strong argument to prioritise reducing existing injustice over a potential future injustice or a delayed impact with uncertain consequences, it is nevertheless important to acknowledge that actions taken now will have an impact on the ability for future generations to thrive. Furthermore, given that wealthy individuals and groups are disproportionately responsible for environmental ills, it is perverse to blame poverty-reduction strategies for future environmental consequences.

Temporal considerations and trade-offs between prioritising immediate needs versus longer-term consequences are particularly pertinent in just sustainability. These trade-offs are evident in the impact that historical actions have had on our current ability to achieve sustainable and just cities. Climate change exemplifies the way in which environmental costs of past (and current) development have been externalised onto future generations. The way cities and infrastructure have developed over time has a direct influence on current and future resource consumption patterns (IRP, 2018) and in many cases cities have been locked into highly resource consumptive patterns because they were built at a time when resource availability was not a constraint (or was less of a concern than the immediate need) and there was little understanding of the environmental and social costs of pollution and ecological degradation. It is important to note that the temporal trade-offs are not necessarily restricted to short-term social justice versus longer-term environmental justice imperatives. Apartheid spatial planning in South African cities, which deliberately excluded the black populations from accessing basic services and economic opportunities, has had lasting effects on both environmental sustainability and social justice. Now, more than two decades after the end of apartheid, South African cities are characterised by sprawl, where long-distance commutes and the high cost (financial and environmental) of delivering basic services are disproportionately borne by the least advantaged in society (Culwick and Patel, 2020; Mubiwa and Annegarn, 2013). This illustration of temporal considerations also highlights the importance of the spatial distribution of resources and development.

Urban spatial form has direct implications for resource use, and land-use change and degradation. A dispersed and sprawling urban form not only increases land consumption and the embedded resource costs of infrastructure provision (Sinha and Griffith, 2019; Camagni et al., 2002), but the distribution of resources and opportunities over space also has a direct impact on the accessibility of services and opportunities for urban residents (Rode et al., 2014). In some cases, reducing spatial injustice aligns with reduced resource consumption and waste production. For example, urban areas like the Gauteng City-Region have developed in car-centric ways, which not only entrenches the need for private cars to facilitate urban accessibility, but also results in inefficient urban form. Rode et al. (2014) argue that accessibility and resource efficiency can both be improved through building compact cities that are designed around public transport. This is a key consideration given that cities in Africa are growing at globally unprecedented rates in terms of population (OECD/SWAC, 2020) and cities in the global South are growing faster in urban extent than population (UN-Habitat, 2020). These patterns suggest that unless current growth trajectories change dramatically, African cities are set to become highly resource intensive, with poor accessibility.

However, not all actions that increase accessibility for the least advantaged in society will have positive environmental consequences, and vice versa. As Kane (Chapter 6) argues, given the persistent spatial inequality set in place during apartheid, private cars are necessary to improve access to opportunities for disadvantaged groups. Thus facilitating private car use might be a socially just strategy, especially given that the existing spatial form is economically unsustainable for mass public transport (e.g. buses and trains). However, such car use is an environmentally unsustainable strategy. This example demonstrates path dependencies of urban spatial form and infrastructure decisions and the impact these can make on future decision-making options. Furthermore, as Culwick Fatti (Chapter 5) demonstrates, superficial analyses that are based on assumptions about sprawl or what 'well-located' means can lead to incorrect conclusions regarding environmental sustainability and social justice.

There are also instances where actions framed as environmentally sustainable result in the creation of exclusionary spaces. For example, privatising or charging access to green open space can help to ensure proper maintenance, thus maximising the quality of these spaces and their ecosystem services, but as a consequence they become exclusionary for those who cannot afford to pay for access.

This section has demonstrated the importance of nuanced and context-specific analysis in understanding the interactions between social justice and environmental sustainability. Furthermore, understanding the interactions within and between dimensions of society, space and time can reveal conflicts or contradictions that have significant implications for decision-making.

Conflicting rationalities and decision-making

While justice and sustainability are imperatives that are strongly interwoven throughout policies, legislation and plans, Patel (2006, p. 692) emphasises that 'a policy commitment to sustainable development does not automatically result in the achievement of social and environmental justice'. This inability to achieve both just and sustainable outcomes is not necessarily reflective of a lack of will, or even the lack of explicit strategies to foster these imperatives, but rather the result of a complex set of factors and trade-offs.

A key challenge of applying just sustainability is in identifying who the least advantaged in society are. Campbell (1996) demonstrates that assessing what the most just or fair position is can be very difficult, particularly when a just process does not align with a just outcome. This challenge is further complicated where an equitable distribution of one resource undermines the equitable distribution of another, or where an equitable distribution across current generations undermines the potential for equitable distribution across generations. In some cases, a just outcome has negative environmental consequences and vice versa (see examples above).

Photograph by Clive Hassall

Conflicting rationalities between different interpretations of justice or where trade-offs exist often result in decisions that favour those with power and influence. Active planning and participatory decision-making processes are required to counteract this tendency and ensure that the least advantaged are not further disadvantaged by procedural injustice. The environmental justice movement draws attention to the fact that poor and marginalised groups tend to have limited influence over decision-making despite bearing a disproportionate burden of consequences. This intersection emphasises the importance of giving a voice to the least advantaged. However, as Harvey (2003) highlights, ensuring procedural justice does not necessarily result in distributional justice, and in some cases, it is impossible for the affected groups to participate in decision-making. For example, future generations who will bear the consequences of past decisions cannot be part of the relevant decision-making processes.

Murdoch (2000) asserts that both technical and political considerations influence urban decision-making. For example, data and models that quantify the need for housing and services feed into planning of government housing developments. However, these processes are also influenced by political agendas, urban planning philosophies and individual perceptions. To understand what guides decisions, particularly within the context of competing rationalities and necessary trade-offs, it is critical to understand both the knowledge that guides decisions, as well as the underlying assumptions and the different philosophical, ethical and moral positions of decision-makers (Patel, 2006). Cock (2019) argues that to make progress towards just sustainability, conventional wisdom and assumptions need to be challenged. For example, support for a systemic shift towards renewable energy requires that the widely held assumptions around the dependence of economic growth on coal mining and associated power generation are challenged. The inertia of existing logics and practices can pose significant barriers to achieving just sustainability (Duminy et al., 2014).

Watson (2003) highlights the importance of exploring how conflicting rationalities are debated and dealt with, not only to build a more in-depth understanding of real conflicts, but also to expand imaginations around how such conflicts could be dealt with. Here she calls for analysis not merely of the differences in perspective but also the underlying power, politics and cultural factors that build different perspectives (Watson, 2003). This requires interrogating how decisions are made, who makes them, what knowledge influences different positions, and to what extent knowledge and power are used to influence different outcomes (Patel, 2006).

Urban political ecology scholars emphasise the importance of looking beyond a particular example of inequality to explore the regional, national and international influences that produce inequality (Swyngedouw and Heynen, 2003). The power dynamics within and between actors across all scales play a critical role in influencing why decisions are made, by whom and in what or whose interest (Koch et al., 2007; Swyngedouw and Heynen, 2003). Mummery and Mummery (2019, p. 6) argue that justice and injustice are 'normative claims based on contextual – even localised – understandings as to how things should be'. They draw explicit links with climate and environmental justice and posit that these concepts are derived from the normative assumptions around 'proper' distribution and 'proper' procedures, which in many cases are influenced by scientific and modelled data. In practice, ideas around justice (and, by inference, just sustainability) are subject to individual ideologies, beliefs and perspectives.

Urban development visions and policies are by necessity normative and designed to be universally beneficial. However, the assumption that it is possible to achieve an outcome that is universally beneficial undermines the real diversity that exists with real trade-offs that need to be made (Watson, 2003).

The inertia of existing practices can pose significant barriers to achieving just sustainability

For example, it could be argued that the transition towards renewable energy in South Africa is universally beneficial in terms of reducing carbon emissions, improving air quality and creating a more stable electricity grid. However, this transition is not in the interests of communities that depend on coal-related jobs. Patel (2006, p. 691) highlights that 'in situations of competing rationalities, critical questions around the universality of ethics and whose ethics should prevail inevitably arise'. Watson (2003) calls for decision-makers to be aware of their ethics and worldviews and to be conscious that these may be in conflict with those for whom they are planning. While different positions or rationalities may be derived from evidence and justified by research, different positions are also underpinned by power and desires to control or influence outcomes in particular ways (Watson, 2003). Government planning and officials are assumed to be rational and not influenced by political motivations (Watson, 2003; Murdoch, 2000); however, this assumption obscures the influence of individual worldviews and power in decision-making, as well as the non-linear nature of decision-making.

Interrogating decision-making processes and the role of knowledge in these processes can reveal the trade-offs between social justice and environmental sustainability. A critical component of this is understanding what types of knowledge (formal, tacit, etc.) are drawn upon in decision-making processes, and what knowledge is excluded. This understanding can provide an indicator of power in decision-making processes. There is growing attention to the role of transdisciplinarity and drawing on multiple forms of knowledge in decision-making to effect the transformative change that is required (Ziervogel et al., 2021; Culwick et al., 2019; Culwick and Patel, 2017).

However, achieving just sustainability is not merely a case of understanding and planning carefully enough to ensure alignment is found between environmental sustainability and social justice. Rather, pursuing just sustainability requires an ongoing process of multifaceted, political negotiation between potentially competing imperatives (Leach et al., 2018). This has contributed to the difficulty in translating commitments to just sustainability and theoretical alignment between justice and sustainability into reality (Vogel et al., 2016; Patel, 2006; Visser, 2004).

2.4 Conclusion

This chapter has provided background to ideas around social justice and environmental sustainability, explored where they intersect, and identified ways in which just sustainability can be conceptualised. While some scholars emphasise that environmental sustainability and social justice are interdependent and that achieving one requires the other, other scholars maintain that these imperatives are conflictual. This research argues that neither of these positions is constructive for understanding the nuances of the theoretical interactions between sustainability and justice, nor are they helpful in supporting the practical challenge of building more just and more sustainable cities.

Assessing the interactions between social justice and environmental sustainability across society, space and time is productive for enabling engagement with the complexity around implementing just sustainability. Furthermore, the scale at which these imperatives is assessed can have implications for whether plans or actions could be considered just or sustainable. In some cases, an action that enhances justice and/or sustainability at one scale might undermine the ability to achieve these goals at another scale. These conflicts and contradictions have significant implications for decision-making aimed at transitioning towards a more just and sustainable society. This chapter emphasises the importance of considering how conflicting rationalities are played out through knowledge and decision-making processes. Furthering just sustainability in the context of approaching planetary boundaries and the current levels of poverty and inequality requires robust engagement with complex interactions between just sustainability and pushing back against simplification. By exploring just sustainability from different perspectives, and engaging with both the tension and alignment between justice and sustainability, a rich, nuanced and complex understanding can be found, which is critical for urban decision-making for transformative change.

Photograph by Christina Culwick Fatti

Chapter 3

Using complexity studies to think through issues of environmental sustainability and social justice in the South African coal expansion programme

EMILY TYLER AND BRETT COHEN

Abstract

Urban policy-making in South Africa is regularly confronted with the challenge of navigating between environmental sustainability (ES) and social justice (SJ). This chapter considers these issues in the electricity sector by exploring the empirical case of a proposed new independent coal-fired power-producing plant, Khanyisa, in the South African province of Mpumalanga (and in the broader Gauteng City-Region). The empirical findings of the case are then considered from the perspective of complexity studies to explore ways of engaging with the complexity, multidimensionality, contestation and indeterminism that are revealed. From a complexity perspective, the evident entanglements of ES and SJ issues in the Khanyisa case are embraced rather than ignored or abstracted away. A complex systems view prioritises consideration of ES and SJ aspects at various scales (international, national, urban and local), the impact of non-linearity, and space and time as case specific and relevant. Complexity further recasts the role of data in decision-making, highlights the dangers of simplification, and prioritises attention to a whole system view and path dependencies in societal, economic, environmental and policy-making systems. The chapter concludes that, approached from a complexity view, the policy objectives of ES and SJ raise particular questions for urban decision-makers, in particular how policy-making processes can be designed to reveal the systemic complexities, interconnections and contradictions. For it is through exploring and experimenting with these systematic factors at a local level that the 'spaces of the possible' for better ES and SJ alignment will be found.

3.1 Introduction

This chapter deals with environmental sustainability (ES) and social justice (SJ) issues as they relate to power generation and urban power-related policy-making. The Gauteng City-Region (GCR) relies on the national electricity grid for its power supply, with much of the electricity consumed in the GCR generated elsewhere in South Africa. Through the case of the proposed Khanyisa power plant in the Mpumalanga province, directly adjacent to Gauteng province, the chapter reveals and explores the multidimensional complexities related to ES and SJ for urban power sector policy-makers.

The chapter commences with an empirical discussion of the Khanyisa project's implications for ES and SJ based on empirical evidence. Two primary research methods were used: a desktop review

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and personal communication with stakeholders.[1] The chapter then draws on complexity studies to assist in navigating the complexity and competing rationalities revealed by the empirical research. The chapter concludes by reflecting on the implications of the analysis for urban policy-makers, arguing that accessing a complexity view enables sight of Mitleton-Kelly's (2015) 'spaces of the possible' for advancing ES and SJ agendas simultaneously, a view that the current South African policy-making and socio-economic system currently obscures.

3.2 South Africa's electricity sector

In South Africa, only Eskom, the state-owned power utility, can purchase electricity for on-sale and transmit electricity via the national grid. As a result, the GCR is currently dependent on Eskom for the source, reliability and price of its electricity supply. Historically, Eskom provided relatively low-cost power generation to the South African economy for a number of decades, predominantly from coal-fired power plants. Due to this legacy, 92% of South African electricity is currently produced from coal (Burton and Winkler, 2014).

However, this situation changed with the 2007/08 electricity supply crisis, which was driven largely by underinvestment in power generation capacity. The immediate response to the crisis was to commission two of the largest coal-fired power plants in the world: Medupi in Limpopo province and Kusile in Mpumalanga province. These add to Eskom's existing fleet of 14 coal-fired power plants of various ages. Most of these power stations are situated in Mpumalanga on the Central Basin coalfields.

As a further response to the supply crisis, the government initiated a number of programmes to support independent (i.e. non-Eskom) power producers (IPPs). One of these is the highly successful and internationally acclaimed Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) (Fourie et al., 2015; Yuen, 2014), which has signed up 92 projects to date (DOE, n.d.). Another is a programme to procure additional coal-fired electricity generation capacity – the Coal Baseload Independent Power Producer Procurement Programme (hereafter Coal IPPPP). A primary motivation for the development of this programme was to supply baseload power. To date, two projects have been awarded bids in a first phase of the Coal IPPPP: Thabametsi in Limpopo (557 MW) and Khanyisa in the Emalahleni region, Mpumalanga (306 MW) (DOE, 2016).

3.3 Proposed Khanyisa independent power plant

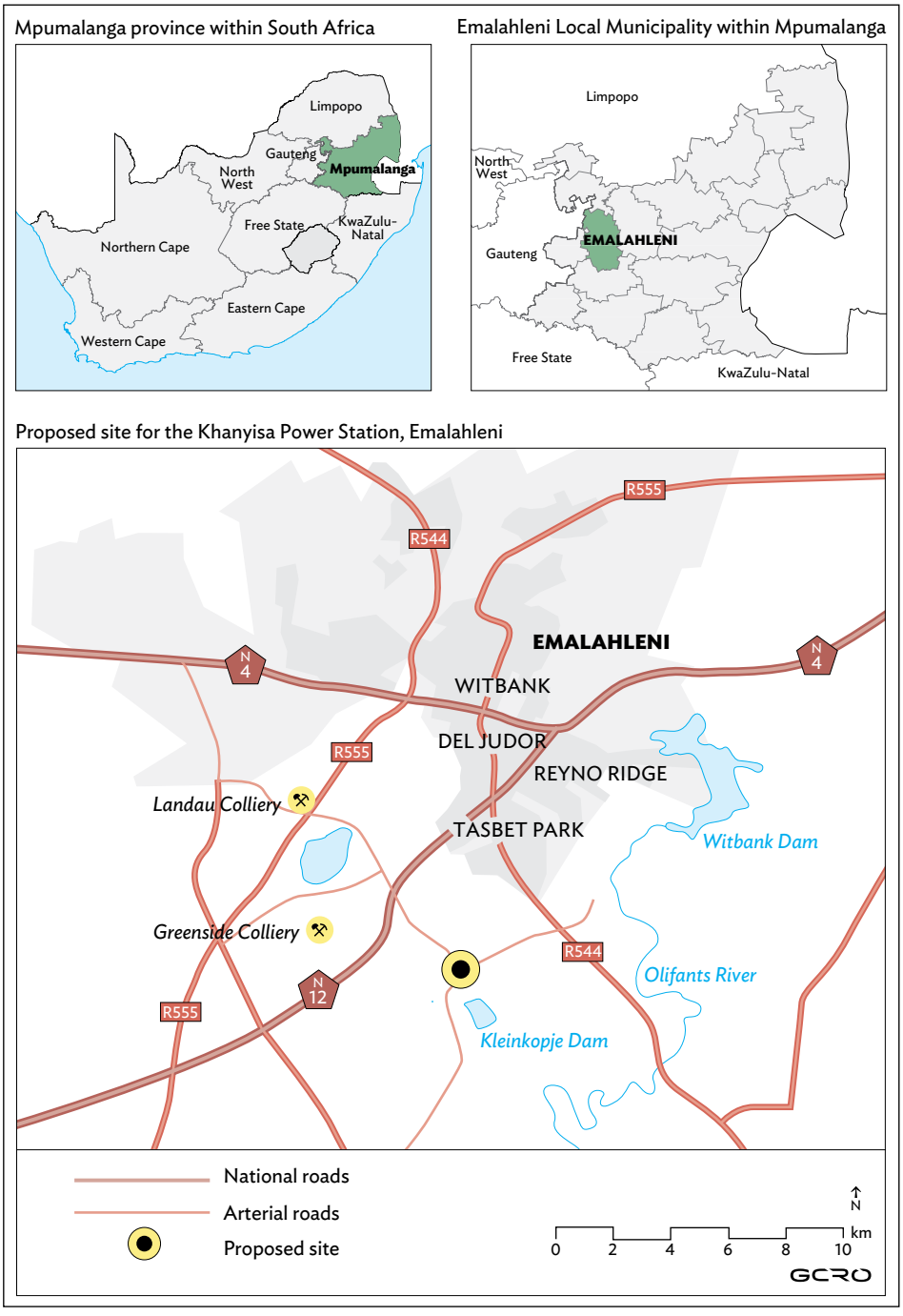
The Khanyisa project site is greenfield land belonging to the mining company Anglo American, 10 km south of the town of Emalahleni, in the Emalahleni Local Municipality, within the Nkangala District Municipality and Mpumalanga province (Figure 3.1). Mpumalanga lies directly to the east of Gauteng.

Emalahleni means 'the place of coal' and is located in the Central Basin coalfields, with the highest concentration of coal mines in South Africa (Emalahleni Local Municipality, 2017). Mpumalanga's provincial economy accounts for 83% of South Africa's coal production (Ptsera, 2011). This is the territory of mining and power generation (Hallowes and Munnik, 2017), with Kusile, Eskom's 4 800 MW plant located just 50 km away from the project site. The majority of Mpumalanga's population is extremely poor (Ptsera, 2011). In Emalahleni itself, social issues

1 The desktop review of relevant primary and secondary documentation in the public domain comprised Khanyisa's project documentation: energy, environmental and economic policy documents, reports of the various institutions related to the project, and academic and activist analysis of some of the issues at play. The series of personal communications with stakeholders to the project included meetings, telephone calls and email correspondence.

Figure 3.1: Locality map, Khanyisa Power Station

Maps by Janet Alexander



abound: the provision of potable water and reliable electricity supply is constrained, and there is a severe housing backlog (Ptsera, 2011). The Emalahleni Local District had a Gini co-efficient of 0.62[2] in 2011 (Emalahleni Local Municipality, 2017). Mining has experienced a stagnation in Mpumalanga over the past decade, contributing to social instability in the province (Siyongwana and Shabalala, 2018).

The Khanyisa power plant was originally a project of Anglo American, who intended to supply power directly to a nearby Anglo Platinum plant (ACWA Power, 2017). ACWA Power, a Saudi Arabian independent water and power company,[3] was selected by Anglo American in 2012 as a preferred development partner for the project. Towards the end of 2013, due to the slump in the global commodities markets (P. Govender, Executive Director: Business Development Phase of the Khanyisa project, personal communication, 26 February 2018) and a shift in strategic direction (ACWA Power, 2017), Anglo American decided to put Khanyisa on hold. When the South African government announced the Coal IPPPP, ACWA Power, in consultation with Anglo American, submitted a bid for the Khanyisa project to be included in the programme as a 306 MW grid-connected plant, a bid they subsequently won in October 2016 (P. Govender, Khanyisa project, 26 February 2018). This success entitles Khanyisa to sell its power to Eskom for a period of 30 years. In 2015, ACWA Power submitted an Environmental Authorisation Amendment Report applying for, amongst other things, the amendment of the 2012 authorisation to a power plant of 600 MW capacity to increase the amount of power sold on either to the grid or privately in the future. The amendments were approved by the Department of Environmental Affairs (DEA, 2017, 2015a).[4]

Specialist geotechnical drilling has been undertaken at the Khanyisa site to confirm site feasibility, as has some site development and preparation (ACWA Power, 2017). Apart from this, the project remained on paper at the time of writing (2020), with ACWA Power working to achieve an investment decision. While this was envisaged to be achievable in 2017 (ACWA Power, 2017), various licences remain outstanding or subject to appeal and legal challenge (N. Loser and M. Koyama, Centre for Environmental Rights (CER), personal communication, 19 February 2018).

ACWA Power holds the primary equity stake of 40% in the project, which is project financed (ACWA Power, 2017). Local companies Thebe Investments, Pele Natural Energy, Hulisani Capital and the Palace Group each hold a minority stake (ACWA Power, n.d.), together accounting for 37% of the project value (Creamer, 2016b). Debt finance is provided by the publicly owned Industrial Development Corporation (R1.2 billion, 25.3% of total project cost) (Creamer, 2016a) and major private South African banks.[5] ACWA Power and the Palace Group will operate the project together (ACWA Power, n.d.), with General Electric being identified as the engineering, procurement and construction contractor (ACWA Power, 2017).

The Khanyisa project envisages utilising discard coal to generate power through the use of circulating fluidised bed (CFB) boiler technology. This is the first time this technology is being used in South Africa (ACWA Power, 2017; Creamer, 2016b). Because discard coal is of a quality too poor for either export or use in the Eskom fleet (P. Govender, Khanyisa project, 26 February 2018), it is currently maintained in coal heaps that, if left unmanaged, pollute both the groundwater and possibly the air across the mining areas. In Khanyisa's case, the nearby Kleinkopje and Greenside collieries of Anglo American will supply the discard coal, constructing a discard coal handling and retreatment plant for this purpose (Shangoni Management Services, 2017). The coal will be transported to the project site by means of conveyors (ACWA Power, 2017).

The plant includes a dry-cooled condenser to minimise water use and will utilise treated mine

2 The Gini co-efficient is a measurement of wealth inequality, which ranges from perfect equality (0) to complete inequality (1).

3 See www.acwapower.com

4 The Department of Environmental Affairs (DEA) was renamed the Department of Environment, Forestry and Fisheries in 2019. Because the focus of the Khanyisa case is on the period where the environmental function was under the DEA, this name has been retained throughout the case.

5 The figures in this paragraph do not add up to 100%, likely because they are derived from different sources.

wastewater from the Emalahleni Water Reclamation Plant operated by Anglo American and Exxaro, 5 km from the site. This facility currently treats acid mine water from a number of local mining operations, also producing potable water for the Emalahleni municipality (P. Govender, Khanyisa project, 26 February 2018). The ash from the plant will be disposed of 3 km away, in a disused open-cast coal mine.

3.4 How might Khanyisa impact environmental sustainability?

Khanyisa's impact on its natural environment occurs across at least four dimensions, which are discussed in the following sections: local air quality, groundwater contamination, dust and fly-ash production, and greenhouse gas (GHG) emissions production.

Local air quality

The project's environmental assessment reports (Aurecon, 2012, 2015) found that local air pollutants of concern include particulate matter, sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and carbon monoxide (CO). These were all found to be within the post-2030 National Ambient Air Quality Standard (NAAQS) and, with mitigation measures, could be reduced to low or very low significance. In response to the environmental impact assessments, the DEA issued an Environmental Authorisation (EA) (DEA, 2012) and two amendments (DEA, 2017, 2015a) for Khanyisa, taking the view that if the project's environmental emissions are below the national regulated limits and the proposed environmental management plan is adhered to, then the ES issues are manageable.

ACWA Power describes Khanyisa as employing 'environmental best practice', adhering to both World Bank and Equator Principles (ACWA Power, n.d.; P. Govender, Khanyisa project, 26 February 2018), resulting in its atmospheric emissions being below both international best practice (ACWA Power, 2017) and South African regulatory requirements (P. Govender, Khanyisa project, 26 February 2018). The project further includes the 'best available emission abatement technologies' (ACWA Power, 2017, p. 8), including the introduction of limestone into the boiler to mitigate sulphur emissions.[6]

Neither the DEA nor ACWA Power's views, however, takes the cumulative impact of these local air emissions into account. The Khanyisa site is located within the Highveld Priority Area, an area 'characterised by poor air quality and exceedances of pollutant limits set in South African legislation' (Aurecon, 2015, p. 14) due to the industrial, power generation and mining activities in the region. Groundwork, a non-profit environmental justice organisation,[7] describes the Highveld as the 'worst possible place for air emissions' (Hallowes and Munnik, 2017, p. 54) given its particular atmospheric conditions of long-lived high-pressure systems which produce atmospheric stability: clear skies and low wind speeds. The area is also characterised by temperature inversions, particularly during winter nights when pollution is trapped in the layer of air closest to the ground. Despite mines and power generators having emissions limits in place, the air quality subsystem continues to be characterised by emissions above the legal limits, particularly in the winter months (Hallowes and Munnik, 2017, 2016; Aurecon, 2015). As a result, the 2015 environmental assessment report admits that 'any contribution resulting from the proposed project would in fact contribute to exceeding the legal concentration levels for the aforementioned pollutants during the winter months' (Aurecon, 2015, p. 21), and also that 'if uncontrolled, the proposed power station could significantly influence the air quality in the Emalahleni (Witbank) region and further afield' (Aurecon, 2015, p. 14).

6 Limestone ($CaCO_3$) is added directly into the plant where it is converted to lime (CaO), releasing carbon dioxide (CO_2). The lime reacts with sulphur dioxide (SO_2) to form gypsum, which is a stable product.

7 See https://www.groundwork.org.za/

The issue of cumulative atmospheric emissions in the area was anticipated to be dealt with by the 2011 Highveld Priority Area air quality management plan. However, the 2015 mid-term review of this plan showed little improvement in the area's ambient air quality and continued 'significant exceedances of the NAAQS' (DEA, 2015b, p. v). Government's assumption that management plans are implemented is thereby brought into question.

From the perspective of cumulative impacts and the fact that management plans are not necessarily adhered to, it is likely Khanyisa will have a negative impact on local air quality. Given that Emalahleni is adjacent to the GCR, with interlinked environmental subsystems, it is possible that the GCR's air quality may also be affected.

Water

ACWA Power (2017) indicates that Khanyisa will be relatively water efficient due to the use of dry cooling and the utilisation of mine wastewater streams. Nevertheless, the 2015 environmental assessment report finds that a 600 MW plant will require 7 200 m^3 per hour of water for the circulating flow (Aurecon, 2015). This is additional to the existing demand on the area's water supplies.

Climate change is likely to impact water supply negatively in the area as Southern Africa becomes hotter and the weather more extreme (DEA, 2019), exacerbating current water issues, and Groundwork has indicated it will challenge Khanyisa's water-use licence (Peek, 2018). Pollution of the water subsystem of the Emalahleni Local Municipality due to the mining activities in the area is also a significant issue, with the groundwater not being useable by the municipality because of acid mine drainage (Emalahleni Local Municipality, 2017). Three water treatment plants operate in the area (Emalahleni Local Municipality, 2017); however, only the very poor are reported to drink tap water, with most residents relying on bottled water for drinking (D. Hallowes, Groundwork, personal communication, 12 March 2021).

Similar to the effect on local air quality, it is likely that Khanyisa will have a net negative effect on local Emalahleni water resources from a cumulative perspective, and there is the same degree of scepticism as to the effectiveness of management plans. The impact of acid mine drainage on the GCR's immediate water supply may also present an issue.

Dust and fly-ash

Fly-ash is a potentially toxic by-product of coal combustion and must be contained to avoid polluting the water resources. There is also concern about dust in the ash handling process. In the Khanyisa project documentation, it is proposed that the ash be contained on-site, in a suitably sized and lined ash disposal facility (Aurecon, 2015). ACWA Power (2017) argues that the project will also reduce dust released from the discard coal heaps and that the coal will be carried to the plant in closed conveyors. The legal activist organisation CER is not convinced that Khanyisa's ash will be suitably contained and fears it will further pollute the already compromised Olifants River catchment area (N. Loser and M. Koyama, CER, 19 February 2018).

The net effect (reducing dust from discard coal heaps versus the ability to contain the fly-ash in coal combustion) cannot be fully determined in advance, and there is limited research on other instances of this as far as the authors are aware. Therefore, the impact of Khanyisa on ES in this dimension appears to depend on the perspectives of various stakeholders at this stage.

Greenhouse gas emissions

GHGs are atmospheric emissions that are non-local in their impact; rather, the global accumulation of GHG emissions causes climate change (which then has local manifestations). The main impact of Khanyisa on GHG emissions is through the burning of discard coal using CFB technology, which releases carbon dioxide and nitrous oxide.[8] GHG emissions will also be released by the reaction

8 Nitrous oxide is not to be confused with the local atmospheric pollutant, nitrogen dioxide.

of the limestone being proposed as a mitigation measure for SO_2 emissions. However, based on the Thabametsi climate change study (Savannah Environmental, 2017), the limestone emissions are not significant when compared to those from the burning of coal. Further, the use of discard coal may avoid GHG emissions released by the currently dormant coal heaps (ACWA Power, 2017), although research within the South African context finds these to be minimal if the coal heap is properly remediated (Cook and Lloyd, 2012).

ACWA Power argues that Khanyisa's CFB technology offers 'CO_2/MWh lower than [the] current [Eskom] fleet of older plants' (2017, p. 9), and as such 'transfers important transitional coal beneficiation technology' (2017, p. 2). Neither the DEA's 2012 environmental authorisation, nor Aurecon's 2015 environmental assessment report considered Khanyisa's GHG emissions in detail, something that was challenged legally by the CER in late 2017 following a similar challenge to the Thabametsi plant's environmental authorisation.[9] Aurecon's 2012 environmental assessment report does however state that Khanyisa is likely to contribute about 4.3 million tons of CO_2 per year. This is based on the assumption of 'a 450 MW power station with an emission factor of 1 100 g CO_2 per kWh sent out, operating with FGD (Flue Gas Desulphurisation) on Kleinkopje discard for 8700 h per year' (Aurecon, 2012, p. 199). A GHG emission factor of 1 100 g is in line with that of Eskom's less efficient power stations, so this finding does not align with ACWA Power's 'intrinsically lower emissions' argument.

The use of the 1 100 g emission factor in Aurecon's 2012 report is queried by Ireland and Burton (2018), who recommend the use of the factor of 1 230 g calculated by the Environmental Monitoring Group for Thabametsi, which also uses CFB technology (Savannah Environmental, 2017), as this figure is 'the most comprehensively investigated and recent figure accounting for GHG emissions of CFB in South Africa' (Ireland and Burton, 2018, p. 11). The differential between the two is due to the inclusion of the GHG N_2O emissions, significant in CFB, as opposed to conventional pulverised-fuel coal plants such as Eskom's. Taking N_2O emissions into consideration renders the GHG emissions of a CFB plant such as Khanyisa '24% higher than the current Eskom fleet average, and 58% higher than Medupi and Kusile' (Ireland and Burton, 2018, p. 11). Ireland and Burton do acknowledge that there may be ways in which a plant like Khanyisa can mitigate N_2O emissions, although these remain unacknowledged and unaddressed by either ACWA Power or the Khanyisa literature. Ireland and Burton's analysis therefore further undermines ACWA Power's argument of 'lower emissions'. Khanyisa's GHG emissions appear to be far higher than the latest conventional coal technologies, and certainly higher than gas-fired power, suggesting that a technology like coal CFB is hard to justify from a GHG emissions and therefore ES perspective.

ACWA Power further claims that the 'Khanyisa GHG emissions are accommodated in the [...] SA National Benchmark Emissions Trajectory' (ACWA Power, 2017). This is a reference to the National Climate Change Response White Paper (DEA, 2011), which specifies a 'trajectory range' quantifying the range of acceptable national GHG emissions until 2050. This trajectory range peaks between 2020 and 2025, plateaus for a decade after this and then declines, and is included in the South African nationally determined contribution (NDC) submitted

It is likely Khanyisa will have a net negative effect on local Emalahleni water resources from a cumulative perspective

9 The case was still pending at the time of writing.

under the 2015 Paris Agreement, thus constituting an internationally recognised commitment.

South Africa's emissions are currently within this trajectory range, and projections suggest that the IPP coal power plants will not by themselves cause the country to exceed this (DEA, 2018). However, whether this means that Khanyisa's GHG emissions contribute to ES requires further interrogation under two aspects. First, is South Africa's NDC commitment an adequate contribution to global mitigation efforts? While the upper limit of this trajectory range has been deemed 'inadequate' in meeting the Paris Agreement's goals,[10] the lower limit has been described as 'fair' (Marquard, 2019). The NDC commitments as a mechanism of the Paris Agreement are also required to ratchet up in terms of ambition every five years (Voigt and Ferreira, 2016).

Second, what degree of mitigation effort is required from the electricity sector to meet the lower trajectory and its increasingly more ambitious interpretation? The policy work to assign proportions of the carbon budget implicit in the trajectory range to various activities (such as power generation) has not yet been concluded. In the 2010 Integrated Resource Plan (IRP), the power sector voluntarily adopted a 275 Mt carbon dioxide equivalent constraint based on South Africa's international commitments in the Copenhagen Pledge (DEA, 2010). Particularly given the significant subsequent decline in renewable energy power generation costs, the power sector contains the majority of South Africa's least-cost mitigation options (J. Burton, Energy Research Centre, University of Cape Town, personal communication, 29 August 2018) and therefore will be needed to do more than that identified in the 2010 IRP in order for the country to comply with its Paris Agreement obligations (Tyler and Hochstetler, 2021; McCall et al., 2019).

This notwithstanding, in 2019, an updated IRP was published retaining the 275 Mt CO_2e constraint and including both Thabametsi and Khanyisa, together with a significant renewable energy programme.

The issue of cumulative versus relative impact discussed in the subsections above is also relevant with regard to GHG emissions, evidenced in the dual focus of the discussion, first on the emissions factor and then on Khanyisa's impact on the power sector's carbon budget. Although no management plans are yet identified for Khanyisa's GHG emissions, adherence to these is a moot point in light of the discussion of the previous ES dimensions.

The implications of Khanyisa's GHG emissions for the GCR differ from those of local ES impacts and occur in two ways. First, higher global GHG emissions increase the GCR's climate impacts and adaptation requirements. While Khanyisa's emissions are proportionately insignificant,[11] the fact that the South African government supports the plant undermines global mitigation efforts, which are cooperative and cumulative in nature. Second, a higher grid emissions factor means higher embedded emissions for GCR activities, services and products, an aspect that is increasingly likely to undermine the region's competitiveness as markets become sensitive to the carbon context of exports, and the ability of metros to access financing becomes linked to their carbon intensity (C40 Cities Climate Leadership Group, 2018).

The discussion on Khanyisa's GHG emissions highlights the role of data in assessing ES implications. While the data available during the early stages of the research for this paper were indeterminate with regards to either Khanyisa's incremental or cumulative ES impact, the work done by Environmental Resources Management for the Thabametsi court case[12] – and given weight in Ireland and Burton's report (2018) – reveals that the implications of Khanyisa for GHG emissions are strongly negative.

10 See the Climate Change Tracker: https://climateactiontracker.org/countries/south-africa/

11 At an emissions factor of 1 100 g, Khanyisa's emissions will be in the region of 4.3 MT, less than 1% of South Africa's current national emissions (DEA, 2015a), a percentage that will grow as the grid is decarbonised over time.

12 https://cer.org.za/programmes/pollution-climate-change/litigation/the-proposed-thabametsi-ipp-earthlife-africa-johannesburg-v-department-of-environmental-affairs-thabametsi-power-project-pty-ltd-and-others

3.5 How might Khanyisa impact social justice?

Social justice as a concept was not represented in any of the official Khanyisa project documentation. Rather, the concept of 'development' dominates the narrative on social aspects, referred to by stakeholders in terms of employment, social upliftment, energy security (DOE IPP Office, 2018) and economic growth (P. Govender, Khanyisa project, 26 February 2018; A. Netch, Head of Environmental Health and Safety, Industrial Development Corporation, personal communication, 27 February 2018; DOE, 2016). While there are clearly overlaps between 'development' and SJ, including the provision of basic services such as sanitation and a reliable water supply, their relationship is contested both internationally and in South Africa, and particularly so in the context of ES (Fioramonti, 2017; Rist, 2007). Groundwork highlights this specifically in the context of power generation in Mpumalanga, where 'development' in the form of coal-powered industrialisation has been unjust for those struggling with ill health and a polluted environment (Hallowes and Munnik, 2017, 2016).

The discussion in this section is contextualised by this contestation and, as a result, is more tentative than that for ES. Four dimensions are considered here, two at the local level (employment and local economic implications, and health) and two at the national level (redressing historical equality and the role of national power supply).

Employment and local economic implications

Employment creation is easily and frequently associated with the concept of development. However, interrogating 'just' employment creation requires an understanding of aspects such as who the jobs are going to, the nature of the livelihoods these jobs support, the potential for advancement, and the conditions and duration of employment. These data points are not directly reported (Stands, 2015), although something can be inferred from whether the jobs created are skilled or unskilled, whether they occur only in the construction phase or also in operation and maintenance, whether the jobs will go to the local communities or to outsiders, and the effects of such considerations on social stability.

Mirroring the challenges in assessing and reporting employment in the South African power sector more generally (Tyler and Steyn, 2018), there are a number of conflicting employment projections for Khanyisa. The Department of the Environment's (DOE) fact sheet for the Coal IPPPP (DOE, 2016) shows Khanyisa as contributing 4 500 jobs during construction and 1 300 in operations and maintenance. ACWA Power only reports 250 local jobs during construction and 150 during operation (ACWA Power, n.d., 2017). In ACWA Power's National

Photograph by Clive Hassall

Energy Regulator of South Africa (NERSA) licensing application, a total of 1 500 jobs during construction are identified (NERSA, n.d.). *Engineering News* identifies 3 000 jobs in construction and 150 in operation (Creamer, 2016a). The social impact assessment (for a 450 MW power project) identified an average of 900 people for the construction period and 120 during operation (Ptsera, 2011).

The extent of the variability in these numbers is testament to a lack of both reliable data and accountability in its use in the South African power sector. As Tyler and Steyn (2018) caution, this situation is abused by those pursuing particular agendas through an emotive and misleading national discourse.

In addition to the direct employment creation, ACWA Power claims Khanyisa will contribute to employment and social stability through its absorption of Kusile's labour force when that project ends (P. Govender, Khanyisa project, 26 February 2018). There are also likely to be indirect jobs created in supplying the power generator with discard coal and in providing limestone, as well as jobs created at the discard coal and water treatment facilities.

The Emalahleni Local Municipality (2017) Integrated Development Plan (IDP) supports electricity-generation projects, describing them as being key to the local economy, and describing large projects as important for accessing public infrastructure funding. This is despite the local links between employment, economic growth, mining and power generation being controversial – Emalahleni, an urban hub, has been at the epicentre of the coal economy for 150 years, and has at least 40% unemployment in its townships (D. Hallowes, Groundwork, 12 March 2021) and a Gini co-efficient above the national average. The largest employing industries in Emalahleni are reported as trade and community/government services (Emalahleni Local Municipality, 2017), not mining or power generation. The Emalahleni IDP describes the district's infrastructure as 'dilapidated' (2017, p. 58), and transport, electricity and water infrastructure as priority areas. Khanyisa itself is anticipated to contribute to the further degrading of infrastructure due to increased activity, and to reduced mobility in the area as a result of increased road congestion, particularly in the construction phase (Ptsera, 2011). However, the terms of Khanyisa's power purchase agreement under the Coal IPPPP require a number of contributions to local social development, including the Khanyisa Socio-Economic Development Programme (such as skills, supplier and infrastructure development) (ACWA Power, 2017). ACWA Power (2017) states its commitment to establishing an engagement plan and protocols to ensure fairness and transparency for all stakeholders in the project, suggesting an attempt at applying procedural justice locally. The company anticipates investing in one of the local water treatment plants, which will enable additional treated water to become available for municipal use (P. Govender, Khanyisa project, 26 February 2018).

Khanyisa's 2011 social impact assessment (Ptsera, 2011) provides some indication from different social groups affected by the plant (including directly and indirectly affected communities both formal and informal, farmers and farmworkers, and road users) that, while the employment opportunities were identified as being desirable, there were also specific justice-related concerns. Khanyisa would attract skills away from existing jobs in the area due to higher wages from short-term construction contracts; there would be in-migration to the area of people seeking work; and these changes, together with the excess workforce after the construction phase, would destabilise existing communities. Nearby informal settlements were reported as not wanting another power plant since 'even when all management processes are in place, there are still negative effects' (Ptsera, 2011, p. 37).

The employment creation potential of any large capital project should be considered not only in

The lack of reliable employment data is abused by those pursuing particular agendas through an emotive and misleading national discourse

isolation, but also from the perspective of alternative applications of that capital. There is a lot of interest in considering the employment creation potential of, for example, renewable energy projects in the Mpumalanga area (Montmasson-Clair, 2020).

Finally, unemployment and social instability in Emalahleni directly affect the GCR as job seekers and those looking for a better life migrate to the metropolitan areas, putting pressure on urban infrastructure and service provision.

Health

Health is an area where the environmental and the social impacts of coal-fired power generation are most obviously correlated. Groundwork's 2017 report on the impacts of coal-fired power generation finds that research into the health effects of atmospheric pollution in the Highveld has been 'curiously neglected' (Hallowes and Munnik, 2017, p. 36). Nor was evidence found for national or provincial health programmes to support the affected population. Nevertheless, the report cites the Highveld Priority Area Air Quality Management Plan of 2011 as suggesting that power generation is the primary driver for hospital admissions in Mpumalanga. Air pollution is linked to, amongst other health problems, heart disease, lung cancer, stroke and chronic obstructive pulmonary disease (Naledzi Environmental Consultants, 2018).

The issue of health also slips between the cracks of the environmental authorisation process. Neither the Khanyisa environmental impact assessments, nor its social impact study (Pstera, 2011), attempts to quantify the local health impacts of the Khanyisa plant. While the health implications of elevated atmospheric pollutants are detailed in the social impact study, this attention is not carried through in the social impact report, which merely identifies the increased incidence of air quality health challenges in vulnerable groups such as children, those with asthma and the elderly (Ptsera, 2011).

Considering the health dimension of SJ from the GCR perspective reveals an interesting paradox. A significant source of urban local air pollution comes from the use of primary energy sources (coal, kerosene, wood) for lower-income residential energy services, resulting in corresponding respiratory health issues in poor urban areas. These sources of energy are favoured over electricity in part because electricity is expensive (Ismail and Khembo, 2015). Air pollution in Emalahleni may be increased on balance due to Khanyisa, but there is an argument (which is considered in greater detail below) that Khanyisa will decrease air pollution in the GCR.

Redressing historical inequality

One of the main ways in which South Africa has attempted to address its racial history is through the government's Broad-Based Black Economic Empowerment (B-BBEE) programme. This programme requires a percentage of black ownership across economic activities, with the Coal IPPPP in particular having been identified as a vehicle for this policy. The Coal IPPPP bid requires a weighted B-BBEE Contributor Status Level 5 in terms of South African based shareholders (DOE, 2016). As such, four local B-BBEE accredited companies are involved in the Khanyisa project's finance structure, with effective black ownership in the project of greater than 35% (ACWA Power, 2017). It is this dimension of SJ that ACWA Power focuses on in its communications. However, it is likely that those who benefit from B-BBEE are those with access to a level of education, finance and networks, and are more likely to be located in the GCR than in the Emalahleni area.

National power supply

The maintenance and expansion of grid power is deeply embedded in South African policy narratives around development and poverty alleviation (National Planning Commission, 2011), based on the assumption that grid electricity is the cheapest form of electricity provision. As such, a main feature of the Coal IPPPP is to provide 'increased energy security and contribute towards socio-economic and sustainable growth objectives'.[13]

The assumption of a national utility providing lowest-cost electricity via the grid has held for a long

13 As per the Coal IPPPP website, www.ipp-coal.co.za

period in South Africa. The power sector is now being described as in the midst of a period of disruptive change that may profoundly alter its structure (Bischof-Niemz and Creamer, 2018).

Because of this, and despite the investments in and commitments to grid electricity generation (both coal and renewables), the South African electricity system is currently in a state of crisis due to both internal and external factors. Eskom is battling corruption, the terminal decline of the coal sector upon which its business model is based, and the early stages of a utility death spiral where the utility counters falling demand with rising prices (in large part due to the capital costs of Medupi and Kusile), prompting more customers to turn to independent power generation (Steyn et al., 2017). Low-cost renewable energy options are increasingly available, and their costs are plummeting (Ireland and Burton, 2018; Wright et al., 2017). The costs of storage technologies and embedded generation appear to be on a similar trajectory. Electricity demand has plateaued since the inception of the Coal IPPPP due to a combination of economic stagnation and a reduction in the energy intensity of economic activity (Ireland and Burton, 2018). The rise of urban-embedded generation (such as rooftop solar) and international environmental scrutiny at the city-level[14] is driving tension between metros and national government around the single purchaser model and encouraging those who can afford to do so to install off-grid solutions (as described in Chapter 4 of this volume). In 2017, the City of Cape Town went so far as to take the national Department of Energy and the energy regulator (NERSA) to court over the City's right to procure independently generated power directly, although the issue has not yet been resolved there. These changes have influenced and will continue to influence the quantity, nature and price of grid electricity, with corresponding implications for ES and SJ.

The DOE and ACWA Power both use a set of assumptions about the electricity sector to promote Khanyisa's contribution to 'development': that grid electricity is the most affordable; that the South African grid requires additional baseload power; and that the use of discard coal is a cost-effective way to provide this. ACWA Power (2017, p. 2) specifically describes Khanyisa as transferring important 'transitional coal beneficiation technology that contributes to a number of South Africa's developmental objectives'. While there is no consensus on these issues, recent modelling shows both coal IPPs as being amongst the most expensive power generation options available to South Africa, and that the implications of committing to these plants will be negative for the country's economic development (Ireland and Burton, 2018; Wright et al., 2017).[15] The consideration of a large, green industrialisation programme focused on utility-scale renewables and the Mpumalanga region is an important point of comparison (Montmasson-Clair, 2020).

The implications of Khanyisa for SJ in the GCR are closely related to the price of grid electricity. As this price increases, the wealthy can defect and turn to off-grid solutions. Collectively, this action exacerbates the utility death spiral, further increasing electricity prices for the poor

Recent modelling shows that committing to these plants will be negative for the country's economic development

14 See www.c40.org

15 The inclusion of Khanyisa in the generation mix will result in an 'addition in the total discounted [power generation] system cost' across all four of the scenarios (Ireland and Burton, 2018, p. 2).

(see Chapter 4). In addition, lower overall electricity revenues for the metros, which achieve a large portion of their municipal budgets through the distribution of grid electricity, reduce the funds available for urban public services generally, with further negative implications for the poor.

3.6 Using complexity studies to engage the multidimensional complexities of ES and SJ in the power sector

The empirically focused discussion in the preceding two sections highlights the complex, interconnected and multidimensional nature of Khanyisa's potential impact on ES and SJ, with a number of themes emerging: (1) the cumulative impact of Khanyisa on various dimensions of ES is obscured by environmental authorisation processes and developer rhetoric; (2) Khanyisa's ES and SJ implications differ between the different dimensions of each issue (e.g. employment creation and health), across different locations (e.g. Emalahleni and the GCR) and across different timeframes (historical and present-day injustice); (3) the lack of current and reliable data enables powerful interests to dominate; and (4) high-level conceptual terminology can hide competing rationalities. As such, the discussion evidences the complexities of the ES and SJ relationships across the dimensions of society, time and space discussed in Chapter 2, the framing chapter of this volume. The chapter now turns to complexity studies to provide a perspective on these relationships.

The field of complexity studies is represented by nascent theoretical and applied work spread both wide and thin across the academy (e.g. Cairney and Geyer, 2015; Price et al., 2015; Chettiparamb, 2014; Wells, 2013; Walby, 2007; Morin, 2006; Kurtz and Snowden, 2003). There is no one 'unifying' theory of complexity (Chu et al., 2003); rather, it is better understood as a series of perspectives and interpretations drawing from a core and developing a set of concepts and principles. While complexity theory's origins lie in the natural sciences, it is being increasingly taken up by the social sciences, engineering, information technology and medicine, amongst other disciplines, as well as from a transdisciplinary perspective, with its application to issues of sustainability particularly identified (Wells, 2013). In response to the themes emerging from the empirical discussion, we select a few complexity concepts and principles to explore the Khanyisa case. First, we use the concept of a complex system as an organising frame for considering Khanyisa's ES and SJ implications across time and scale. Second, we consider the role of research and data using complexity principles. Third, from a complexity paradigm, we draw attention to the dangers of simplification.

The complex system as an organising concept

From a complexity view, the universe as we know it both is and is comprised of complex systems. Complex systems are nested within complex systems, and complex systems overlap each other. They can comprise any combination of human, animate and inanimate components. They are inherently uncertain and unpredictable yet can be recognised through their patterning. Complex systems are dynamic, finding stability through constant change (Shine, 2015). Complex systems also have particular properties. Engaging the 'complex system' as a conceptual frame through which the ES and SJ implications of Khanyisa are considered presents a view that embraces, rather than attempts to negate or contain, interconnection and complexity.

System components and interconnections

System components relevant to Khanyisa include the typical energy sector concerns of technology, finance and economics as well as concerns of the humanities and social sciences (history, power, politics and worldviews), societal and cultural knowledges, data, regulations and policy, and even concepts such as ES and SJ.

A complex systems view emphasises the interconnections between system components, and values the revealing of these interconnections. In the Khanyisa case, ES and SJ cannot operate as stand-alone, separate concepts. System components co-determine each other and co-evolve in response to internal and external change. They are interconnected, both to each other and

within their own dimensions, in different ways. In the case of Khanyisa: poor air quality negatively impacts the health of the vulnerable; the addition of limestone to reduce local atmospheric emissions increases GHG emissions; the project increases employment opportunities but decreases social stability; it addresses aspects of historical inequity but perpetuates an economic system that drives inequality; it transfers technology that utilises polluting discard coal heaps but increases GHG emissions; and it utilises mine wastewater and expands the availability of treated water for municipal use. This messiness – the entanglement of and tensions between ES and SJ – is evident and acting as a source of localised variability that complexity theories suggest provides both systemic stability and the source of change (Boulton et al., 2015). Through experimental responses to address ES and SJ interactions arising locally, 'spaces of the possible' are opened at other systemic scales (Mitleton-Kelly, 2015; Shine, 2015). As in ecological systems, the greater the diversity in a system, the greater the raw material for innovations that will align with ES and SJ in the future.

A whole system view

A complexity conceptualisation involves taking a whole system view, as opposed to the linear, separate and marginal views of classical disciplinary science and in particular its application in economics. Such a view favours the cumulative perspective on ES above the incremental, more quickly highlighting the failure of the DEA's processes to reveal Khanyisa's cumulative ES impacts and undermining ACWA Power's appeals to relatively more efficient technology.

Engaging scale

Complex systems operate at different scales, with Khanyisa's impact on ES and SJ playing out across a number of such scales. This aspect of scale in a complex system resonates with Chapter 2, which describes dimensions across which the ES and SJ relationships find expression. What contributes towards ES and/or SJ at one scale may negatively impact it at another. Khanyisa may worsen ES in Emalahleni while contributing to both ES and SJ in the GCR through the provision of electricity. Although Khanyisa contributes towards redressing

Photograph by Christina Culwick Fatti

a form of historical injustice at a national economic level, the project may simultaneously be exacerbating current local injustices through social instability in Emalahleni. The use of CFB technology may enable the removal of discard coal heaps in South Africa, but this activity contributes to global GHG emissions.

Space and time in complexity

Complex systems have clearly articulated dimensions of space and time, in contrast to an abstraction from these dimensions that typically occurs under classical science. As regards space, complexity theories state that detailed context specificity determines the local variations that drive both system-wide stability and change. Time in complexity is unidirectional; a system's history determines its future, and the particular patterning that is due to this history is relevant to understanding how current events might play out. The South African economic system has developed a central minerals and energy complex (MEC) (Burton, 2011; Fine and Rustomjee, 1996) over the past century. Deeply entrenched MEC structures feature in South Africa's power generation sector and economy as a result, such as the reliance on coal and large technology solutions. These structures hinder both the consideration and uptake of viable alternatives, such as off-grid embedded electricity generation, or the generation of electricity from renewables plus storage. Khanyisa is both a product of these structures and strengthens them going forward in a self-perpetuating feedback loop, or vicious cycle, typical of complex systems. Similarly, South Africa's persistently high levels of inequality have deep historical roots. Countering these entrenched patterns requires the disruptive change of the type currently occurring in the electricity sector, suggesting that this is a window of opportunity for policy-makers to support and enable a shift towards more ES and SJ patterning going forward.

Mechanisms of complex systems: Non-linearity and path dependency

Complex systems are non-linear, prioritising a consideration of how a project such as Khanyisa could initiate or sustain path dependencies. The Khanyisa project both benefits from South Africa's historical coal path dependency and perpetuates it in a particular form through the introduction of CFB technology to utilise discard coal but also through the model of a B-BBEE empowered project finance structure and the absorption of a portion of Kusile's labour force once that plant is completed.[16] Systemic structure is a significant contributor towards path dependencies in systems, acting as a lag on the system and an inhibitor of change. These path dependencies operate in policy and regulatory processes, locking out the ability to consider alternatives such as utility-scale renewable energy, which may have very different ES and SJ implications for both Mpumalanga and the GCR. Khanyisa introduces long-term physical (generating plant, transmission, transport) and institutional (ACWA's 30-year power purchase agreement) structure into the complex systemic environment. This phenomenon is also termed 'lock-in', and is discussed extensively in the context of South African coal-fired power generation by Burton and Winkler (2014).

A complex view suggests, then, that Khanyisa is most appropriately considered not as a decision about an individual power plant but rather as the desirability or otherwise of ushering in a fleet of discard coal-fired power plants. Indeed, this is partially the basis of ACWA Power's argument for the project.

Role of research and data in complexity

Complex systems cannot be 'known', as any observation of the system is just one observation from one perspective at one point in time. What then is the role of data and knowledge-making in a complexity view? Certainly, research into

16 The construction of Kusile has required a huge labour force, and the project is coming to the end of its construction phase. Some of this labour is anticipated to be absorbed in the construction of Khanyisa, only 50 km from the Kusile site. This may reduce (or delay) some of the social disruption anticipated from the loss of Kusile's jobs. Whether greater social stability is desirable depends on perspective – destabilisation provides fertile ground for a shift in the phase state of a system .

a system's historical patterning is valuable in order to better understand how the present-day system may respond to events. Data such as Environmental Resource Management's emissions factor for CFB or Khanyisa's employment creation is most valuable to decision-makers at the time of its production, given complexity's emphasis on the particular context in which the data were generated. Data become part of the system itself, to influence or to be used by other system agents. Access to timely and reliable research and data is also important for decision-makers to be able to respond to the system as it currently is rather than to a historical version.

A focus on what the system is currently doing (in terms of ES and SJ) is also highly relevant. These issues are powerfully demonstrated in ACWA Power's appeal to the National Emissions Benchmark Trajectory Range and IRP process to legitimate its GHG emissions and power supply impact, despite the current state of the South African power system and the fact that mitigation commitments have moved on. The lack of reliable employment data again demonstrates how path dependent structures (here the MEC) can use different versions to assert power. Timely information on emissions factors, system modelling and technology developments have similarly been used by civil society (such as the CER) to resist the project.

Dangers of simplification

While some simplification is necessary to function in complex contexts, complexity theories warn of its dangers. In each instance of simplification, something is lost. Given the importance of context and variation for system resilience (Boulton et al., 2015), simplification then actively reduces systemic resilience.

The Khanyisa case engages with an area of simplification that is central to this volume: conceptual simplification. The terms 'ES', 'SJ', 'development' and 'economic growth' are all simplifications, or 'conceptual smoothings' as Lisa Kane describes them in Chapter 6. While these hard-won, high-level simplified concepts did the work of bringing ES and SJ issues onto the political agenda, it is not clear that they are now adequate for shifting our complex social systems in an environmentally sustainable and socially just direction. Much has been lost in the attempt to cohere different interest groups around these concepts at a political level. In particular, conceptual simplifications become vehicles for the exercise of power in the system and may now be used to actively resist change. In the Khanyisa case, the views of the powerful (government and business) on ES and SJ – which are based on the assumption that management plans are implemented and that economic growth is the best path for SJ – can overwhelm the local experiences of the less powerful, including Emalahleni residents, the urban poor and non-governmental organisations. Aspects of SJ and ES are undermined and lost.

Complexity theory suggests instead that the opposite of simplification is useful – a 'complexification' to regain the local variations that these concepts now hide, to describe and populate the spaces between and within the simplifications of ES and SJ. Support for local and contextual experimentation and innovation, for micro-level initiatives, for small and medium enterprises, all adds diversity and complexification.

3.7 Reflections for urban power sector decision-makers

The chapter's empirical discussion of the Khanyisa coal-fired power generation plant's implications for ES and SJ reveals the multidimensional and complex relationships both between and within the two concepts as they meet in the case, as well as the different temporal and spatial locations where these are held in tension. Complexity thinking provides an awareness of and a particular way of thinking about this complexity that challenges the dominant analytical ideals of simplicity and clarity upon which many policy processes are based.

Complexity thinking recasts the Khanyisa project in a whole system view, encouraging an active consideration of scale, perspectives,

different knowledges and cumulative impacts. In so doing, the entanglement, messiness and tensions both between and within dimensions of ES and SJ are quickly revealed. A whole system conceptualisation undermines incremental and relative arguments that Khanyisa contributes to ES, 'development' or SJ. Further, the complex systemic property of non-linearity reveals that the Khanyisa decision is more significant than suggested by its size (306 MW), as it both strengthens and expands South Africa's coal-powered path dependency. Attention to the conceptual simplification inherent in the term 'development' highlights what is lost through such simplification, as well as what is gained, and by whom. For Khanyisa, powerful interests use arguments around supporting 'development' to resist systemic change. Using complexity thinking, the multiple scales at which the systemic ES and SJ implications of Khanyisa play out are foregrounded. Electricity consumed in the GCR does not arrive devoid of ES and SJ implications at either local or national scales and, similarly, decisions around electricity made within the urban area impact other scales.

The complexity view of Khanyisa and the South African power system raises and prioritises a specific set of questions for decision-makers at various scales. Who is power bought from and at what price? What are the ES and SJ implications of this purchase at other scales? What are the implications of going off grid? How much grid power does a country, city or town need and how much can it self-generate? What path dependencies are being supported or created through different decisions? What are the cumulative ES impacts? How does one compare ES and SJ implications at different scales? What processes might do better than the current environmental impact assessments to reveal cumulative and systemic ES and SJ impacts? How do knowledge and data enter the system and influence decision-making? How current is the information about the system? How much do we know of historical patterns? What power patterning is enabled or sustained through high-level simple concepts? Understanding historical patterns and access to real-time data on the current state of the system becomes a priority in responding to these questions, as does accessing the disciplinary skills of the social sciences in addition to those of engineering and the natural sciences.

Responding to these insights, and exploring rather than avoiding the contestation and complexity, may open up new 'spaces of the possible' (Mitleton-Kelly, 2015; Shine, 2015) towards which the system as a whole might move into systemic configurations more closely oriented towards both ES and SJ. Urban policy processes that support this revealing and exploring are needed, processes which go far beyond those policy and regulatory processes evident in the Khanyisa case that are steeped in path dependencies and incrementalism.

On balance, it appears that the empirical evidence is stacked against Khanyisa's contribution towards ES and SJ in South Africa, and that the project may slow down or make the transition to a more just and environmentally sustainable power sector in South Africa more painful. Such a conclusion notwithstanding, there remains within the case a messiness of competing evidence and indeterminate findings. While uncomfortable, this complexity is also the source of richness and variation which, in complexity studies, is theorised as the raw material for systemic transformation.

The Khanyisa project may make the transition to a more just and environmentally sustainable power sector more painful

Photograph by Christina Culwick Fatti

Chapter 4

Parkhurst's 'Go Green Initiative': Governance, sustainable urbanism and social justice

MARGOT RUBIN

Abstract

Parkhurst, in the City of Johannesburg, was the first suburb in South Africa to attempt to go off grid, trying to move away from dependence on the Eskom and City Power lines of production and distribution. This was to be the first step in constructing a fully self-reliant 'green' suburb that was effectively disconnected from state-supplied services. Although the plan has not proven to be a success, the case study offers clear insights into what happens when the elite choose to try to secede from the rest of the City and demonstrates the tensions between various forms of justice and different interpretations of social justice. Removing a high-revenue suburb from the grid and reducing consumption does assist with the environmental sustainability agenda; however, the loss of revenue for the City of Johannesburg means that there is less money to cross-subsidise poorer residents. There are also questions of spatial and procedural justice as the area seeks to find ways to enclave and disconnect from the rest of the City, raising the issue of how such actions are not a just transition and generally impede notions of distributive and social justice.

4.1 Introduction

In 2015, a local community paper in Johannesburg exclaimed: 'Parkhurst wants freedom from Eskom' (Rosebank Killarney Gazette, 2017). This was followed a few months later by another article, entitled 'Power to the people – Parkhurst residents getting off the grid' (Oxford, 2015). Both articles discussed the upper-income suburb's dissatisfaction with the extensive power outages ('load shedding') that had struck South Africa over the previous few months. They also described the community's plans to find ways of disengaging from Eskom, the national power provider. The plan was named the 'Go Green Initiative' (GGI) and was intended to find new ways to generate and distribute power on a micro-grid that would feed the power back to the City of Johannesburg 's (CoJ) grid. The desired outcome was the eventual creation of a totally self-sustained community.

The plan was touted as the first project of its kind in South Africa and received substantial media attention. A little over five years later, the implementation of the project has been very limited, with only a fraction of the households in Parkhurst installing the solar panels needed to go off the grid. As a heuristic device, the Parkhurst case offers a useful set of insights into the potential implications of what would happen should such initiatives achieve scale and replicability in suburbs throughout South Africa. The case also surfaces a set of interrelated questions regarding the transition of a small and

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elite suburb to a more 'sustainable' approach to energy, focusing on the potential impact the transition would have on different forms of justice and relations with the state.

The chapter is based on six interviews with members of the Parkhurst Residents and Business Owners Association (PRABOA) and officials from City Power, Joburg Water and the South African Cities Network. The research also included watching and analysing four years of recorded PRABOA annual general meetings and numerous other recorded community events, as well as reviewing 15 PRABOA documents from their website, their Facebook page and 26 media and other reports.

The first section locates the chapter within the wider literature on energy-transition governance and questions of justice and sustainability. This is followed by an overarching narrative tracing the origin and evolution of the GGI, which argues that the initiative is a product of the larger energy context of load shedding and increasingly affordable solar power, but also of the specific community identity that defines this particular middle-class area. Thereafter, the chapter engages with the paradox of a middle-class community striving towards a form of energy sustainability and an overall green agenda. If taken to its logical conclusion and scaled up, such an initiative may have some serious, albeit unintended, consequences for social justice for the broader community. Using the lens of distributive, spatial and procedural justice, this section demonstrates that there are tensions in attempting to achieve both social justice and environmental sustainability. However, it also demonstrates that the form of procedural justice implemented in the project is in many ways aspirational. The discussion on justice is then complexified by asking a set of questions about intentionality, commonly pooled resources and whether the inconsistencies between the agendas of environmental sustainability and social justice can be mediated.

The chapter concludes that while the two agendas are not mutually exclusive, they are unevenly inclusive. Certain aspects of environmental sustainability and social justice may be simultaneously possible in a context like Johannesburg, but they require significant information-sharing, sensitivity to the existing cityscape and a willingness for communities to reflect on the possible effects and impacts on the

Photograph by Tatum Kok

larger environment. The Parkhurst case study raises questions around justice for whom and sustainability for whom. The chapter also more broadly asks what urban energy-transition governance is, and what its implications are for relationships between local government and residents.

4.2 Post-networked infrastructure, urban governance and social justice

This chapter sits at the nexus of a number of contemporary discussions around urban infrastructure transitions, governance and social justice. In these debates, urban infrastructure transitions are seen as 'radical, systemic and managed change towards "more sustainable" [...] patterns of provision and use of energy' (Rutherford and Coutard, 2014, p. 1354), 'which fundamentally alter the nature of the sociotechnical configuration' (Bolton and Foxon, 2013, p. 2196). These transitions encompass new technologies and changes in state policy and practice, and users (Monstadt and Wolff, 2015). Meadowcroft (2009, p. 324) argues: 'It is now widely recognized that transforming socio-technical systems, which underpin production and consumption patterns in core sectors – such as [...] energy – is essential if human activities are to be brought back within ecological boundaries.'

There is a recognition that energy transitions are often (and no doubt increasingly will be) situated in the urban and will involve finding renewable and non-polluting ways in which the state and residents generate, distribute and store power for urban activities. There is a dialectical relationship between 'urban processes, urban practices and urban change, and that, concomitantly, the urban experience and condition are constantly reconfigured by energy and by the evolving and contested ways in which they are connected' (Rutherford and Coutard, 2014, pp. 1354–1355). Thus, many contemporary energy transitions are connected to the politics, powers and practices of a range of urban constituencies and interests. Coutard and Jaglin (2015, p. 174) define this as energy-transition governance, which they use 'broadly to capture the multitude of ways in which urban actors engage with energy systems, flows and infrastructures in order to meet particular collective goals and needs, but also in debates, contestations and conflicts over policy orientations, resources and outcomes'.

Energy transitions are being encouraged from three directions: multilateral agreements, local government initiatives and grassroots, civil society initiatives. Multilateral organisations are deeply connected to local government sustainability drives, beginning with Local Agenda 21 almost 40 years ago and most recently through the Sustainable Development Goals, with their specific focus on local government. The uptake by municipalities has been seen as part of a larger movement towards municipal governments becoming localised centres of power. Brand (2007) speculates that the green agenda and sustainability have given local government back its legitimacy and importance in residents' daily lives. In addition, grassroots initiatives have arisen at a number of scales, from the niches of small community innovations to large town or more holistic and system-wide changes.[1] Seyfang and Smith (2007, p. 585) note that these movements generally have 'innovative networks of activists and organisations [...] solutions that respond to the local situation and the interests and values of the communities involved [...] and involve committed activists who experiment with social innovations as well as using greener technologies and techniques'.

Grassroot niches are distinguished from other niches by 'creating a space for: developing new ideas and practices; experimenting with new systems of provision; enabling people to express

1 Since 2005, 284 German municipalities, largely driven by non-governmental organisations, civil society and communities, have chosen to no longer link into national or international utility grids. They have decided to follow the policy of *Rekommunalisierung*, basically to reclaim ownership of their public utilities and generate their own power (Chakrabortty, 2018). Elsewhere, Australia predicts that by 2050, at least a third of all Australians will have left the grid (Kane, 2016).

"alternative" green and progressive values; and the tangible achievement of sustainability improvements, albeit on a small scale' (Seyfang and Smith, 2007, p. 587). These are thus independent, generally independently funded, community-driven sets of sustainable practices, which are sites of new thinking and innovation.

Not all civil society pushes are so benign. Meadowcroft (2009) identifies difficulties in replicating, mainstreaming or scaling up innovations due to the interrelationships between power, interests and infrastructure. As a consequence, cities and spaces become 'locked in' to suboptimal energy regimes due to vested interests, the obduracy of the built form and the 'tight fit' of regulations, financing and markets that have co-evolved. Thus, transitions are often difficult to implement and remain 'social technical niches or experiments' rather than true transitions across a variety of sectors (Monstadt and Wolff, 2015, p. 214).

Energy-transition governance also brings into question the traditional view that '[c]entralised infrastructure [is] a key way of connecting citizens with the state, and extending state power' (Lawhon et al., 2018, p. 728). Within this framing, 'access to state-provided services can be sought as a means of legitimising urban residence' (Lawhorn et al., 2018, p. 724). The question then is what happens in terms of governance when the service provision and citizenship nexus is disrupted, either by choice or by scarcity. McFarlane (2010, p. 135) notes that in these situations '[i]nterruption is mediated by inequality, and poorer groups often have the least capacity to cope with interruption and to improvise temporary or long-term solutions'. He further argues that 'infrastructure reflects and reproduces urban inequality. Interruption and crisis can lay bare this inequality' (McFarlane, 2010, p. 144). However, as will be seen, they can also entrench and exacerbate it. There is thus a recursive relationship between energy crises (or lack of infrastructure provision), governance and issues of inequality and justice.

Star (1999, p. 379) adds that if you '[s]tudy a city and neglect its sewers and power supplies (as many have) [...] you miss essential aspects of distributional justice and planning power'. As others have done, she points to the paradoxes and contradictions that may exist when attempting to implement infrastructure and energy transitions, and notes: 'One person's infrastructure is another's difficulty' (Star, 1999, p. 380). Thus, instead of accepting the co-benefits of sustainability and justice, Star (1999), Marcuse (1998) and others question the assumed interrelationship between justice and sustainability. As Marcuse (1998, p. 103) succinctly puts it, while 'programmes and policies can be sustainable and just [...] they can also be sustainable and unjust'; and Culwick (2015, p. 2) adds that 'conversely, just policies can have unsustainable outcomes'. This brings into the conversation two further strands, sustainability and social justice.

Environmental sustainability is about maintaining ecological systems and processes into the future through protection, and by minimising resource consumption and waste production. The Parkhurst case deals with the transition from coal-based electricity generation to renewable sources, and to solar power in particular. While social justice is about 'the fair distribution of benefits and burdens in a community of justice' (Dobson, 2003, p. 86), there are also many other forms of justice: environmental, procedural, spatial and distributive justice, to name a few. This chapter examines three aspects of justice: distributive, procedural and spatial.

Distributive justice is understood as the distribution of benefits and ills among all members of society. Procedural justice manifests as a call for equitable processes that engage all stakeholders in a non-discriminatory way (McCauley et al., 2013): all groups should be able to participate in decision-making and their decisions should be taken seriously. Lastly, spatial justice refers to 'the perception associated with the geographical distance of the resources or the comparison of uneven development

Equity and sustainability are ideologically, ontologically and pragmatically quite far apart

or underdevelopment of these resources among different branches of the organization based on geographical distance' (Soja, 2008, cited in Usmani and Jamal, 2013, p. 360).

It is also important to note that just as there are potential conflicts between sustainability and justice, so too are there tensions between the different forms of justice (Simpson and Clifton, 2016). Focusing on outcomes may of course deny procedural fairness, and the distribution of resources may well be in conflict with spatial justice, just as short-term procedural justice or distributive justice may have longer-term implications for environmental justice or sustainability. All of which is exacerbated by the fact that the perception of which justice 'counts' is of course closely related to one's positionality, normative values and stake in any system.

Dobson (2003) and others have also questioned almost all forms of equity and their relationship to sustainability, arguing that although there are clear political reasons for wanting to merge the two agendas, they are ideologically, ontologically and pragmatically quite far apart. There is no necessary or contingent reason, based on empirical evidence, to suggest that they are mutually constituting in the ways that have been suggested elsewhere. In fact, they may be mutually contradictory, as distributing resources equitably may very well deplete the resource in question, notwithstanding any principles of procedural equity or spatial access.

This chapter offers a modest contribution to these questions to address some of the gaps in energy-transition governance thinking and the just sustainability discourse by improving the dearth of empirical evidence and trying to think through the implications of 'going off grid' for governance, sustainability and the multiple dimensions of justice (Dobson, 2003). The research looks at a very specific set of circumstances, an elite suburb that has mobilised locally in an attempt to transition away from the central supplier and go off the grid.[2] The Parkhurst case shows how a transition towards a more sustainable form of electricity at the suburb level has broader implications for various forms of justice, and for sustainability at a broader scale.

4.3 Parkhurst: A history and context

Parkhurst, which is one of the older areas of Johannesburg, began as a small, privately bought land parcel that was surveyed and laid out as a township by 1903. It was promoted as a home for the nascent Johannesburg middle class since it was 'situated within less than 5 miles [about 6.5 km] of the Market Square, in the direct line of growth and development of Johannesburg's most aristocratic suburbs'.[3]

Originally called New Parktown, it was renamed 'Parkhurst' after a competition. The suburb was slow to grow and only a third was established by the 1930s. The rest of the area was developed after the Second World War when housing was constructed for returning war veterans. By the 1960s, the area began to gentrify, with older houses remodelled and upgraded for higher-income earners. Gentrification over the next few decades was driven by the intensification and commercialisation of land use on two high streets, Sixth Street and Fourth Avenue. The 2011 census put Parkhurst's population at about 4 800 people in 2 152 households, which is a relatively high density for an affluent suburb. The suburb exhibits impressive levels of employment and affluence, with more than half the households earning over R600 000

2 Going off grid generally refers to being independent of state-provided or large utility companies' provision of services, often around water and power supply, but could also include waste removal, sanitation, food supply chains and telecommunications (Vannini and Taggart, 2013). 'Microgrids' are often connected to off-grid ideas, where a 'microgrid is a discrete energy system consisting of distributed energy sources (including demand management, storage, and generation) and loads capable of operating in parallel with, or independently from, the main power grid' (https://www.generalmicrogrids.com/about-microgrids). It is generally connected to a high-speed internet system that allows for the balancing, distribution and management of energy across a localised grid.

3 21 August 1903 edition of the *Transvaal Critic*, a local newspaper of the time.

per year. Property is expensive, and free-standing houses have an average sale price of R3.2 million (PropertyWheel, 2017).

The combination of a high street, perceived commonality and the intention of residents to live in a 'trendy' close-knit community of like-minded people seems to have constructed the idea of the 'Parkhurst Village' in the residents' urban imaginary (Cabaret, 2012). The area is described in local directories and tourist guides as: 'A village within a city – Parkhurst is a shoppers' delight, with cute decor boutiques, book shops, galleries and trendy restaurants [...] enjoy the cafe society and street shopping when visiting 4th Avenue, Parkhurst!'[4] Local residents apparently refer to it as Parkhurst Village, an image that is courted by local estate agents, who boast that '[l]ike a village it has a "high street", made up of the trendy restaurants, sidewalk cafes and shops' (Property24, 2015). It is also 'picturesque and walkable [with] avenues, street café culture and a tight knit community' (PropertyWheel, 2017).

Parkhurst also has an active and engaged residents' association, PRABOA. Oxford (2016) argues that PRABOA is the most active residents' association in South Africa. It has been in existence since 2011, when it was reconstituted out of an earlier residents' association with renewed focus specifically on infrastructure, crime and planning controls. It also decided that it needed to update its communication strategy, embrace new social media platforms and integrate them into its activities. The neighbourhood and the residents' association are considered innovators: they originated a number of community projects and initiatives, such as the Village Fair and Halloween Walks. But it was their decision to be the first 'open'[5] community to bring fibre to the home (FTH) that initially put them in the media spotlight and also paved the way for the later GGI.

According to Cheryl Labuschagne, Chair of PRABOA, FTH was prompted by a spike in crime, which resulted in a meeting at which 'there was standing room only' (C. Labuschagne, PRABOA Chair, personal communication, September 2017). The idea tabled at the meeting was to install CCTV for crime prevention, but this required high-speed internet and at the time the community 'had the worst internet, about a megabit per second' (PRABOA executive member, personal communication, 2017). They wanted a crime prevention solution and improved internet access through FTH technology. After the decision was taken to investigate options, an online community poll was conducted to get a sense of community interest, price points and to 'consolidate a support base' (Dugmore, 2015, p. 59). After sending out a request for proposals, telecommunications service provider Vumatel became the frontrunner. Vumatel was keen to pilot their technology in Parkhurst as its density, high levels of buy-in and affluence made it an ideal test site (C. Labuschagne, PRABOA Chair, September 2017). Since the vast majority of residents signed up, the project has been hailed as a success, not just by the community but also by the media. They described Parkhurst as a 'technology trendsetter' with residents taking matters into their own hands (Mawson, 2014), calling Parkhurst South Africa's first 'fibrehood' (Davie, 2015). Oxford (2015) praised the community and their 'collective action' as tech visionaries who were evolving a new kind of social movement, an idea that recurred after the implementation of the GGI. Vumatel has also reaped the benefits by using Parkhurst as a proof of concept, and they have rolled out FTH to hundreds of thousands of homes across South Africa.

Soon after the success of the FTH rollout in Parkhurst, the GGI was initiated, sparked by a sense of dissatisfaction with the load-shedding events of 2014/15, when rolling blackouts affected much of the country. The causes of load shedding were many, but the final straws were first the Majuba power plant's loss of capacity to generate power in early November 2014 after one of its coal silos collapsed, followed by a second coal silo developing a major crack and shutting the plant down completely. Since Majuba

4 https://www.whatson.co.za/venue.php?venue=503

5 PRABOA is clear that they were not the first neighbourhood to have brought fibre to the home as a number of gated estates and office parks had already done so, but rather they were the first non-gated residential community to do so.

delivered more than 10% of South Africa's power, this was a major blow and resulted in what was called Stage 3 load shedding: power cuts that lasted most of the day. As a consequence, urban residents and businesses were without power for anything between two to 12 hours a day for a period of over five months. Labuschagne remembers that 'when load shedding happened now suddenly everyone [asked] how can City Power not have done x y z [...] yes we want the city to fix it but in the meantime maybe we should look at an alternative here and actually commit to doing something' (C. Labuschagne, PRABOA Chair, 2017).

This bout of load shedding came at a time when there had been significant technological innovation and price reduction in the renewable energy sector, which was in part due to South Africa's state-led renewable energy programme. This broader context opened up the potential for small-scale solar power generation to be a viable alternative energy option for Parkhurst.

PRABOA started to investigate off-grid power solutions, thinking through creating a 'smart-grid' of alternative power, collectively produced through solar panels and managed via an information network and online community platform. PRABOA followed the same model they had used for FTH: using meetings and online platforms to survey the community and get a sense of their interest, in an attempt to get their buy-in. They then reached out to 40 solar panel suppliers to see if they could deliver in bulk to Parkhurst and meet the requirements of PRABOA's members (Dugmore, 2015; Fripp, 2015). After reviewing applications and meeting with suppliers, they decided on two companies, Dako Power and Tasol. The idea was that they could supply Parkhurst residents with a range of options that included solar panels, batteries and inverters. According to Dugmore (2015, p. 63), 'the logic of the GGI [was] to approach RE [renewable energy] in a modular fashion whereby scaling up of the systems occurs when one can afford it. This may take a year or even five years, but their goal [was] to keep pushing people to convert and continue to scale up until completely off the grid'.

The options were price related, so that the more residents spent, the larger the capacity for power generation and storage. Options for mixed systems were also developed. The opening figure was approximately R14 000 (excluding VAT), but the different options went all the way up to about R100 000. PRABOA and the media pundits in support of the project argued that if a resident were to take the price of the solar system over a 25-year life span and compare that to the price of power over the same period and include the proposed increases of over 12.5% for the forthcoming year, then there realistically was a form of price parity. PRABOA also started discussions with the major banks to see if the equipment could be financed (Fripp, 2015). Part of the equation was the ability of the solar generators to sell power back to City Power or Eskom in what is termed a 'buy-back agreement'.

The solar power aspect was the initial part of the project, which then grew into a discussion

Photograph by Christina Culwick Fatti

about making the suburb entirely self-sufficient by 2020 (Oxford, 2015). The ideas evolved and became ever more ambitious, with Simon Beech, one of the PRABOA executive members, suggesting that the suburb construct a smart platform and an 'internet of things' at a personal and community scale, a smart grid to manage power through which '[w]e could stagger access to energy [...] so send a message to all the houses in one block to turn on their pool pumps now, for example' (quoted in Oxford, 2016). The energy produced in the suburb would be for domestic use as well as for street and traffic lights and other communal needs. This was followed by the idea of installing battery charging points across the neighbourhood for green bicycles and cars. It did not stop there: also proposed were community-owned biogas and biofuel production plants to generate methane gas for cooking, and teaching people how to grow their own food and recycle water, with the ultimate aim of living totally off grid (Gordon, 2015).

At the time of writing, a number of households had gone through energy audits with the preferred suppliers and had reduced their power consumption; and approximately 500 homes had incrementally begun to build up their renewable energy systems by purchasing inverters (Dugmore, 2015). However, only 25 households had installed solar panels. In addition, the suburb was applying to become an independent power producer (IPP) and find ways to sell power back to City Power, but that was seen as a slow and uncertain process. However, once the power grid was a bit more stable, 'the [GGI] seems to have taken a back seat' (C. Labuschagne, quoted in the Rosebank Killarney Gazette, 2017).

Although the actual project has yet to reach any kind of scale (and there are doubts as to whether it ever will), the GGI offers a chance to analyse and think through the paradoxes and consequences for justice that are raised when a middle-class community decides to find 'green', 'niche' solutions to service issues. The following sections are the main focus of the chapter and unpick the various threads using four main conceptualisations of justice: distributive, spatial and procedural justice, and the idea of the social contract. These conceptualisations, which have already been discussed in the previous section, are explored and given material form below.

4.4 Power, justice and sustainability

Before getting into the details of the various contrasts and tensions concerning justice and sustainability, it is important to at least sketch out some of the main features of the power landscape in South Africa and Johannesburg, and the political economy of the institutions involved. Eskom, the main public power supplier in South Africa, is 100% state-owned and produces 95% of all power in the country (Jaglin and Dubresson, 2016). It has historically been able to produce power from cheap, low-grade coal, of which there are substantial reserves. The result is that despite relatively modest levels of manufacturing and production, South Africa was ranked 14th in the world for CO_2 emissions (Carbon Brief, 2018). Since 2008, the country has experienced serious power shortages and '[t]he precarious balance between real generation capacity and demand has become structural' (Jaglin and Dubresson, 2016, p. 1), resulting in the institution being managed in crisis mode. The crisis has also been exacerbated by, in large part, the unwillingness of senior political figures to acknowledge the severity of the situation by referring to it as a 'challenge' or a 'constraint'. Jaglin and Dubresson (2016, p. 6) argue that at the root of this behaviour is 'a highly lucrative neopatrimonial system from which the ANC's [African National Congress] political elites profit', a techno-political regime that, they argue, is also hooked into the mining sector. The consequences of these configurations are myriad: although transitioning to less polluting energy sources is a

The solar power aspect grew into a discussion about making the suburb entirely self-sufficient by 2020

stated intention, there is a de facto unwillingness to move towards renewable energy production at the national scale due to the consequent lessening of profits for both the mining industry and Eskom. This has also meant a slow engagement with IPPs, and opacity and confusion about their role, policies regardingtheir uptake and their deals with Eskom.

In Johannesburg, power is distributed by both Eskom and City Power. City Power, a 100% municipal-owned entity, purchases the majority of its energy from Eskom, with the remainder supplied by the independently owned and operated Kelvin Power Station. Energy from both sources is then distributed to its customers. City Power identifies *inter alia* three core mandates that include acquiring electricity from alternative energy sources; reducing their greenhouse gas emissions; and making use of a variety of technologies, especially renewable energy sources.[6] However, just as within the national sphere, there has been some confusion around the role that IPPs can play, and if and how they could sell power back to the grid.

Energy and power generation are thus entangled with a host of different interests, and despite formal agreements and commitments to more environmentally sustainable options, little has so far been accomplished, and there is some doubt as to the future of these commitments to any kind of energy transition. The following subsections examine three dimensions of justice at the very local and grassroots level – the Parkhurst GGI – and point to some of the contradictions and paradoxes that have and potentially could result from this energy-transition initiative.

Distributive justice: Consequences for cross-subsidisation

Post-apartheid South Africa, and especially the urban centres, took clear decisions to pursue a redistributive set of policies, noting the legalised and entrenched forms of inequity of the previous regime and choosing to do something about them (Seekings, 2008). In Johannesburg, the new principles were promoted through a range of policy and planning mechanisms: the 'one city, one tax base' mantra and a slew of municipal legislation allowed for services to be cross-subsidised from tax generated in wealthier suburbs and businesses to pay for infrastructure costs and services in poorer townships and marginalised areas.

Power provision was no different, and in Johannesburg the wealthy have subsidised poorer neighbourhoods. According to the White Paper on Local Government: 'In addition to targeted subsidies to poor households, municipalities can cross-subsidise between high and low-income consumers, both within particular services and between services' (quoted in South African Cities Network, 2017, p. 21). One of the principles contained in the CoJ's policy for power tariff-setting is that 'tariffs must provide for transparent cross-subsidisation of poor households, where necessary and feasible' (CoJ, 2018, p. 3). Paul Vermeulen from City Power explained that 'in terms of the electricity pricing policy, we have got to protect the poor and that policy allows you to create cross-subsidies from business [and higher income areas] to let's call it low-income residential' (P. Vermeulen, City Power official, personal communication, 2017).

Outside of the injunction for cross-subsidisation, there is also an increasing demand for municipal governments to be more self-sustaining and to demand less from the (declining) national fiscus. One of the key sites of revenue generation has been in the service-provision sector. In Johannesburg, service charges comprised 55% of total revenue and, of that, almost 60% came from electricity sales – a total of almost R14 billion in 2016/17 (CoJ, 2017). However, when load shedding occurred, 'all of a sudden, you've got those that can afford to, spending a lot of money on energy-efficient appliances and lighting and whatever, and these new options' (P. Vermeulen, City Power official, 2017). Households also became aware of the cost of power and the year-on-year increases. As a consequence, they either maintained or upgraded the mitigating measures they had put in place during load shedding. City Power and Eskom thus saw a decline in sales

6 https://www.citypower.co.za/city-power/Pages/Company-Profile.aspx

Table 4.1: Year-on-year growth and decline in electricity sales in the City of Johannesburg

SOURCE: Recreated from CoJ (2018, p. 3)

Financial year	Actual growth	
	Demand (GWh/a)	Volume growth (%)
2004/05	11 727	
2005/06	12 147	3.6
2006/07	12 900	6.2
2007/08	13 091	1.5
2008/09	12 938	-1.2
2009/10	13 115	1.4
2010/11	13 114	0.0
2011/12	13 066	-0.4
2012/13	12 826	-1.8
2013/14	12 623	-1.6
2014/15	12 361	-2.1
2015/16	12 159	-1.6
2016/17	12 151	-0.1
2017/18	11 755	-3.3
2018/19	11 813	0.5

(see Table 4.1). This meant that there was simply less money to directly cross-subsidise power and other municipal investments across the Johannesburg metro, and that City Power and Eskom both had declining revenues.

Solar energy was seen as the best alternative for Parkhurst since generators are both noisy and polluting, and wind turbines need a far larger scale to be cost effective. In addition, Johannesburg has high levels of solar radiation, panels can be fitted at very small scales and there are few environmental consequences (PRABOA, 2015a). It was also seen as an affordable solution that could be upgraded when possible and linked into the existing grid with few issues. However, Greyling (2015) pointed to the interconnections and consequences of these actions:

> City Power owns the distribution network and infrastructure that municipalities use for electricity to generate income. If the 2,000 plus erfs go off the grid this will mean that council loses out on an amount bordering R5.2 million per month, excluding rates and demand side management levies charged to each owner [...] an overhaul on the entire system, though beneficial in the long run, will cost the metropolitan millions upon millions of Rands.

The consequence is not that the metropolitan government will lose money; it is that 'electricity cross-subsidises other areas' in municipalities (South African Cities Network official, personal communication, 2017). The consequence for distributive justice – understood as 'the fair allocation of public spaces and related resources for all social groups' (Kabisch and Haase, 2014, p. 130) – of the environmentally sound decision to go off grid and produce power through solar would mean the removal of millions of rands from the municipal fiscus and lessen the ability to cross-subsidise. This exacerbates the unequal distribution of resources that currently exists.

Breaking of the social contract and spatial justice

There are, however, other consequences of the move to solar power, including questions of governance and spatial justice. Apparently, Parkhurst residents were 'fed up with bureaucracy, load shedding, and lack of progress' and, by choosing solar, they were 'taking the future into their own hands' (Oxford, 2015). The implication is that in some way the state has failed in its social contract, which is largely mediated in modern societies through the consistent provision of good-quality services (cf. Lawhon et al., 2018). The equation seems simple: good residents pay their rates and taxes, are law abiding and pay for their services. In return, all spheres of government, but particularly local government, provide safety and services, and are responsive to the needs of their constituencies. In many ways, load shedding was a disruption, a break in the social contract caused by Eskom and City Power. Residents had paid and obeyed, but the state had not upheld its end of the bargain. As such, Parkhurst residents chose self-provision and, in doing so, further weakened the contract, severing one more thread in the fraying bonds between middle-class residents and the state. The implication was also that this was not a one-off event but rather the first sign in a signal of longer-term deterioration, 'since the City is leaving everything to rot' (PRABOA executive member, personal communication, 2018).

Interestingly, going off the grid was interpreted by the media as a tactic of reconfiguring the relationship of the suburb to all spheres of the state. In language redolent of the liberation struggle, the media portrayed the decision to go off Eskom's grid as a 'power struggle' (Greyling, 2015) and as 'Power to the people' (Oxford, 2015), resonating with both earlier anti-apartheid struggle slogans and intentional (if slightly obvious) puns. The earlier FTH and the GGI projects were hailed as 'a striking example of grassroots democracy in action [where] residents voted with their wallets and their custom: they decided how much they were willing to pay, and found a company prepared to supply superfast broadband on that basis' (Fripp, 2015). Another journalist asked rhetorically of the GGI: 'Grassroots action, middle class style, then. What does that look like in South Africa?' (Oxford, 2016). Going off grid was not just a technological solution to a difficult problem; it was cast as a political act, rejecting the status quo that residents had been forced to endure. Although uncertain, it can be speculated that what was really being rejected was a national state, and a national party with leftist leanings that had been voted in by 'others' and did not reflect the interests, demographics or politics of a middle-class, largely white community (Appelbaum, 2019).

Aside from the media interpretation, there is a strong sense that the GGI cemented the importance of PRABOA as the community's representative institution as well as reinforcing the distance between the residents and the CoJ. To begin with, the GGI could only have developed because PRABOA enjoyed a degree of social and political capital and legitimacy, with the community having enormous trust in the organisation. According to Dugmore (2015, p. 64), 'there is trust by the community that the association is pushing them in the right direction, in a way that is ultimately beneficial for all Parkhurst residents'. On their website, PRABOA have identified themselves as 'a volunteer-based committee that serves in terms of the National Constitution, as the fourth tier of Government'.[7] According to the Constitution of South Africa, there are only three

7 https://parkhurstvillage.com/about-us/

spheres of government, but PRABOA's formulation constructs an additional layer that is part bridge and part obstacle to local government.

The City, however, was seen as being largely unaware of the GGI and not terribly interested. According to the PRABOA Chair, although the 'City typically, makes nice noises', they have not really engaged with the GGI at all (C. Labuschagne, PRABOA Chair, 2017). Dugmore (2015) reported one of his respondents as saying that it was too difficult to get the government involved and that trying to speak with someone in power was nearly impossible. It may be speculated that the techno-political regimes in power have also not been responsive or have not clarified policies around alternative energy provisions and IPPs simply because it is against their best interests. This attitude has maintained or 'locked-in' energy provision and distribution within the CoJ. It can thus be ventured that the initial load shedding, combined with the lack of response and the mistrust of the intentions of the institutions, has chipped away at the already tenuous relationship that existed between these middle-class residents and local government.

Political disconnections aside, the proposed Parkhurst energy transition also involved a material and symbolic removal. Rejection of the larger environment and the enclaving of the elite has been spatialised in many contexts, especially in South Africa and Brazil. It is increasing across both regions through 'gatings' and the cutting off of the wealthy through fortifications (Murray, 2011, 2008; Landman and Schönteich, 2002; Caldeira, 2000, 1996). Graham and Marvin (2001, p. 33) have also noted the ways in which the wealthy have been able to splinter urban environments where 'a parallel set of processes are under way within which infrastructure networks are being "unbundled" in ways that help sustain the fragmentation of the social and material fabric of cities'. Coutard (2008, p. 1816, citing Graham and Marvin, 2001) further explains that '[t]hese bypass strategies contribute to the emergence of so called premium networked spaces. In particular, elite or higher-income groups are increasingly living in 'secessionary' places/spaces that are 'withdrawn from the wider urban fabric' (Graham and Marvin, 2001, p. 268). Such spaces have their own energy and water supply, either drawn from the same sources as the rest of the City but given premium access, or drawn from other sources. Thus, in attempting to find sustainable power solutions and transitioning to solar, they have symbolically drawn a border around the community and created a zone of spatial exception and exclusion, sometimes to the detriment of poorer households due to the elites having better or the only access to resources and thus depriving others, and sometimes through constructing spatial discontinuities within urban centres. The Parkhurst residents have not enclosed their neighbourhood physically. However, by entrenching the imaginary boundaries and borders of the suburb proclaimed by the City's maps, the community has clearly territorialised their space as profoundly as if they had enclosed their community with gates and chains.

The territorialisation began before the GGI. Parkhurst has for some time referred to itself as a 'village', a slightly bizarre identity given its history as a Johannesburg suburb, its central location and its engagement with high-end technology. However, it is clear that there is a strong imaginary of the suburb as a village and, accordingly, what it should look like. Minutes of the 2015 Annual General Meeting (PRABOA, 2015a) are revealing: 'We are constantly under siege for matters of rezoning which have to be defended should the character of your suburb remain for the reasons you took a decision to live here.' Even without a very deep analysis, the language of us and them is clear, as is the idea of a spatial imaginary that requires some kind of defence against external encroachment and protection of the suburb's 'way of life'. These actions can be understood in terms of what Ballard (2005) and Bauman (1993) have seen as the intersection between identity production and secure social space, whereby '[o]ur sense of self is thus related to our sense of place. People feel comfortable living in a neighbourhood where they see their neighbours as their kind of people, who share their values and are likely to reinforce their sense of themselves' (Ballard, 2005, p. 67). Residents thus have a strong sense of who they are and the space in which they live reaffirms and reinforces that identity, and actions are taken in order to defend and ensure its continuity (Purcell, 2001).

The next steps towards exclusion have been through the use of technology: social media has been used to draw a line around those

whose properties would be included and those who would be excluded from decision-making meetings and information on 'special' deals. As mentioned previously, the FTH installation has created a 'fibrehood' (Davie, 2015), a new kind of neighbourhood defined by high-speed internet access and, prospectively, through access to solar power. Energy expert Chris Yelland states the project essentially entails turning the suburb 'into a self-sufficient island no longer connected to the power grid' (quoted in Dugmore, 2015, p. 58). As such, the residents inside the 'village' would have access to super-fast internet and to subsidised rates for alternative power that would be largely unaffected by the precarities of the general power grid. The consequence is a site that is differentiated: a small pocket of privileged access granted by wealth and technology, a space 'splintered off' from the rest of the City through technology, politically excommunicated if not physically excluded.

Interestingly, although the suburb has always been affluent and highly sought after, the conceptualisation of the site as a 'village' with its active, innovative residents' association seems to have pushed up Parkhurst's desirability. Since 2008, house prices have increased by over 80%, with houses ranging from R2.5 to R7 million (Rawson Property Group, 2015). This desirability is no doubt also due to its location and the relatively small size of the plots, which makes maintenance manageable while still allowing for extension and renovation. These house prices make the area even more exclusive and even further out of the average Johannesburg resident's reach.

Procedural justice and active citizenship

As opposed to spatial justice or distributive justice (which are, in a sense, outcomes-based forms of justice), procedural justice questions the equity and fairness in the processes by which decisions are reached (Low, 2013). Ingrained in the South African mode of local government is the idea that it should be participatory, giving residents a say in their spatial futures and in the decisions that affect them directly. There is a host of planning legislation at a range of scales intended to provide platforms of inclusion for resident populations. For the most part, these have been found difficult to implement, and there is much literature in South Africa detailing the failures of such platforms (Piper and Nadvi, 2010; Heller, 2009; Benit-Gbaffou, 2008). Further to the idea of participatory democracy has been the notion, espoused largely by the National Development Plan, of an 'active citizenry' that plays its part and gets involved.

Parkhurst has offered a form of procedural justice, albeit a highly exclusive one at the neighbourhood scale, where residents were canvassed using social media and online platforms, and where public meetings for information-sharing and decision-making were held. Although, on one hand, the desire seems to arise from concerns around the City's ability to provide infrastructure and do its job, there is also a clear sense that 'people should be responsible for where they live and the resources allocated for that purpose should be decided on by the people who are benefiting from those services, who are closest to those services. I think that's great; the more communities get involved, the better life will be for their community' (PRABOA executive member, 2017). Parkhurst, for those who are included, seems to provide an example of what is possible when residents choose to be active and then have the capability and resources to utilise technology to allow for participation and consensus building. However, this begs the question of who is excluded – non-residents (workers, users and visitors) of the suburb have little say. Furthermore, those outside the suburb's boundaries, irrespective of the impact that these actions will have on them, are not included in the decision-making processes. Finally, the procedural justice that is in evidence at the micro scale once again contrasts with questions of distributive justice at the City scale and beyond.

Parkhurst has offered a highly exclusive form of procedural justice at the neighbourhood scale

Exploring complex interactions and interpretations

The above-mentioned tensions between sustainability (in this case, the use of alternative energy) and three types of justice – distributive, spatial and procedural – raise a set of questions about how to adjudicate these tensions, not from a normative perspective, but from an analytical one. The first set of questions is about intentionality: the actions of the Parkhurst community could paradoxically contribute to certain types of injustice, a splintering of the urban environment, and the entrenching of spatial and socio-economic disparities. However, Labuschagne (PRABOA Chair, 2017) eloquently spoke to what she and PRABOA were attempting to accomplish: 'It is not about me excommunicating myself from the City's social fabric; it is me saying that I need to do what I can do for the people that I can influence [...] that is probably the best I can do.'

At its best, the GGI was intended to change the way that residents lived and win hearts and minds to a more sustainable way of living. In its most benign formulation, it was about trying to do what was possible for their own community and certainly did not anticipate the kind of ill effects that have been drawn out in the preceding sections. This poses the question of whether the way in which the residents and PRABOA view their actions would change if the various injustices were to be made more apparent to them.

As mentioned in an earlier section, only 25 households have taken up solar and the project has largely stalled for the moment, which makes one question just how sustainable a project like this is. Is it really motivated by a dedication to a 'green' agenda or is there something else at play? The micro scale is revealing about the logics and motivations driving this project. There were certainly at least some parties who were driven by an ethical environmentalism, dedicated to sincere changes in lifestyle and consumption. PRABOA's message to its residents included an online circular of what not to do during and in response to load shedding, noting the pros and cons of generators and other technologies and ending, first, with encouragement – 'The RIGHT thing to do! Change the way you live. The time has come for people in our country to realise that resources are limited and will soon become very expensive' – and then with an apocalyptic warning – 'We all therefore need to change our mind-sets to live a greener lifestyle and to be less dependent on resources. Electricity supply is only one of many crises that our country is going to face in the next ten years. Water supply and food is not far behind and we are in a position to start preparing for these now' (PRABOA, 2015b).

However, the interviews also made clear that many people were motivated by the desire to maintain their middle-class standard of living, which was threatened by load shedding. When the worst of the load shedding passed, with just the occasional power outage, one respondent reported that the conversation in the suburbs changed: '[now] what you are talking about is batteries, if you are just worried about a little bit of storage why don't you just get a little bit of storage, what's solar got to do with it, no one is worried about the grid going down for days and days and days which solar would be great [for]' (PRABOA executive member, 2017). This suggests that the framing of 'green' power was less of a motivating factor than maintaining resource consumption patterns and limiting the inconvenience of power interruptions.

There were also a series of other 'workarounds' to maintain quality of life that were considered, such as piping gas into people's homes and getting inverters (PRABOA executive member, 2017). For others, motivation to support the project included the potential to sell power back to the grid, which meant there was a financial incentive, or at the very least the prospect of breaking even. However, no buy-back facilities have been instituted, making the 'business case' unfeasible and, as such, turning some residents away from the overall idea since the economics simply do not make sense.

4.5 Conclusion

The relationship between environmental sustainability and various dimensions of justice is a complex and complicated one. In some ways, Parkhurst's GGI is an example of an environmentally sustainable energy intervention that was developed through just processes at the community scale. In other ways, the case seems to point to a project that

may be neither environmentally sustainable in its current form, nor just. Section 4.4 points to the variations in residents' motivations, from leading a 'greener', more sustainable life to just wanting to maintain their current middle-income lifestyle. Conversely, grassroots activism, as seen in this case, may well provide the necessary pace to experiment and innovate around sustainable energy solutions with joint community ownership. Swilling (2019) argues that these types of small-scale, community-owned renewable energy grids have the potential to contribute to a just energy transition.

However, there are some real concerns around spatial, distributive and procedural justice. The ability of an affluent community to use technology to disconnect from public provision constructs a form of fortification and privatisation that in effect 'splinters' Parkhurst from the surrounding communities and the larger community of Johannesburg, further perpetuating existing socio-economic injustices. As much as self-sufficiency can be read as a form of green innovation, it is also a physical and metaphorical mode of excommunication. This further embeds the existing landscape of inequity by creating 'pockets' of self-provided power within a larger urban fabric of lack, where many communities simply cannot afford to buy and pay for consistent and alternative service provision.

There is also an unintended consequence of such actions. Given that the current municipal fiscal system is derived largely from the payment of services, and many of the CoJ's welfare programmes as well as the cross-subsidisation model rely on the payment of more affluent sectors to sponsor poorer consumers, the withdrawal of payment from the metropolitan fiscus simply means that there is not as much to go around, and there is certainly less money available for poorer areas. This then raises the question of economic sustainability. Would it be viable to continue with the free provision of water and electricity if cross-subsidisation and a declining municipal budget were a more common reality?

There is, however, something undeniably just about the procedural aspects of the Parkhurst GGI. It was highly democratic, it was voted for, tested, used high levels of consensus and had an active and engaged citizenry. All viewpoints had platforms through social media and face-to-face engagement at meetings, and the residents' association had a highly responsive executive. However, the process was also very exclusionary: relying on a set of spatial and social indicators to define inclusion and procedural justice within a small, affluent group may not be a sufficient trade-off for the resulting systemic injustices.

The point remains that there are aspects of environmental sustainability – such as the ability of affluent communities to adopt innovative technical solutions – which ease pressure on the grid and provide more sustainable alternatives. It is also true that these communities arguably offer an interesting and possibly replicable model for procedural justice and active citizens. However, the darker side is that, in doing so, such communities may splinter, fortify and dislocate from the general urban fabric, thus depriving the larger fiscus of important financial and social contributions that allow for the betterment of all. There is also the potential that such self-provisioning effectively means political isolation.

The questions on how to achieve just sustainability are not simple and, as cities become more unequal, climate change more acute and service provision more uneven, these will increasingly be the questions we are faced with. The elite, where possible, may very well splinter off, spatially, politically and socially, with fewer and fewer connections to those around them. However, this need not be the case. More research is needed on elite transitions and modes of secession which would surface these actions and bring them into the light for better scrutiny. Analysis could also mean that these transitions may well become the objects of policy and even litigation, which may be able to stop their worst depredations on the urban environment.

As much as self-sufficiency can be read as a form of green innovation, it is also a physical and metaphorical mode of excommunication

Photograph by Clive Hassall

Chapter 5

Deconstructing sustainability and justice in government housing developments

CHRISTINA CULWICK FATTI

Abstract

Government housing developments can help address the need for adequate housing and access to basic services, and in so doing raise the quality of life for the urban poor. However, the form and geography of these new settlements have implications for social justice and environmental sustainability. Although government housing has enhanced access to housing and basic services for millions of South Africans, these programmes have been criticised for their low densities and peripheral locations, which have exacerbated urban sprawl and locked cities into a high resource consumption trajectory. This chapter uses survey data from Gauteng to test the hypothesis that government housing developments that are closer to economic opportunities and services are more socially just and environmentally sustainable. The literature provides clear indications that just sustainability imperatives are more likely achieved through well-located developments; however, the evidence presented in this chapter does not clearly bear this out. While this study confirms that access to job opportunities is correlated with employment, there are no obvious correlations between proximity to jobs and overall quality of life or marginalisation. The results highlight that 'well-located' means different things depending on what measure of access is used. The chapter concludes that although some measures align towards just sustainability, assessing outcomes across different spatial and temporal scales, as well as across society as a whole, can reveal conflicts between and within justice and sustainability. This chapter calls for more nuance in the debates and analyses that inform government housing developments.

5.1 Introduction

Government housing developments can help address the need for adequate housing and access to basic services, and in so doing raise the quality of life for the urban poor (Turok, 2016a; Shapurjee and Charlton, 2013; Chiu, 2000). However, the geography of these new settlements and the ways in which these developments are undertaken have implications for social justice and environmental sustainability. Different approaches to housing development affect urban residents' ability to access services and opportunities, as well as the housing development's broader environmental impact and associated resource consumption (Monstadt, 2009).

There is a complex interplay between different components of social justice and environmental sustainability with regards to housing developments and spatial form (Aquino and Gainza, 2014). On the one hand, champions of compact urban forms argue that this type of development enhances social justice imperatives through increasing accessibility while reducing environmental impacts, as it minimises

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sprawl and reduces day-to-day travel costs. On the other hand, there are strong arguments claiming that compact and infill developments are unable to develop at the rate and scale required by the demand for housing, and that development on the urban edge is preferable despite the negative implications for environmental sustainability (Charlton, 2014; Cirolia, 2014; Angel et al., 2011; Biermann and van Ryneveld, 2007).

While it might seem intuitive that centrally located housing will better facilitate access to services and economic opportunities than peripheral developments, there is limited empirical evidence that demonstrates this. This chapter tests the hypothesis that better located government housing developments are more environmentally sustainable and socially just than peripherally located developments. To interrogate the assumptions around the implications of government housing for social justice and environmental sustainability in Gauteng, this chapter draws on survey and interview data.

The literature provides clear indications that environmental sustainability and social justice imperatives are more likely achieved through well-located developments; however, the evidence presented in this chapter does not clearly bear this out. This raises questions about how to interpret what 'well-located' means. Furthermore, the resolution of an analysis across society, space and time has a significant impact on the conclusions that can be drawn about whether progress has been made towards just sustainability – development that is concurrently environmentally sustainable, equitable and inclusive. This chapter is innovative in that it probes these debates – which have been going on for many years – using large sample survey data from Gauteng. The analysis shows that assessing different measures provides different conclusions about justice and sustainability, and these also differ from development to development. Achieving both justice and sustainability through government housing developments requires more than just a commitment to these objectives, but also an engagement with difficult questions around what 'well-located' means and what knowledge is used to guide decision-making.

5.2 Social justice, environmental sustainability and government housing

In line with the general definitions in Chapter 1, social justice in this chapter focuses on enhancing the equity of resource distribution (Leach et al., 2018; Campbell, 1996), with an emphasis on distributional rather than procedural or recognitional justice. In terms of government housing, this includes improving the quality of life of the poor through providing adequate shelter and basic services, and enabling access to amenities and economic opportunities (Turok and Borel-Saladin, 2016; Shapurjee and Charlton, 2013; Chiu, 2000). Importantly, achieving justice through housing requires that existing inequality is redressed.

Environmental sustainability draws on principles of maximum efficiency, where the needs of society are met through the least possible impact on resource use and land consumption (IRP, 2018). Housing has both direct and indirect implications for environmental impacts, access to economic opportunities and overall quality of life (Turok, 2016a; Shapurjee and Charlton, 2013; Chiu, 2000). Related consumption includes the resources and land required to construct houses and infrastructure, and the ongoing consumption of water, energy and other resources by residents of such spaces once they are built (IRP, 2018).

The literature highlights that securing access to shelter, basic services, social services and economic opportunities through government housing developments contributes to the quality of life of

A just and sustainable housing development enables access to services and opportunities with the lowest possible environmental impact

the poor (Turok and Borel-Saladin, 2016). A just and sustainable housing development would be one that enables access to services and opportunities at the lowest possible environmental impact (in both construction and post-construction phases). There is an interplay between social justice and environmental sustainability imperatives related to government housing, where enhancing access to shelter and services has unavoidable consequences for environmental impacts, including land transformation, ongoing use of resources and energy, and waste production (Chiu, 2000).

This research positions government housing developments and their associated social justice and environmental sustainability implications within the broader context and debates around urban form and development. Particular emphasis is placed on the debates regarding the implications of housing on transport, accessibility, land, infrastructure and resource use. With these debates as a foundation, this chapter explores how these concepts have evolved within the South African context, particularly in the post-apartheid era. The chapter then explores how ideas around social justice and environmental sustainability interact within the context of low-income housing in Gauteng.

Urban form

Turok (2016a) highlights that housing has the largest impact on urban land transformation of all land uses. Urban planning approaches that focus on environmental sustainability prioritise brownfield[1] and infill[2] development because they minimise the land required per household. Brownfield and infill developments are favoured over greenfield[3] developments and particularly those on the urban edge (Sharifi, 2016). Land-use change from greenfield developments has negative implications for environmental systems because they reduce green spaces and increase built-up spaces. In addition, providing infrastructure to greenfield sites, and particularly those on the urban edge, requires new infrastructure networks which are not only costly (Ballard, 2017), but also require resources for their construction and ongoing maintenance. Long infrastructure networks are associated with high maintenance requirements and resource wastage (e.g. water leakages increase with the length of piping). Greenfield projects are often characterised as being simpler and faster to develop in terms of contractual and administrative complexity (Cirolia, 2014; Biermann and van Ryneveld, 2007). To the extent that this is the case, greenfield developments can enable a greater number of houses to be built in a shorter period, thus enhancing the achievement of the right to adequate housing and basic services.

Housing developments influence longer-term resource use and residents' access to services and economic opportunities, and the location of government housing developments has direct impacts on the costs and availability of land, and on the proximity to existing bulk infrastructure. Land is generally cheaper and more available on the urban edge compared to areas closer to city centres and central business districts; however, infrastructure costs can be lower in infill developments, especially where the existing infrastructure can handle additional load (Steinacker, 2003). Areas that are in close proximity or within easy access to economic and city centres are generally considered 'well-located' (Landman, 2010). However, there is a lack of alignment in the literature on how to assess whether a settlement is well-located or not.

Many of the debates around urban form and environmental sustainability focus on the type of development and their categorisation as 'compact' or 'suburban', where environmental sustainability arguments advocate compact developments over suburban development (Aquino and Gainza, 2014). Compact development is widely considered by planners as the 'ideal' form as it promises maximum benefit from infrastructure investments, increased viability of public transit and accessibility of urban opportunities and amenities, as well as the potential

1 Redevelopment of built-up areas, which can include *inter alia* industrial sites, existing buildings, parking areas.
2 Development within built-up areas.
3 Developments in natural or untransformed areas.

to protect agricultural and other land beyond the urban edge (IRP, 2018; Seeliger and Turok, 2015; Suzuki et al., 2013; Camagni et al., 2002; Gordon and Richardson, 1997). These all contribute to the achievement of just and sustainable cities.

However, Jenks (2000) flags that smaller stand sizes in compact areas limit income-generation opportunities from rental and home-based businesses for low-income groups – a negative outcome for social justice. Compact urban development alone is insufficient to ensure just and sustainable outcomes (IRP, 2018; Biermann, 2005), and in some cases can contribute negatively to both justice and sustainability. Compact development can exacerbate heat island effects, lead to land transformation, encroach on urban green spaces, lead to dark and cramped living conditions, and exacerbate exclusion through land and housing price escalations (Mueller et al., 2018; Krupp and Acharya, 2014; Neuman, 2005). Dave (2010) argues that in Mumbai, higher densities are associated with higher stress, poor respiratory health and lower satisfaction with neighbourhoods than in less dense areas. During the recent COVID-19 pandemic, concerns were raised that high-density cities and areas would be the most vulnerable to the spread of the virus.[4]

Dempsey and Jenks (2010, p. 119) argue that

> the dominant interpretation of the compact city remains a Western one which arguably looks to replicate cities, typically based on a romantic view of their historic centres, such as Barcelona or Amsterdam, and needs to be critically re-examined alongside other interpretations within different cultural contexts from all over the world.

There is a burgeoning set of literature that identifies the inadequacy of compaction in addressing the existing housing backlog and preparing for future growth in cities whose population is increasing (Angel et al., 2011). These arguments emphasise that if such cities plan for their 'inevitable expansion' they could better control the form of urban growth and thus ensure both sustainable and just outcomes (Angel et al., 2011).

While urban expansion projects can address the housing need quickly and potentially at a lower cost to government, this potential needs to be balanced against the externalised cost of transport and accessing urban opportunities (Chapman, 2007), which can further marginalise poor communities (Turok, 2016a; Mubiwa and Annegarn, 2013). Other concerns related to urban expansion include increases in resource consumption, urban-based pollution, congestion, environmental degradation, land-use segregation and higher costs for infrastructure and services (Mubiwa and Annegarn, 2013; Camagni et al., 2002).

On the surface, housing development decisions can seem to be choices between the imperative of ensuring enough adequate housing to meet the demand (through urban expansion) and the imperative of reducing resource consumption and environmental impact (through densification). However, as Aquino and Gainza (2014, p. 5877) argue, the consequences are seldom that neatly divided and, importantly, are influenced by the scale of assessment:

> [A]lthough increasing overall density rates may be a desirable planning goal at the metropolitan scale, it can deepen contradictions within the city depending on how it is obtained. For instance, promoting infill development and containing suburban sprawl may contribute to a more efficient use of services and a more sustainable transportation choice, but at the expense of housing affordability and more access to green space in particular areas of the city.

A key challenge is finding ways to further both justice and sustainability through government housing developments. Waters (2016, p. 13) emphasises that the form of development is important primarily in terms of its ability to facilitate 'connectivity, social vitality and convenience'. Aquino and Gainza (2014) argue that a simplified location-based assessment is insufficient to measure the real impact of

4 Infection data, however, have highlighted that high density (residential population per square kilometre) is not in itself problematic, but rather the level of internal crowding of buildings (Dietz et al., 2020), access to healthcare (Hamidi et al., 2020) and the quality of living and communal spaces.

development – regardless of form – and they argue for deeper engagement with issues around quality of life, access to economic opportunities and urban amenities across different groups in society.

Access to services and opportunities

The length of commuting and trip-making can be used as a proxy for environmental, social and economic impacts. The longer the trip, the greater the resource use and carbon emissions associated with both the transport infrastructure and the trip itself. From an environmental sustainability perspective, it is preferable to have shorter commutes and greater reliance on public transport and non-motorised modes of transport. Longer trips also tend to increase the social and financial costs of accessing services and economic opportunities (FFC, 2011). Suzuki et al. (2013, p. 165) posit that

> [o]ne of the major social ramifications of ill-conceived spatial development is the burden placed on residents who cannot afford to purchase a private vehicle or are unable to live close to work and schools. Many of the poor must consequently endure long-distance commutes to make ends meet.

It is important to note that proximity to services does not necessarily translate into access to services, and being located close to economic opportunities does not necessarily mean higher employment rates. Securing work is influenced by a number of other factors such as education and skills. There can be a mismatch between job opportunities and the skills of people in the surrounding areas (Cross, 2014).

Government housing in Gauteng

Government in Gauteng faces the challenge of balancing the immediate need for housing with growing concerns over resource constraints, as well as the need to transform the city-region's unsustainable and unjust spatial form. Government in South Africa is constitutionally responsible for helping to ensure access to adequate housing and services, and national housing policies stipulate that housing must be located with convenient access to jobs, healthcare, education and other social amenities. Furthermore, policies emphasise the importance of higher-density housing, which ensures efficient land use, maximises economic investment and minimises environmental impacts. These principles are designed to guide spatial restructuring so that cities become more equitable and just (Parnell and Crankshaw, 2013). Housing provision in South Africa is also seen as an opportunity for people to get onto the housing ladder (Newton, 2013), with the intention of changing the ownership profile of land (Rubin, 2014).

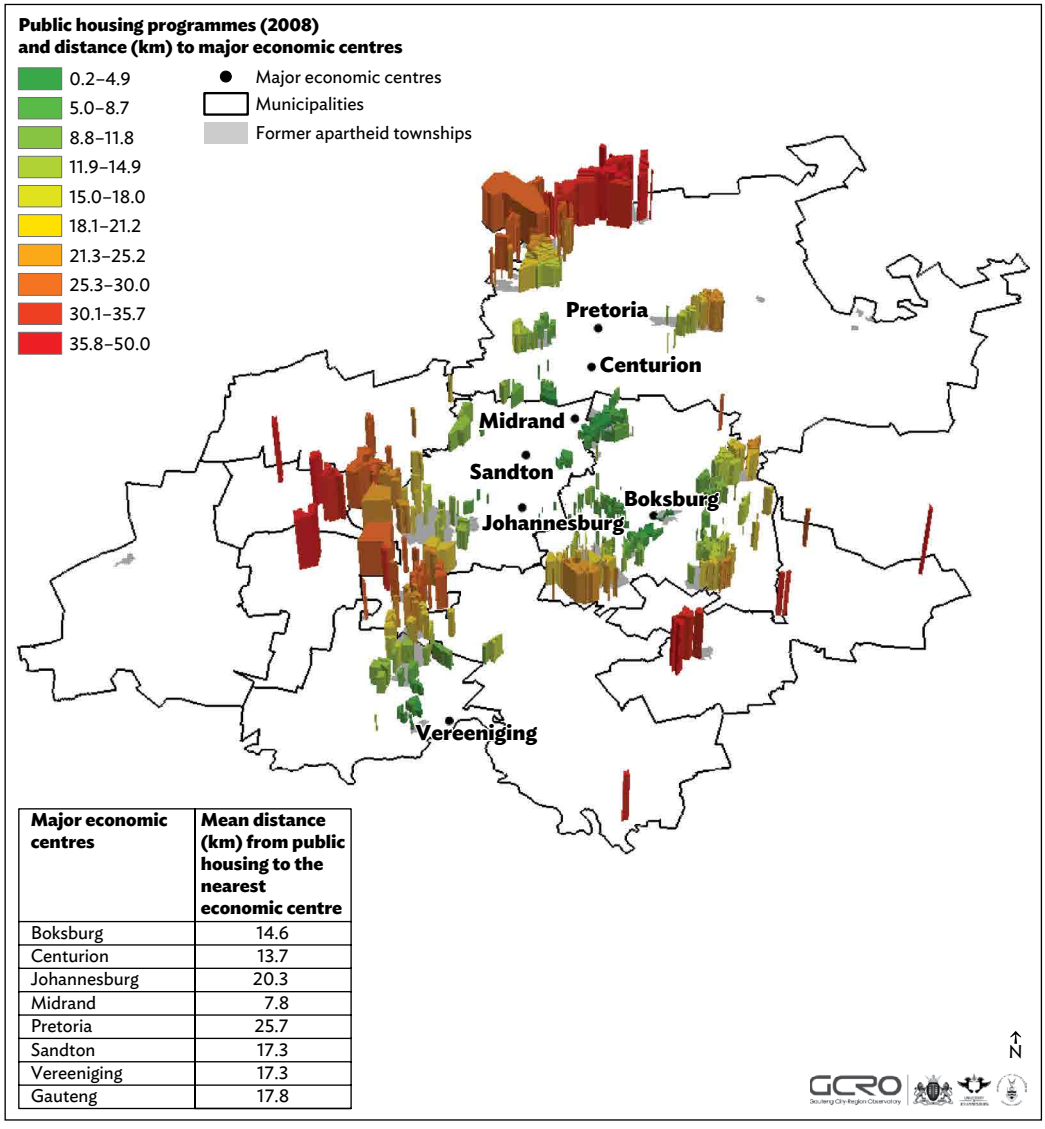
Post-apartheid housing programmes have helped realise the right to housing for millions of South Africans (Turok, 2016a). However, these programmes have been strongly criticised for having low-densities and being located on the urban edge, which exacerbates urban sprawl and locks cities into a high resource consumption trajectory (Mubiwa and Annegarn, 2013; FFC, 2011).

The concerns around the poor location of government housing developments with regard to economic opportunities are demonstrated in Figure 5.1. This map, which draws on data from 2008, presents the location of post-apartheid government housing developments and their proximity to major economic centres in Gauteng. The size and colour of the blocks represents the distance of each development from major economic centres (e.g. Sandton, Midrand, Boksburg, Centurion, Vereeniging and Johannesburg), scaling from small green blocks, which indicate close proximity, to large red blocks, which indicate great distances from economic centres. Although some developments are located close to major economic centres, the map reveals that many government housing developments are indeed poorly located with respect to these centres. The map further shows that on average, government housing programmes are situated

Government faces the challenge of balancing the need for housing with growing concerns over resource constraints

Figure 5.1: Proximity of government housing developments in relation to major economic centres

DATA SOURCE: Gauteng Department of Human Settlements (2008) Public Housing Programme; map by Kibirige and Wray (2014)



Major economic centres	Mean distance (km) from public housing to the nearest economic centre
Boksburg	14.6
Centurion	13.7
Johannesburg	20.3
Midrand	7.8
Pretoria	25.7
Sandton	17.3
Vereeniging	17.3
Gauteng	17.8

17.8 km from the nearest economic centre. The map authors suggest that this spatial pattern replicates the apartheid urban form (Kibirige and Wray, 2014).

Provincial and local government in Gauteng have adopted different approaches to housing and spatial transformation, with the most striking difference being between the province's mega human settlement strategy and the City of Johannesburg's plans to densify along transit corridors (Ballard et al., 2017). The mega human settlement strategy, initially proposed by national government, aims to address housing needs through large-scale projects that can achieve economies of scale and 'catalyse' economic and social development opportunities (Ballard, 2017). Johannesburg's transit-oriented development plans are designed to concentrate development within the existing urban fabric by upgrading existing infrastructure networks to cope with higher population density. Both of these development strategies focus on enhancing sustainability and inclusion albeit through very different approaches. The Johannesburg strategy prioritises infill development over greenfield development, whereas mega human settlements require large tracts of undeveloped land with the aim of creating new integrated human settlements[5] (Ballard, 2017).

Figure 5.2 provides a graphical representation of Gauteng's mega human settlements proposed in 2014 (blue dots) together with concentrations of businesses per square kilometre (red shading) and unemployed people in the province (small grey dots). This representation demonstrates how the proposed developments are located closer to where unemployed people are currently concentrated rather than where formal sector businesses are found. On one hand, this positioning reflects where large enough tracts of land are available to support these megaprojects; on the other, the spatial mismatch between unemployed people and existing economic opportunities highlights the need for these proposed settlements to deliver on their promise of catalysing economic opportunities. Failing this, these new mega human settlements risk (and have been criticised for) perpetuating unsustainable and unjust spatial form because they lock people into areas that have fewer job prospects.

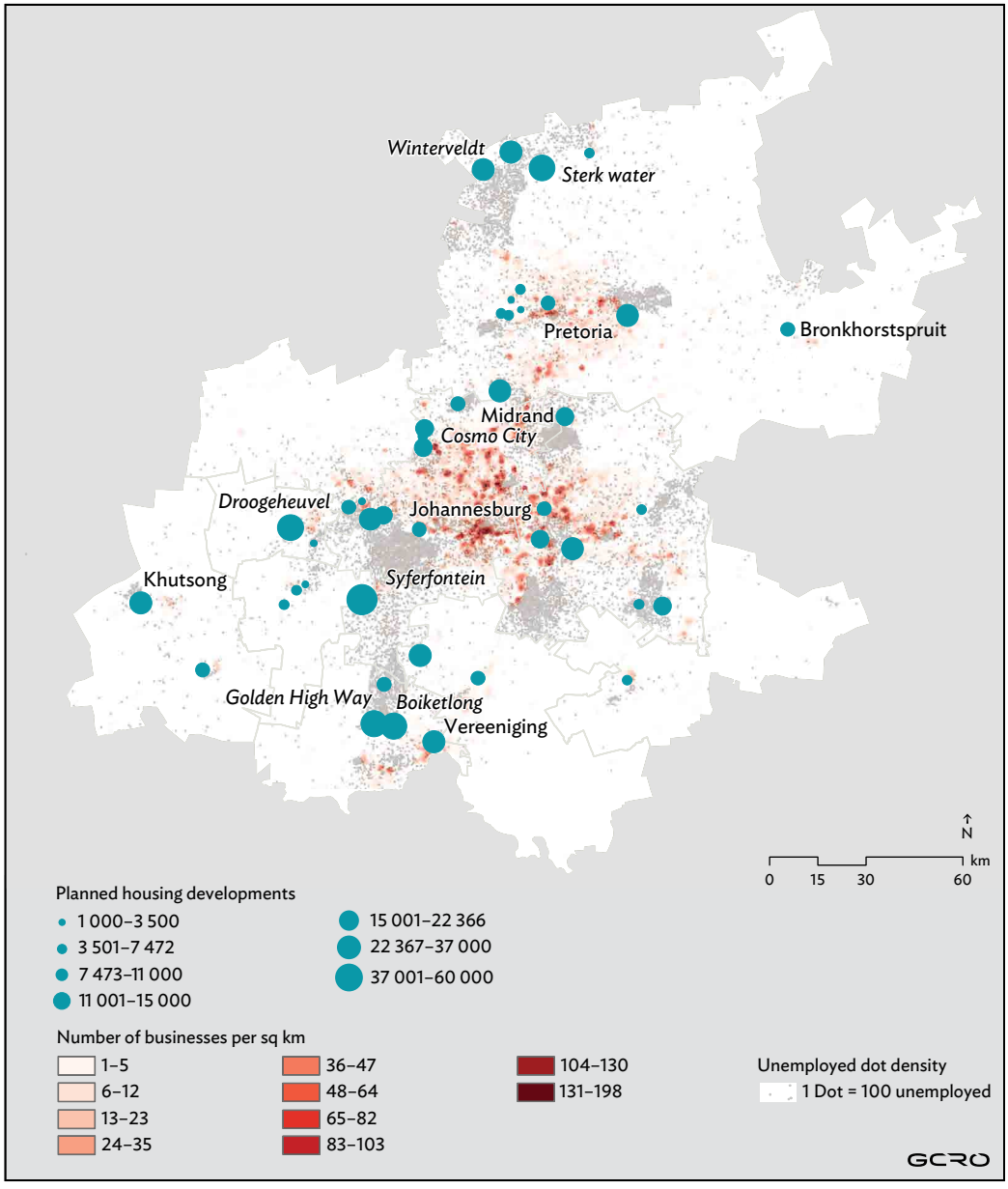
Assessing whether government housing developments contribute to or undermine just sustainability requires the costs of these developments to be measured. Biermann and van Ryneveld (2007) compiled a predictive model to support policy and planning of government housing developments in South Africa, which included the costs and affordability of different options and whether costs are borne by the government or by households. This study aimed to identify the most cost-efficient location and typology for government housing developments. It used a set of costs as the basis of the investigation that included land, housing units, engineering services, environmental services, social amenities, retail (consumer) and transportation costs. These were divided into capital and ongoing costs, and between those accruing to government and those to households (Biermann and van Ryneveld, 2007). The study found that, overall, the cost of the developments decreased with increasing density. However, the cost of the housing units increased significantly with increasing density, to the extent that these costs outweighed the benefits of the reduced land requirements of higher-density options. The study concluded that while the environmental costs were significantly lower in the more dense option, these costs were indirect and the additional cost of the housing unit had a direct 'cash' implication. The higher cost is likely to have a greater influence over decision-making. In terms of access to economic opportunities, Biermann and van Ryneveld (2007) flag that while better located dense developments are likely to increase the residents' potential to find jobs, location does not guarantee better earning potential, and people without income in these developments are worse off because of the higher cost of housing.

Cross (2014) argues that in many South African cities, post-apartheid subsidised housing may not

5 Integrated housing developments, according to the 2004 Breaking New Ground (BNG) housing policy, focuses primarily on internally integrated developments with 'adequate access to economic opportunities, a mix of safe and secure housing and tenure types, reliable and affordable basic services, educational, entertainment and cultural activities and health, welfare and police services' (Gauteng Department of Human Settlements, 2004, p. 17).

Figure 5.2: The location of planned government housing developments in Gauteng in relation to concentrations of businesses and unemployed people

DATA SOURCE: Statistics South Africa 2011 Census; AfriGIS Biscount (2010); map by Wray et al. (2015)



be as poorly located as many critics suggest. Areas in close proximity to traditional economic centres may not be the best places for most unskilled and unemployed people to find income-generating opportunities as they are most likely to find work in informal contexts or decentralised economic zones (Pieterse, 2019; Cross, 2014). Biermann (2005) found that while many of the critiques of low-income housing developments focus on the distance of these developments from the traditional economic centre, an empirical study of eight low-income housing developments across Johannesburg and eThekwini revealed that only a small portion of the trips ended up in the central business district. The study identified that access to formal employment nodes is less important for low-income housing developments than access to informal service opportunities (e.g. household services in high-income areas) (Biermann, 2005). This puts into question the importance of location with respect to traditional business districts, and suggests that greater analysis is required into the travel patterns of people who live in government housing developments.

Many of the critiques of government housing located on the urban edge assume that the associated consequences have not been sufficiently thought through or are motivated by an unwillingness to engage with the challenges of densification (Cirolia, 2014). Proponents of urban expansion are often portrayed as ill-informed, having vested interests or that they have misused information and data to justify this development approach. However, there is a range of justifications for 'poorly' located government housing projects in Gauteng, including the urgency of the housing need, land costs, administrative and legal constraints, as well as socio-political factors and the geographic location of those who need to be housed (Charlton, 2014).

One of the factors at play in the different spheres of government pushing opposing development agendas is the misalignment between local and provincial government priorities (Turok, 2016b; Charlton, 2014). Provincial government controls housing subsidies, while municipal government is responsible for spatial planning and providing infrastructure to support housing developments (Charlton, 2014). The provincial and national human settlement departments are under significant pressure to address the housing backlog, and are thus incentivised to invest in developments that minimise the upfront costs because this enables a greater number of houses to be built with the budget available. Municipalities, on the other hand, are more incentivised to consider the ongoing and long-term implications for infrastructure development, maintenance and transport. The contrasting performance measures of the various spheres of government thus lead to different consequences for environmental and social justice.

5.3 Method

This chapter uses survey data from Gauteng to assess some of the justice and sustainability outcomes of post-apartheid government housing developments. Social justice is measured through access to housing, basic services, amenities, social services and economic opportunities, as well as overall quality of life and marginalisation. Environmental sustainability of housing developments can be divided into the sustainability of the construction phase and that of the post-construction phase. This analysis focuses on the environmental sustainability of the post-construction phase, which is assessed through the ease of accessing services and commuting length, which are both proxies for resource consumption.

The analysis draws on the Gauteng City-Region Observatory's Quality of Life V (2017/18) Survey (hereafter QoL V) (GCRO, 2019) in which 24 887 adult residents of Gauteng were interviewed. The survey is designed to be representative of the Gauteng population, which was achieved by a multi-stage randomisation process for selecting a dwelling unit, household and respondent for each interview. The survey comprises 248 closed-ended questions that span a wide range of topics including demographics, basic services, employment, transport, satisfaction and personal opinions. The survey responses provide insight into the lived experience of Gauteng residents, and offer an unparalleled opportunity to assess residents of government housing developments in the province.

Each interview is georeferenced, thus allowing the QoL V respondents living in government housing developments to be extracted from the rest of the survey. This was based on a 2014 spatial dataset of government housing developments defined by the Gauteng Department of Human Settlements (Figure 5.3). To ensure statistical validity, the analyses, which are disaggregated by individual developments, are limited to where there are at least 15 respondents per housing development. Commuting distance, which is used as a proxy for proximity to economic opportunities, is derived from the straight line distance between the interview location (i.e. the respondent's residence) and where the respondent works (measured from the centroid of the subplace identified by the respondent). IBM SPSS software was used to analyse the data.

The analysis draws on a number of multi-dimensional indices that have been constructed using the QoL V data (GCRO, 2019), including the Quality of Life, Marginalisation and Accessibility indices. The Quality of Life Index measures overall well-being through combining a set of 58 objective and subjective measures related to aspects such as work, dwelling and infrastructure, family and socio-political attitudes. The Quality of Life Index is calculated as a score out of ten, where quality of life increases as scores go up (Culwick, 2018). The Marginalisation Index comprises some 28 variables that focus, in particular, on psycho-social aspects of marginalisation, based on *inter alia* housing, relationships, extreme views, safety and health. The Marginalisation Index is scored out of ten, where marginalisation worsens as scores increase (i.e. a score of ten reflects complete marginalisation) (Parker and de Kadt, 2019). The Accessibility Index provides a measure of proximity to a range of economic and public services, such as shops, libraries, hospitals and schools, and draws on 13 variables from QoL V (GCRO, 2019) to produce a total score out of ten, where accessibility improves as scores go up (Culwick and Patel, 2020).

In order to examine the implications of government housing programmes on social justice and environmental sustainability, this chapter uses the QoL V data (GCRO, 2019) to test the hypothesis that government housing developments that are closer to economic opportunities and services are more socially just and environmentally sustainable. However, it does not attempt to provide a comprehensive assessment of the characteristics and outcomes of government housing. This chapter uses empirical data to explore the complex interplay between the various characteristics with the intention of opening opportunities for debate around the interaction between social justice and environmental sustainability.

5.4 Assessing government housing in Gauteng

The primary focus of government housing programmes in Gauteng is to provide housing and basic services to citizens. Table 5.1 demonstrates the relative success of these programmes in achieving this goal by comparing respondents living in government housing to those in informal settlements and 'the rest of Gauteng'. The vast majority of people who live in post-apartheid government housing developments in Gauteng have access to formal accommodation, piped water, electricity and adequate sanitation. These proportions are significantly higher than for residents living in informal settlements, although slightly lower than in the rest of Gauteng.[6] This demonstrates the success of government housing in furthering the rights to shelter, water and sanitation that are enshrined in South Africa's Constitution.

Table 5.1 also shows that the majority of people living in government housing developments have access to public schools and health facilities, although access is lower than in the rest of Gauteng.

6 Respondents in the 'government housing' subset of the dataset are not restricted to recipients of government-subsidised houses, but include all residents within these areas. The lower access to formal accommodation and basic services compared to the rest of Gauteng might be attributed to the prevalence of informal backyard dwellings that have been built by residents in government housing developments (Culwick and Patel, 2020).

Figure 5.3: Planned and built post-apartheid government housing programmes and the urban footprint in Gauteng

DATA SOURCE: GeoTerraImage (2013); Gauteng Department of Human Settlements (2014); map by Christian Hamman (2018)

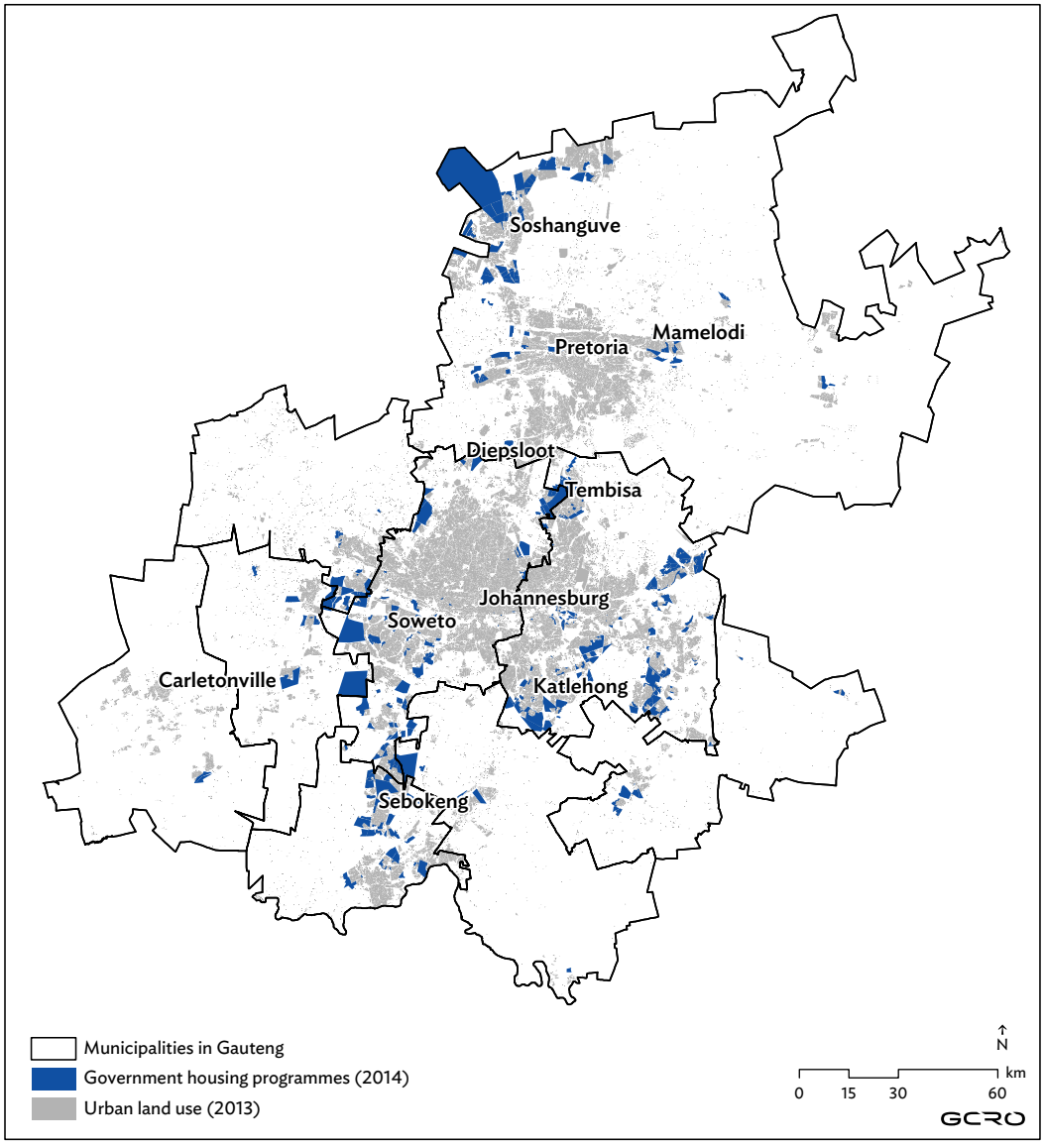


Table 5.1: Comparison of a range of variables across respondents living in government housing developments, informal settlements and the rest of Gauteng

DATA SOURCE: GCRO (2019)

	Government housing	Informal settlement	Rest of Gauteng
Access to formal accommodation	76%	0%	92%
Water piped in dwelling or yard	92%	40%	96%
Access to electricity	91%	48%	94%
Access to adequate sanitation	87%	22%	96%
No public schools in area*	11%	45%	9%
No public health facilities in area*	13%	41%	9%
Public transport within 20 min walk	91%	87%	81%
Average number of household members	3.5	2.9	3.2
Average monthly household income	R5 232	R2 691	R12 025
Employed	32%	34%	43%
Average commuting distance	17.2 km	13.9 km	14.0 km
Average Quality of Life Index score (out of 10)	6.0	5.0	6.6
Average Marginalisation Index score (out of 10)	2.6	3.6	2.1
Average Accessibility Index score (out of 10)	5.1	3.4	5.6

* Access to public schools and healthcare facilities is drawn from a question regarding satisfaction with public schools and healthcare facilities, where responses included a range from 'very dissatisfied' to 'very satisfied' and an option for 'there are none'.

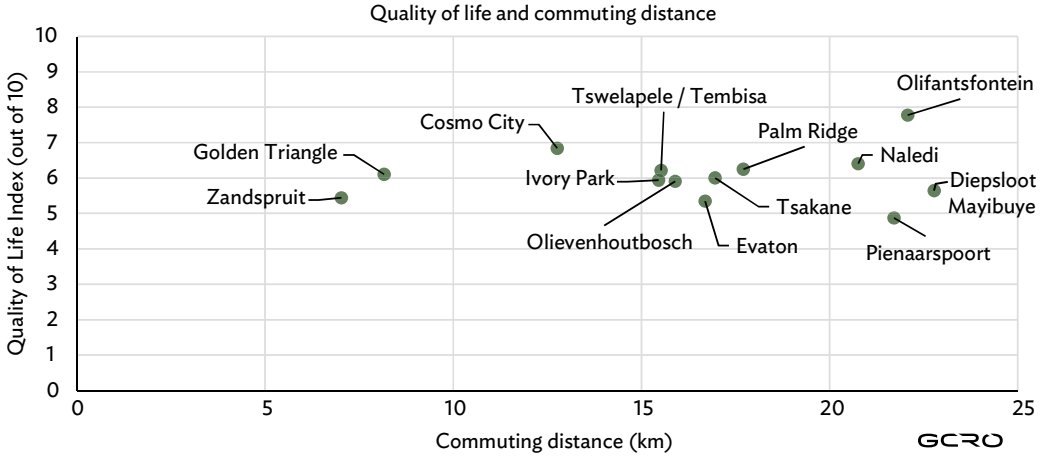
Access to public transport is highest among residents of government housing developments compared to those living in informal settlements and the rest of Gauteng. The employment rate in government housing developments (32%) is the lowest of the three groups; however, the average household income is approximately double that of people living in informal settlements. This is likely due to greater access to government grants for those in government housing as well as rental income (Culwick and Patel, 2020). However, household sizes are larger in government housing developments, thus bringing down the income per household member.

The remainder of this analysis focuses on interactions between overall quality of life, marginalisation, accessibility to services and amenities, and commuting distance. In overall terms, commuting distances are the longest for government housing residents compared to people living in informal settlements and the rest of Gauteng (Table 5.1). The following set of analyses considers the indirect factors associated with government housing developments that influence social justice and environmental sustainability outcomes.

Figure 5.4 presents the Quality of Life Index score for government housing developments against

Figure 5.4: Comparison between the Quality of Life Index and average commuting distance of government housing developments

DATA SOURCE: GCRO (2019)



commuting distance.[7] The graph shows no trend across the results. In some instances, high Quality of Life scores are found in developments where average commuting distance is very far (e.g. Olifantsfontein), while lower Quality of Life scores are found in settlements where commutes are either short (e.g. Zandspruit) or long (e.g. Pienaarspoort). Similarly, there is no trend between commuting distance and marginalisation (Figure 5.5). Housing developments with short average commutes can either have low or high Marginalisation scores. This is also the case for developments with long commutes.

Although the results show no trend with regards to proximity to jobs for either quality of life or marginalisation, Figure 5.6 suggests that there is a relationship between employment rate and average commuting distance. The small number of settlements that could be included in the analysis limits statistically significant results; however, the graph indicates a correlation between long commutes and low employment rates, where employment rate decreases with increasing commuting distance.

Although proximity to economic opportunities is a key consideration for housing developments, access to services and amenities is also important. Figure 5.7 maps government housing developments across Gauteng together with the average Accessibility Index score for each development, and these are overlaid on the urban footprint (dark grey). The map shows that accessibility ranges significantly across different developments, where some, such as Cosmo City (Johannesburg) and the Vereeniging Inner City Regeneration Development (Sedibeng), have high average Accessibility scores, while others have very low average Accessibility scores, such as Winterveld (Tshwane), Savanna City (Johannesburg) and Pienaarspoort (Tshwane). Although in some cases poor Accessibility scores are found in developments that are on the urban edge and higher scores in areas closer to traditional economic centres, this pattern is not evident across all government housing developments.

7 This is restricted to settlements with commuting data for at least 15 respondents.

Figure 5.5: Comparison between the Marginalisation Index and average commuting distance of government housing developments

DATA SOURCE: GCRO (2019)

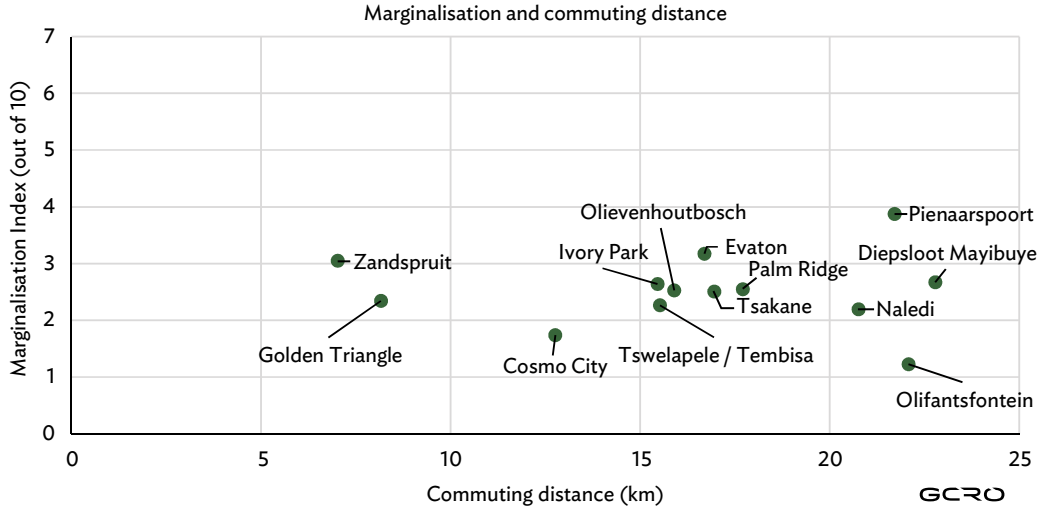


Figure 5.6: Comparison between the rate of employment and average commuting distance of government housing developments

DATA SOURCE: GCRO (2019)

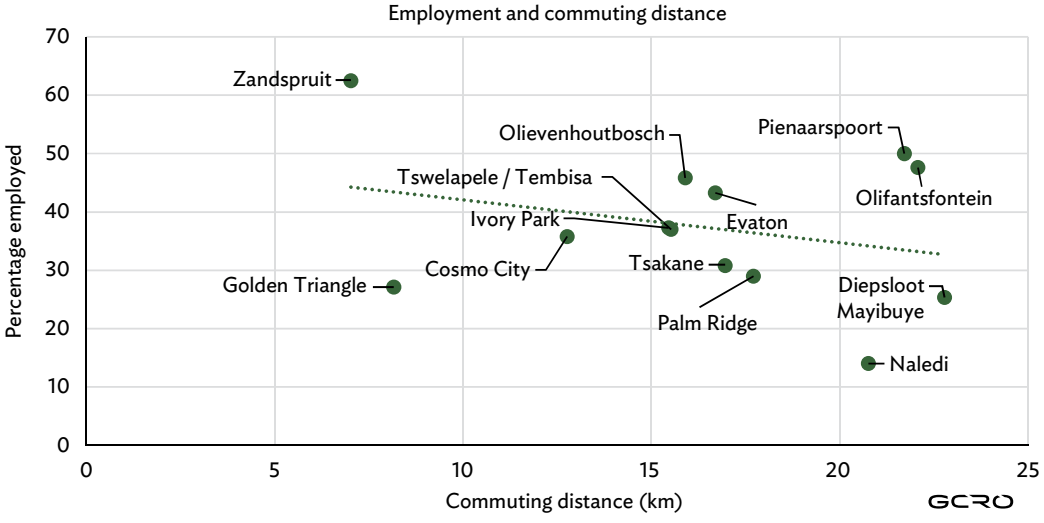


Figure 5.7: Accessibility of government housing programmes in Gauteng

DATA SOURCES: GCRO (2019); GeoTerra Image (2013); Gauteng Department of Human Settlements (2014); map by Bonolo Mohulatsi and Christina Culwick (2019)

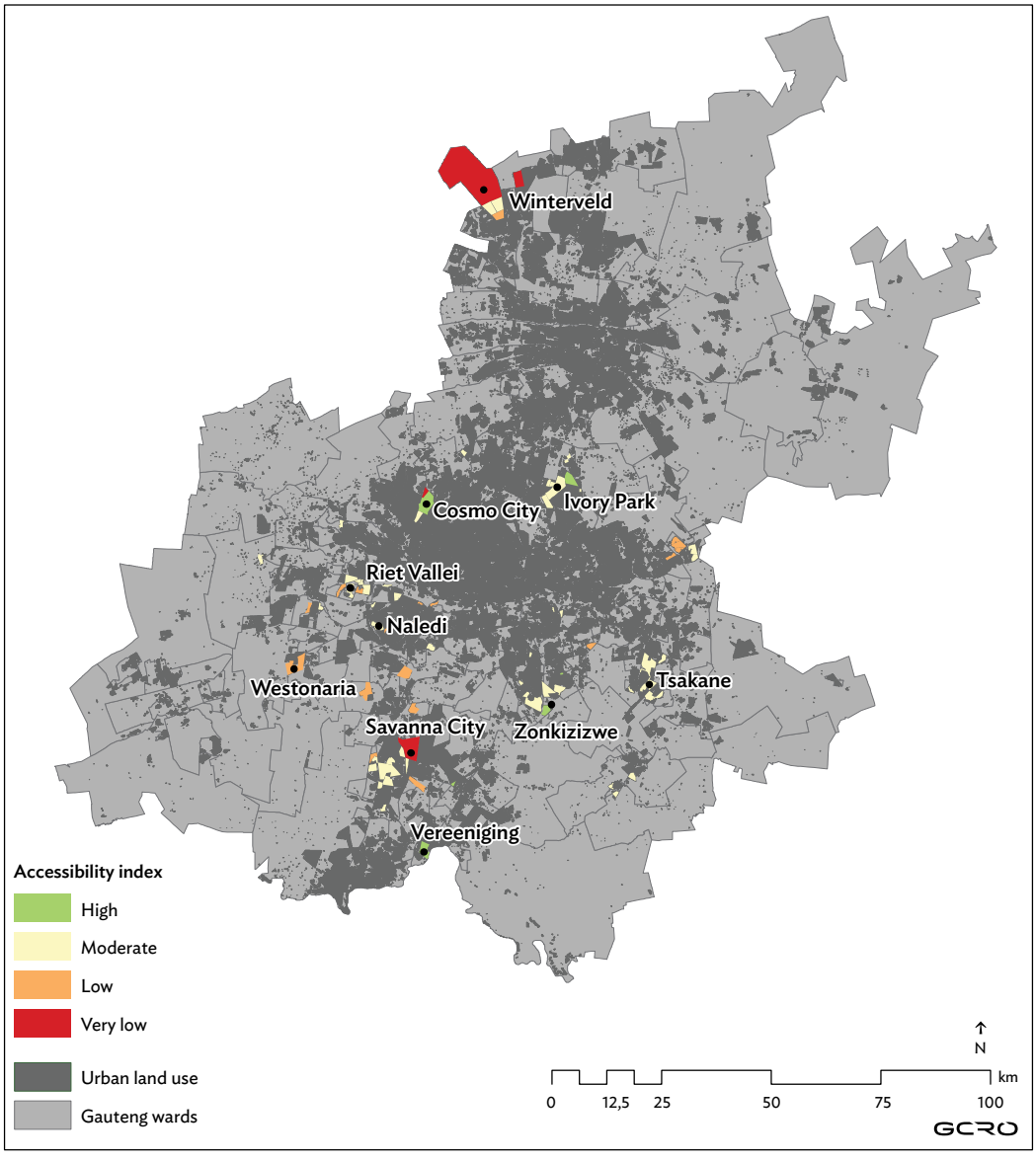


Figure 5.8 tests whether access to services and amenities correlates with overall well-being, by comparing the average Quality of Life Index against the Accessibility Index across 90 government housing developments in Gauteng. The results show that there is a statistically significant relationship ($p<0.01$) between the two indices, where Quality of Life scores improve as Accessibility scores increase.

Figure 5.9 compares the Marginalisation Index against the Accessibility Index across government housing developments. The graph shows a statistically significant relationship

Figure 5.8: Quality of Life and Accessibility indices for government housing developments in Gauteng

DATA SOURCE: GCRO (2019)

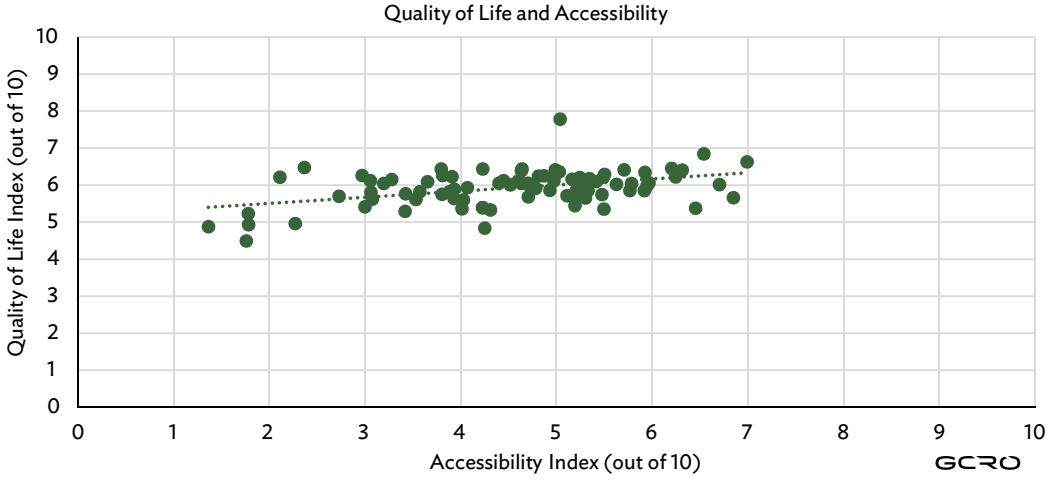
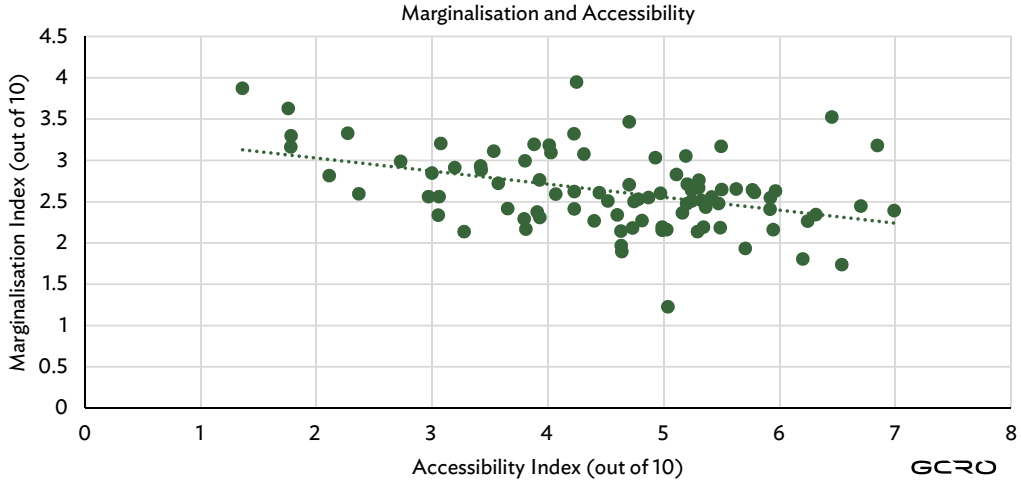


Figure 5.9: Marginalisation and Accessibility indices for government housing developments in Gauteng

DATA SOURCE: GCRO (2019)



($p<0.01$) between accessibility and marginalisation where, as Accessibility scores improve, Marginalisation scores decrease. This suggests that there is a relationship between psycho-social improvements and improved accessibility to a range of services.

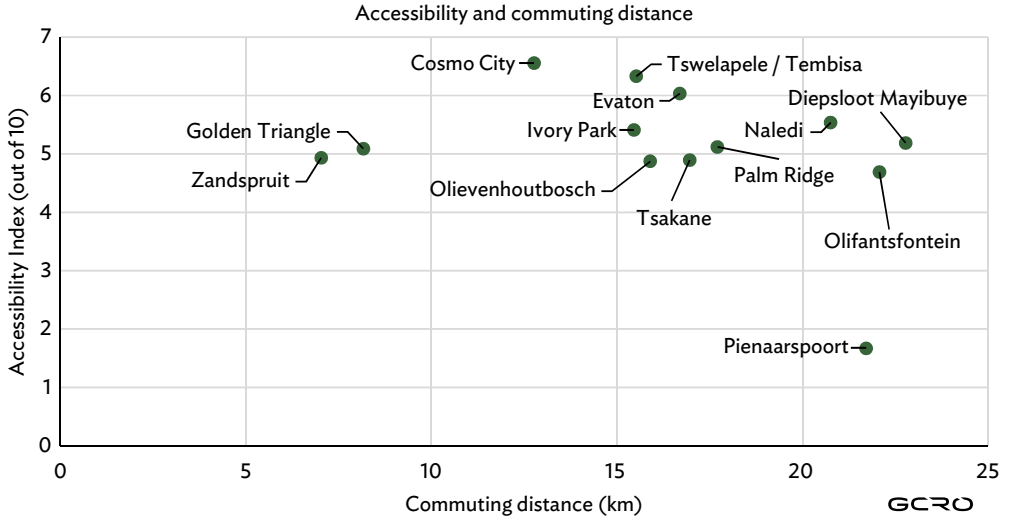
The idea of well-located housing depends on residents being able to access the things that they need. Figure 5.10 tests whether proximity to jobs is correlated with access to services and amenities. The results from an analysis of commuting distance and accessibility (Figure 5.10) show no significant relationship between these two measures. Notwithstanding the small sample size, this analysis suggests that access to economic opportunities is distinct from access to services and amenities. In other words, 'well-located' means different things depending on what measure of access is used.

Although the results in this set of analyses reveal some overall relationships across the various measures, there are clear differences between different settlements. In some cases, overall trends do not provide an accurate reflection of individual developments. For example, the Diepsloot Hostel development has high accessibility yet is also highly marginalised, and the Pienaarspoort development has a high employment rate (50%) despite a long average commuting distance (22 km). This demonstrates the importance of context, and of taking individual location and settlement dynamics into account in decision-making.

It is important to note that these analyses show correlation, not causality. For example, while higher Accessibility scores are associated with higher Quality of Life scores, it is not valid to deduce that higher accessibility necessarily leads to high quality of life or vice versa. These two factors could be driven by something else, such as the age of a settlement or its average household income. More established communities are more likely to have better access to services and amenities, stronger communities and other characteristics that contribute to higher overall quality of life. Despite this caveat, the results open up opportunities for debate and for revising assumptions regarding the outcomes of government housing for social justice and environmental sustainability.

Figure 5.10: Comparison between average Accessibility Index score and average commuting distance in government housing developments

DATA SOURCE: GCRO (2019)



5.5 Government housing in Gauteng: Just and sustainable?

The analysis in this chapter demonstrates the success of Gauteng's government housing developments in improving quality of life through formal accommodation and basic service provision. However, furthering social justice in this way has a direct impact on resource consumption, both from the construction of housing and the associated infrastructure, and from ongoing resource consumption. Here, achieving a social justice imperative has negative implications for environmental sustainability. However, the environmental impact of higher resource consumption by poor households is minimal compared to the ongoing resource consumption of elite households (Goebel, 2007). Furthermore, distributive justice across society as a whole would require higher users to reduce their consumption to ensure sufficient resources are available for those with limited access.

Despite the theoretical alignment between just and sustainable outcomes from shorter commutes, the analysis does not provide clear evidence that government housing developments with shorter commutes are better off in terms of quality of life or marginalisation. This suggests that the social justice imperatives of enhancing quality of life and marginalisation are not necessarily aligned with shorter commutes (and the associated environmental sustainability benefits). The data do show a correlation between shorter average commutes and higher employment rates. Since poverty alleviation (a social justice imperative) is enhanced through higher employment levels, the alignment between commuting distance and employment highlights a positive relationship between these particular social justice and environmental sustainability objectives. However, this analysis could not conclude whether this is a causal relationship, or whether it could be influenced by other factors such as education, skill level or income. The correlation between commuting distance and unemployment might seem to suggest that developments far from economic opportunities undermine the potential to secure work. However, social grants could, as Posel et al. (2006) highlight, enable people the freedom to search for jobs in areas close to economic opportunities, while grandmothers care for the job seekers' children in peripheral areas.

The results show significant trends with respect to access to services, where average quality of life and marginalisation both improve with greater accessibility. In these cases, social justice objectives (higher quality of life and lower marginalisation) are well aligned with the environmental sustainability objective of reducing the distance between people and the services they need. However, the accessibility of residents of government housing developments to services and amenities is not necessarily associated with their location within the broader urban footprint. Furthermore, there is no association between accessibility and commuting distance, which suggests that access to jobs and access to services and amenities are distinct measures in Gauteng.

The temporal lag between the construction of houses and the development of supporting services and economic opportunities has a fundamental impact on the outcomes of housing developments. It is likely that accessibility to services and jobs will increase over time, thus improving social justice and environmental sustainability outcomes.

In the South African context, the spatial distribution of housing is a particularly important justice consideration because the apartheid regime deliberately used spatial planning to systematically undermine access to services and jobs for black people. Although government is working to realign spatial configurations to bring about social justice, the analysis has demonstrated that this reconfiguration is not straightforward. That the results do not offer definitive conclusions around what constitutes 'well-located' has the potential to exacerbate the already conflicting development planning approaches across different government spheres.

5.6 Conclusion

Cities face the challenge of identifying the 'best' form of urban development to meet the growing need for housing and services. In addressing these needs, it is inevitable that the distribution of services and opportunities will be uneven across both space and society. To minimise the negative consequences of development, policies and plans need to consider the consequences of different options and, where necessary, negotiate the trade-offs between sustainable and just

outcomes. This requires weighing up different options with regards to the costs and potential consequences for social, economic and environmental systems. Despite the growing emphasis on building cities that are both inclusive and sustainable, no single solution is able to address all aspects of this goal. Furthermore, there is a lack of consensus regarding what forms of development will be able to achieve this imperative. In Gauteng, this is evident in the contrasting development strategies adopted by provincial and local government.

Despite commitments to inclusive and efficient spatial form, some large-scale housing projects continue to be planned and built in ways that perpetuate peripheral development, and many scholars argue that this contributes to spatial exclusion and unsustainable urban form (Harrison and Todes, 2015; Charlton, 2014; Cirolia, 2014; Todes, 2012; FFC, 2011). While this study confirms that access to job opportunities is correlated with employment, there are no obvious correlations between proximity to jobs and overall quality of life or marginalisation.

On some measures, the data confirm the hypothesis that well-located government housing projects facilitate positive social justice and environmentally sustainable outcomes (e.g. higher employment with shorter commuting distance, or access to services and quality of life). However, in other instances this hypothesis does not hold true (e.g. close proximity to economic opportunities is not associated with the social justice imperatives of improving quality of life and reducing marginalisation). The analysis throws up questions around temporal justice. Does the hope or expectation that access to services and opportunities will improve over time help to justify building government housing in areas without good access to these things currently? Some would argue that this type of development, although seeming to replicate apartheid spatial form now, could address a range of justice and sustainability issues in the long term.

Proponents of compact urban form argue that social justice and environmental sustainability are aligned, where environmental impacts are minimised by limiting distances to work and for accessing services, and this also fosters social justice imperatives. The analysis presented in this chapter highlights that although this alignment does indeed play out for some variables, it does not for others. Distance to economic centres is a poor indicator of increasing equity and spatial justice. However, the environmental implications of developments remain strongly rooted in location consequences of development, and options that reduce the length of infrastructure (e.g. brownfield and infill development) will be most likely to achieve just sustainability.

The different positions regarding the 'best' form of urban development draw on different knowledge and are influenced by different incentives. While data and knowledge are used to justify different positions, it is important to be conscious of what measures are used to justify what decisions, and that power dynamics and vested interests influence the different stances. This chapter demonstrates that while in theory there might be alignment between social justice and environmental sustainability, the practical reality is much more complex. Part of this complexity relates to what is assessed. This chapter raises questions about how 'well-located' is defined, and the impact of these definitions on where development and infrastructure investment are made. If Gauteng is to accommodate the growing urban population in a just and sustainable way, it is necessary to build an understanding of what knowledge guides different policy positions as well as how power and politics influence decision-making.

This chapter has engaged with the debate around the location of government housing developments and has brought new empirical evidence that opens up the long-standing assumptions associated with well-being and job opportunities. The results call for more nuance in the debates and analyses, and particularly where they inform decision-making around the location of low-income housing. Government decision-makers need to consider not only the costs and burdens of the housing development itself, but also the long-term implications for residents. This is critical for the achievement of just and sustainable cities through housing.

Photograph by Sunshine Seeds/Shutterstock.com

Chapter 6

The 'conceptual smoothing' work of 'environment', 'social' and 'road' in the performance of e-tolling and the Gauteng Freeway Improvement Project

LISA KANE

Abstract

In this case study of e-tolling and the Gauteng Freeway Improvement Project (GFIP), the use of 'environmental sustainability' and 'social justice' concepts as parts of road engineering practices is explored. This is done in order to more deeply understand conflicts between and within these concepts, as a contribution to the theoretical literature on 'just sustainability'. The chapter proposes the notion of 'conceptual smoothing' to describe the work done by terms like 'environment', 'social' and 'just sustainability'. Such terms are argued as analytically unhelpful for just, sustainable policy action in cities in the global South (while probably rhetorically necessary in calls to action). The case for opening up the tensions between and within 'environmental sustainability' and 'social justice' across categories of society, space and time is made in order to better understand where a just sustainability might be possible, and where it sits in tension. In short, if policy action is necessary, then specificity is also required. If a 'just transition' is the aim, then it is necessary to ask questions around justice and sustainability for whom, where and when? The reasons for decisions on the GFIP (colloquially called the 'e-toll scheme') are unpacked by considering the work done over a ten-year period between 2007 and 2017. Statements in favour of the e-toll scheme by the South African National Roads Agency Limited (SANRAL), and in opposition to it by various organisations and individuals, are examined. The manner in which the initial, multiple policy directions and expressed objectives of SANRAL played out in the e-toll case are shown as well as the arguments raised in opposition to the scheme. The durability of SANRAL's more traditional financial, economic and congestion-alleviation road engineering arguments are illustrated and contrasted with the performance of environmental and social objectives, which are shown to be mostly fragile. The 'conceptual smoothing' work done by general terms like 'environment', 'social' and 'road' is shown as a mechanism through which nuance and complexity are ironed over in the GFIP case. Specifically, the notion of a general just sustainability in road transport is shown to be problematic.

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6.1 Introduction

In 2013, in a Supreme Court ruling on a matter between the Opposition to Urban Tolling Alliance (OUTA) and others and the South African National Roads Agency Limited (SANRAL) and others, the judge described the declaration of toll roads in the Gauteng area of South Africa as one which had given rise to unprecedented public and political debate, a massive public outcry and 'widespread and unparalleled public opposition [...] that even crossed political dividing lines' (Brand et al., 2013, p. 9).

Not surprisingly, e-tolling of the Gauteng freeways is said to have cost the ruling African National Congress (ANC) at the election box in Gauteng municipal elections in 2016, where the ANC shifted from being a confident majority local government to one in opposition.

This chapter uses this high-profile e-toll case and the associated Gauteng Freeway Improvement Project (GFIP) to consider the ideals of 'social justice' and 'environmental sustainability' and the idea of 'just sustainability' in road engineering in South Africa. The chapter starts by sketching theoretical arguments for environmental sustainability and social justice within transport planning, road engineering and road pricing. The general arguments for sustainable transport in the South Africa context are discussed as well as the implications of these for social justice and environmental sustainability. The chapter then outlines the history of the GFIP and the related e-tolling scheme through a focus on the role of SANRAL and their opposition voices. This chapter draws on the author's previous experience working with and researching South African road engineering practices (Kane, 2014, 2010; Behrens and Kane, 2004). The chapter also draws on the large repository of news articles, radio commentary, and grey and published literature, much of which was available thanks to the Gauteng City-Region Observatory's (GCRO) own work on the project.

Methodologically, the work sits within a general 'material semiotic' sensibility which uses detailed historical or ethnographic case study work in science and technology settings (see Law, 2004, for a theoretical discussion and Norton, 2008, for an example of the social construction of technology relevant to roads). In short, empirical materials are examined to ask: how are these (GFIP and e-toll road) technologies socio-materially made? This mode of interrogation requires honest and serious attention to the explicit and hidden ways in which things, people and systems work together in relationships to make realities. In a material semiotic way of understanding the world, the structural descriptions of things are understood as the consequences of multiple heterogeneous relations and practices (Law, 2008; Barnes, 2002; Law and Singleton, 2000).

In this sensibility, we do not ask what 'road engineering' (or 'social justice' or 'environmental sustainability') *is*, or where it may be found, but rather how it is *enacted* through systems of heterogeneous, relational socio-material *practices*. Throughout this chapter, the focus is on practices, particularly road engineering practices. Within the material semiotic sensibility, the world is understood more as interlinked processes than as compartmentalised structures. To take one example, what we understand as 'road engineering' can be understood as practices which are to some degree historically rooted in materials – curricula, books, standards, journals, modelling and design approaches, software, materials and so on. These in turn are given their meaning (semiotics) thanks to the practices of networks of continually reproduced professional and educational institutions, consultant offices, conferences, collegial friendships and so on. That 'road engineering' has any sense of being real and durable rests on a whole amalgam of interrelated social and material practices which make meaning. It is these practices, as described explicitly or implied in public statements about the project, that this chapter will start to tease out through exploring 'social justice', 'environmental sustainability' and 'road engineering' in the e-toll case.

The focus in such a material semiotic interrogation is less on whether a particular policy direction is 'good' or 'bad', but rather on how it is practised as such. It forces attention onto statements about processes of policy-making rather than on a critique of these from a normative position. In this case of e-tolls, there are many who would argue it was a 'bad' thing, and vice versa. In this chapter, the normative judgement on the e-toll project is set aside and instead the question is: what practices enacted the e-toll project as 'good', and what others enacted it as 'bad'? Understanding *how* policies are social and

materially *performed* as environmentally sustainable and socially just is a way of deepening understanding and so ultimately – it is argued – enabling a more informed critique.

First, though, this chapter looks at transport theory generally and considerations about social justice, environmental sustainability and the tensions between these in the road and transport context of South Africa, and then turns to the pricing of urban roads.

6.2 Environmental sustainability and social justice in the transport sector

As a sector which is a substantial and growing contributor to urban greenhouse gas emissions, transport has become a necessary focus for environmental sustainability (hereafter sustainability) and climate change policy at international, national and local levels. Overall, transport accounts for about 9% of South Africa's greenhouse gas emissions. However, in South African cities, more than a third of emissions are from transport (mostly private transport) and more than 50% of energy use is transport related. Thinking beyond climate issues, transport is a major contributor to air pollution through engine particulates and it also has multiple other health impacts (Cohen, 2016; Sustainable Energy Africa, 2015; Pachauri et al., 2014). Although there are differing policy interpretations of what 'sustainable transport' means, a sustainable transport approach is linked most directly to fuel and urban space resources (Bakker et al., 2014). A sustainable transport policy is generally understood as one which reduces vehicular emissions through minimising the use of fuel. This can be done by minimising single occupancy vehicles; improving vehicle efficiencies; shifting travellers onto more efficient public transport, cycling or walking; or reducing the need to travel altogether. This general argument is linked directly to the efficient use of space, that is, to transport which uses the least space (and thus carries the least weight) per traveller to complete a journey. Generally speaking, private vehicles are among the least efficient in terms of space used (and weight moved) per traveller, especially when they have single occupancy. Non-motorised transport (e.g. walking and cycling) is generally viewed as the most sustainable form of transport, followed by well-utilised public transport, especially using renewable electricity (e.g. in trams or rail), although there are contingencies which can shift this pattern (Sims et al., 2014; Figueroa et al., 2013).

In South Africa, the urban sustainable transport issue is complicated by the legacy of apartheid spatial planning (Kane, 2010). Apartheid planning resulted in the poorest being located on urban peripheries and in settlements with underdeveloped transport networks. Furthermore, economic and many social opportunities were located away from township settlements. As a result, current public transport usage is highly directional – full in one direction and not in the other during peak times. Such imbalanced public transport systems struggle to be economical and are not optimal environmentally. The financial necessities of minibus taxi operators, who wait for full vehicles before moving, tend to make minibus taxis more environmentally sustainable than scheduled bus operators. This in spite of the minimal public capital investment in minibus infrastructure and the absence of subsidies. In general, then, public transport is a more sustainable mode of transport than private transport and given that major investments in urban highway infrastructure disproportionately favour private modes, such highways are difficult to justify in terms of environmental sustainability (Walters, 2013).

Alongside the environmental debates, transport also sits at centre stage in urban spatial and social justice discussions in South Africa and elsewhere in the global South (see Chapter 7 of this volume; Jennings, 2015; Vasconcellos, 2001, 1997). A socially just transport system would be one in which the costs and benefits of transport are equitably distributed across society, and where the spatial, economic and

The urban sustainable transport issue is complicated by the legacy of apartheid spatial planning

social dimensions do not pose barriers to accessing services and opportunities.

The legacy of apartheid means that many of the poorest South Africans have long distances to travel to work and this tends to be on road-based public transport. Increasingly, though, the middle-income group are switching out of public transport and into private cars (Statistics South Africa, 2014; Wray and Götz, 2014; National Planning Commission, 2011). However, given that only 38% of Gauteng households have a car in good working order (GCRO, 2016) and that very little road infrastructure in the country prioritises road-based public transport, it is difficult to make a general social justice argument for road investment, especially when compared to public transport investment. Fostering social justice was, however, part of the argument justifying the GFIP and e-tolling.

Considering environmental sustainability and social justice together, the label of a 'just and sustainable transport' barely features in the South African transport academic, policy or practice discourses (see Chapter 7 of this volume). Martens (2016) notes that traditional transport planning, with its focus on speed, efficiency and to a lesser extent safety, has been well challenged and alternative approaches have emerged (see below). How to take justice into account comprehensively has not been resolved, however, and the practices of traditional transport planning have not adjusted accordingly. Consequently, the idea of 'just sustainability' is not integrated into road planning processes.

Despite this general lack of reflexivity within the sector about just, sustainable transport, many of the policies which are part of progressive transport policy *can* be argued to be both socially just and environmentally sustainable. For example, increasing the quality and quantity of public transport and improvements in walking and cycling provision are understood to be socially and environmentally progressive (Santos et al., 2010a). These are the thrust of much transport policy in South Africa, even if the funding environment is not yet fully supportive of it (Sustainable Energy Africa, 2015; Walters, 2013). Hence the current city policy trajectory in South Africa can be argued as shifting towards a more environmentally sustainable and socially just state, even if operationalising this is patchy and under-resourced.

In general terms, environmentally sustainable transport can be measured in terms of emissions per person, which is also a rough proxy for urban transport space efficiency. Coincidentally, policies which focus on urban transport space efficiency (public transport investment and road space allocation to public transport, walking and cycling) tend to favour the poorest in the South African context. More complex is the middle-income group for whom car ownership is a possibility and public transport use is a choice. For this group, transport access tends to be easier by private vehicle; but car use is most often less environmentally sustainable than an equivalent trip by public transport.

Those in poverty, then, are effectively captive to public transport and walking, and are thus environmentally sustainable by default. The affluent are 'stubborn' users of cars and resistant to policy action (see Chapter 7 in this volume for a more detailed discussion). It is in the middle-income group where environmentally sustainable policy has, in theory, the greatest potential for impact. Yet, while retaining the middle-income group on the public transport system can be argued as environmentally just for society as a whole, it also effectively perpetuates an unjust apartheid spatial disadvantage for the middle-income people living in areas remote from opportunities. This one example highlights how understanding 'just sustainability' requires considering different demographic or spatial scales (Martens, 2016; Bakker et al., 2014).

Despite the importance of transport in environmental and social debates in South Africa, urban and inter-urban road schemes alike have tended to be justified not in light of environmental or social justice imperatives, but in financial or economic terms, with the alleviation of congestion firmly connected in the discourse to renewed potential for economic growth. These arguments for roads have been based on a traditional, relatively narrow road-based view of urban efficiency. Conventionally, roads are modelled and cost benefits due to time-savings are calculated. Using this (contested) idea of time-savings on improved roads, general economic benefits are then derived, even though the ability of typically large infrastructure schemes to contribute positively to the economy is strongly disputed in the literature (see Ansar et al., 2016; Metz, 2008).

6.3 Road pricing

Road congestion is seen, from an economic perspective, as a straightforward case of a demand which is greater than supply due to a 'flawed' pricing system. The failure of urban road infrastructure to overcome traffic congestion problems in urban areas internationally has led to arguments for the economic pricing of road congestion. The theoretical justification for this was laid down in the 1960s (Smeed, 1964), but in practice it has struggled to gain traction. Versions of it have been successfully introduced in Singapore, London, Milan and some Norwegian cities, but implementation has proved to be a precarious process (Eliasson, 2018; Vonk Noordegraaf et al., 2014). Despite the practical problems, the pricing theory remains robust. There is broad agreement amongst transport practitioners that the pricing of congestion and other 'externalities', such as human injury, loss of life and damage to the environment, offers great potential benefits to transport systems, especially in the alleviation of congestion (Rouhani, 2016; Santos et al., 2010b).

Transport economists will thus argue for the implementation of economically efficient tolls in urban areas. For environmentalists, the reduced (or at least more efficient) use of urban road space (and also fuel) implied by a congestion price makes it an attractive policy mechanism. However, the social consequences of road pricing are potentially problematic, although this has local specificity that is difficult to generalise about. The GCRO Quality of Life IV (2015/16) Survey shows that highway use increases with income in Gauteng (GCRO, 2016) and so highway pricing can be viewed from a general perspective as a progressive tax. However, the specific geographies of South African cities, formed as much by politics and social segregation as by land markets, make the theoretically progressive idea of highway pricing problematic for social groups who use private vehicles as a means to overcome the spatial legacy of apartheid. Congestion pricing can be argued in general to be 'just' (in terms of economics), environmentally progressive and also economically efficient, but in South Africa such pricing is problematic due to its particular impact on previously disenfranchised groups.

In the London Congestion Charge case, some of these fairness issues were resolved through increased investments in public transport, ensuring the most deserving received support. Road-based public transport such as buses also benefited from the relatively free roads post-Congestion Charge. The road system was so improved that bus timetables had to be changed to accommodate the constantly early buses. These fairness measures were necessary to sell the London Congestion Charge to the public there. Arguably, they are even more necessary in the South African urban context, which has even higher inequality. Unfortunately, these complexities of the urban context were not well considered due in part to the particular governance arrangements of the lead agency for e-tolls – SANRAL. This case is considered in more detail below.

6.4 The Gauteng Freeway Improvement Project e-toll case: A brief overview

The pricing of urban roads has the potential for increasing urban efficiency with environmental benefits and potentially resolvable social tensions. However, the successful working out of this depends greatly on local context (Ueckermann and Venter, 2008). This case of urban tolling in Gauteng shows how e-tolling was justified by SANRAL in a basket of ways, many of which were well beyond the suggested role of e-tolls as a travel demand management measure. Most importantly, e-tolls were seen as a means of raising money for fulfilling SANRAL's national mandate and improving roads outside of Gauteng. The competing claims by opposition voices to SANRAL's position, in particular the Congress of South African Trade Unions (COSATU) and OUTA, are unpacked below.

The pricing of urban roads has the potential for increasing urban efficiency with environmental benefits

The so-called 'e-tolling' case, more formally described as the GFIP, concerns the upgrade and tolling of 120 km of seven freeway roads around the major commercial hubs of Johannesburg and Tshwane (previously known as Pretoria) (Figure 6.1). While toll roads with manual or semi-automated fee collection are commonplace between South Africa's urban centres, the GFIP urban tolls were intended to be tolled electronically using overhead gantries and in-vehicle electronic tags (e-tags) from the outset. Electronic tag technologies had been used elsewhere, notably in Singapore, but had previously only been used in South Africa between Tshwane and the Botswana border, and not at the urban scale as envisaged in Gauteng.

SANRAL positions (2007–2011)

SANRAL was established in 1998 and is a direct descendant of the National Roads Board (of 1988) and the earlier National Transport Commission (of 1948), which were empowered to plan, develop, construct and maintain national roads (Pienaar, 2012; Nieuwoudt, 2009). The lineage of SANRAL and its legal framing has led, inevitably, to an agency primarily concerned with, and particularly skilled in, the provision of high-quality, inter-urban national routes. It is not a general transport agency.

On 12 October 2007, the National Government Gazette (Vol. 508, No. 30372) declared an intention to toll six sections of Gauteng's roads, a total of 191.5 km. The public were given just over a month to respond, and some 82 comments were received. Cabinet approved funding in January of 2008, the Gauteng roads were legally declared toll roads in March and, in June 2008, construction began.

At the time of the official launch of the scheme in 2007, the arguments made by SANRAL for the GFIP were about overcoming congestion, the wastage of valuable resources, time and productivity losses, frustration and unhappiness (of drivers), and also effects on the environment (through excessive emissions). SANRAL also spoke about providing a 'safe and reliable' strategic network for freight and road-based public transport, and about promoting 'travel demand management' through the provision of dedicated, high-occupancy vehicle lanes (SANRAL, 2007). Media releases stated that the project would be financed through the 'user-pays' principle, which they described as an equitable way of paying for services used. Mention was frequently made in press releases of 'intelligent transport systems', that is, new technologies to allow for the unhindered and free flow of traffic via the systems attached to gantries and e-tags.

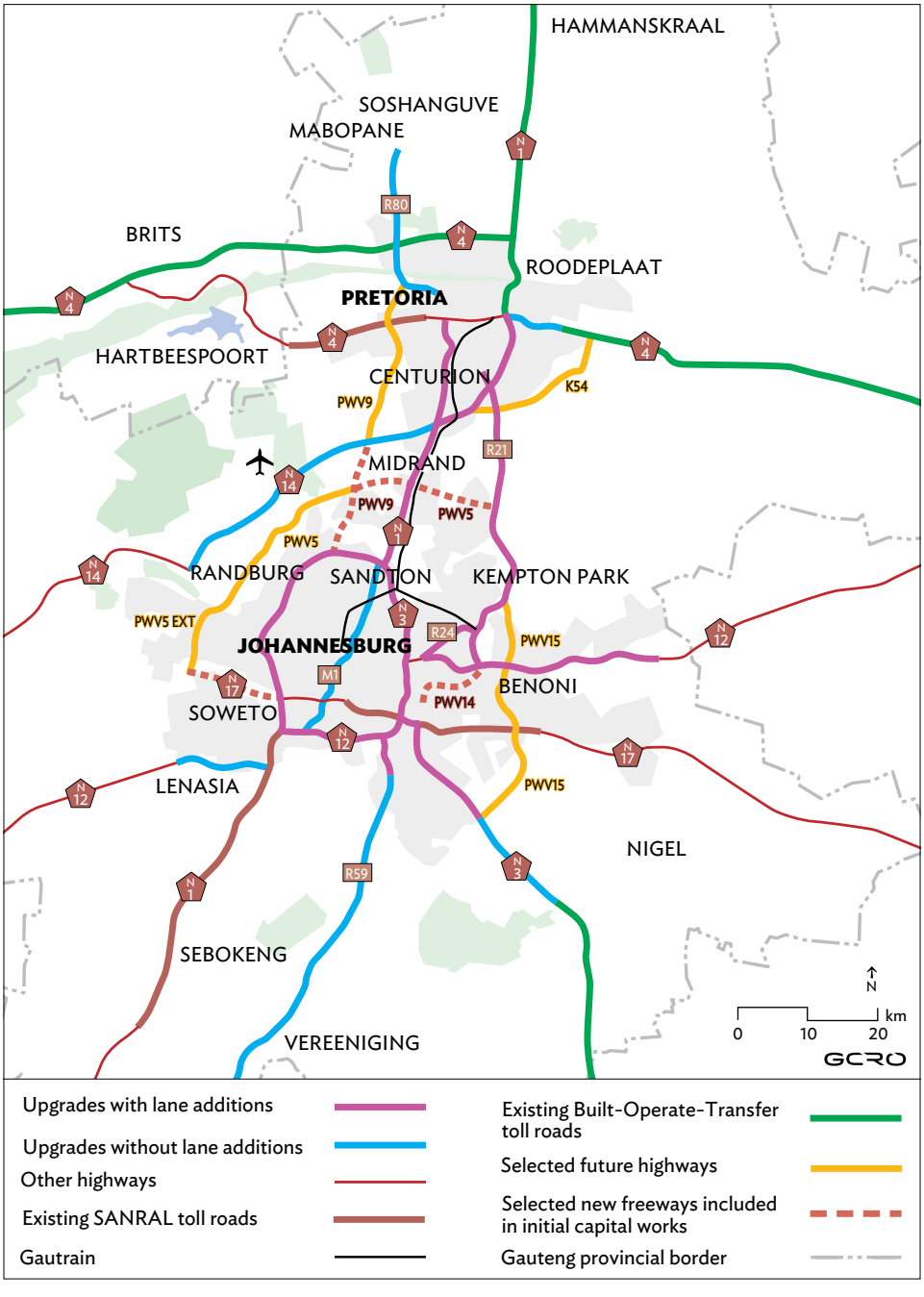
Over time, the narrative about the schemes shifted away from strategic or technical transport planning concerns to include social development, job creation, promotion of public transport and 'co-operative governance that reflects the true spirit of our democracy' (SANRAL, 2008a). However, SANRAL's position on this was not consistent. In another press release in the same month, SANRAL indicated deep concern about the financial benefits of tolling over tax revenue. E-tolls would 'provide dedicated funding for maintenance and upgrading' and SANRAL would not have to 'endure the long wait for tax revenues to provide roads' (SANRAL, 2008b).

The particular expertise of SANRAL – as competent project leads on inter-urban road engineering schemes – is evident in the storyline of the GFIP as told in the press. The road technologies and infrastructure were frequently highlighted, especially in the initial phases. Broader urban transport concerns were not examined in detail and although SANRAL partnered with the Gauteng Provincial Government (GPG) and the National Department of Transport, it was clearly the lead agent. In July 2009, SANRAL began speaking more specifically about the mechanics of the tolling scheme, while also bringing in more policy angles to prop up the arguments for it (SANRAL, 2009). These multiple arguments can be grouped into four overlapping narratives: job creation/economic growth development; congestion; access (especially of the poor); and the environment. Of these, the arguments around job creation, economic growth and development were most prevalent. E-tolls:

- Inject R29 billion into the South African economy, creating nearly 30 000 direct jobs; allow unimpeded growth in Gauteng ('paving the way for major investment into small medium and micro-enterprise as well as black economic empowerment businesses via construction'); make developments more viable; and become the catalyst for substantial economic growth and job creation;

Figure 6.1: The Gauteng Freeway Improvement Project

SOURCE: SANRAL; map by Janet Alexander



- Significantly reduce congestion and unblock access to economic opportunities and social development projects;
- Ensure that bottlenecks at interchanges are resolved;
- Improve conditions for road-based public transport with options for high-occupancy vehicle lanes and links with the non-road-based transport; provide an interconnected freeway system that includes western and south-western ('township') settlements; improve the quality of life and family time of ordinary citizens;
- Give more choice for either using public transportation or car-pooling; reduce the direct cost of travel and minimise environmentally unfriendly driving practices caused by stop-start traffic flow (SANRAL, 2009).

The SANRAL chief executive officer at the time, Nazir Alli, stressed that

> Transportation funding is a critical issue for social development and economic growth in South Africa and that tolls invariably complement the conventional funding sources in boosting the quality and extent of the country's national road infrastructure [...] SANRAL recognises the role that a safely engineered, comfortable and reliable national road network plays in advancing South Africa's global competitiveness, the economy, tourism and social upliftment as well as the contribution a superior road network makes in pushing back the frontiers of poverty. (SANRAL, 2009)

Interestingly, though, despite SANRAL's multifaceted rationales for the GFIP, the radio adverts at the time led with a simple emotional hook – the frustration and unhappiness of drivers.

Reading the actions of SANRAL as 'performances' (Law and Singleton, 2000) rooted in a civil engineering disciplinary context helps us to better understand the objectives expressed above. By contextualising SANRAL within its historical context, we can argue (not very controversially) that SANRAL is about roads and in particular about the planning, engineering, financing and physical construction of roads. This is at the heart of what SANRAL does. In this 'performance' as road engineers in the civil engineering tradition, SANRAL performs as experts in the field, as an organisation whose people have attained a high level of education with professional training and recognition. This training involves some mastery over quantitative analysis, which has a certain power over non-quantitative approaches (Porter, 1995).

The civil engineering discipline trains road engineers to believe that complex problems can be simplified and solved through creating boundaries between the socio-political and those parts of the problem that can be measured. The quantified part of the problem is then solved using maths and physics. The socio-political is labelled as such and identified as an area that is not an engineering concern. Engineers thus enact socio-political worlds as external to their technical realm of problem-solving. In so doing, they both define the problem and also place the problem-solving possibilities firmly within their own hands (Harvey and Knox, 2015; Bucciarelli, 1994).

A 2010 article in the professional *Civil Engineering* magazine offers a window into this particular bounded, technical worldview (Weidemann, 2010). This article focuses on the construction of the Ben Schoeman freeway in the GFIP and starts with a description: 'The project aims to provide a safe and reliable strategic road network and to optimize, among others, traffic flow and the movement of freight and road-based transport.' Note here the emphasis on strategic (that is, regional movements) optimising traffic flow (that is, focusing on road-based rather than more general economic, social, environmental or even transport objectives). The article (Weidemann, 2010, p. 9) goes on to list other aims:

> [T]he upgraded and expanded freeways will significantly reduce traffic congestion and unblock access to economic opportunities and social development projects [...] One of the most significant aims [...] reduction of travel times for ordinary citizens [...] many productive hours are wasted as a result of long travel times [...] bottlenecks at interchanges are alleviated [...] aim is improvement of the environmental impact of the freeway, due to the decreased vehicle emissions resulting from the reduced traffic congestion. Road safety will be enhanced [...].

Aimed at a civil engineering audience, this comprehensive article acknowledges how a road can have social and environmental impacts but gives no hints of any challenges to come in the tolling of urban roads. Roads, to a civil engineering audience in particular, are performed as a technical matter and as quite separate from politics.

South Africa has constitutional and policy commitments to social justice. SANRAL performed awareness of this through publicly stated social objectives such as the creation of jobs; enabling access; providing connections to township settlements; improving the quality of life and family time of ordinary citizens; unblocking social development projects; and improving conditions for road-based public transport (generally considered a progressive policy). However, the performance of these ideas – that is, the ability of SANRAL to operationalise these intentions – was weak. They were unable to draw on strong and robust methods, materials, expertise or social networks within the road engineering discipline (Barnes, 2002).

However, this is not to place blame on SANRAL in particular. The rhetorical arguments for social justice in the transport sector, and the supporting socio-material systems which would enable effective arguments, are not yet well established in South Africa. At least, they are not established to the degree needed to even sit in equal status to other, more durable and robust financial and economic road engineering arguments. Social justice has only recently emerged in any coherent way in the global transport planning literature (Martens, 2016).

In the GPG's comprehensive review of the GFIP scheme in 2014, social justice is a prominent theme. The report (GPG, 2014) highlights transport inefficiencies and inequalities, and is structured around the ideas of social justice and freedom. Issues of integrated planning, budgeting, mutual accountability, inclusive deliberation and participation, and sustainable funding mechanisms were emphasised, implying that this interrelated set of issues had not been adequately addressed at that point (GPG, 2014). I suggest that matters of social concern were, at least initially, smoothed over in the SANRAL process and referred to only in broad terms in contrast to the financial, economic and technical parts of the scheme, which were unpacked in great detail using the traditional road engineering toolkit.

Hommels (2005) suggests that urban practices operate according to persistent traditions in which current practices are firmly rooted. Hommels argues that these deep historical contexts help us account for the professional obduracy which is described in cases like this. All institutions, argues Hommels (2005), even those we consider as 'technical', come with cultural habits which embed assumptions about who or what should benefit, and who or what matters.

From an environmental point of view, SANRAL's analyses were project specific and thus limited. They did not attempt to grapple with the deeper underlying reasons for environmental emissions from the urban transport system as a whole, which would have required very different modelling and analysis procedures from the ones adopted. They also did not initially analyse or discuss the urban land-use structures which had created the conditions for long drives and congestion. Nor did they engage with genuine urban congestion charges, which would have required an approach based on urban areas rather than on national routes. These would all have required different analyses, expertise and planning approaches to the ones engaged by SANRAL.

It also seems that the political consequences of tolling national roads through an urban context were not considered to the same extent as concerns about alleviating congestion and addressing the economy (as it is understood within traditional transport economics). This is not entirely surprising given the lack of political engagement by civil engineering education and professional practices generally. The discipline of civil engineering limits itself to the material manifestation of the road and some of its readily measurable impacts. This is not to criticise individual engineers involved in this or any other project but rather to point out that there are structural education and professional limitations for those engineering practices that are engaged in

SANRAL's analyses did not grapple with the underlying reasons for environmental emissions from the urban transport system

complex urban settings. In these urban 'worlds', civil engineering practices are strained to do the work of separating out the engineering of the material road infrastructure (solvable by maths and physics) from the social and political practices which co-create them. The complex and immeasurable is smoothed over and the measurable and resolvable is foregrounded (Bucciarelli, 1994).

The opposition (2011–2017)

Until late 2010, the public narrative about the GFIP was dominated by SANRAL media releases and was largely self-congratulatory and celebratory. The GFIP freeways had not been tolled at the outset, with some sections completed for the 2010 FIFA Soccer World Cup and kept free at point of use (SANRAL, 2009). Throughout 2011, SANRAL's statements to the press mainly concerned the construction itself, although opposition voices started to speak out during this time.

In February 2011, SANRAL announced the proposed toll fee structure for the roads and a Deloitte economist raised concerns that stakeholders may not have fully considered the implications of the tolling and that e-toll could negatively impact on operations, competitiveness and the business bottom line (Walsh, 2011). By this time, 30 of the planned 49 gantries had already been erected, indicating SANRAL's strong commitment to e-tolling.

By the end of February 2011, there was a growing public outcry and national Minister of Transport S'bu Ndebele and Gauteng Premier Nomvula Mokonyane announced a task team review of the toll tariffs. COSATU resolved to fight e-tolls and planned strike action in protest. They claimed, along with the Gauteng ANC, not to have been consulted about the tolls. Also, they were not happy with the transport minister's suggestion that they should use the rail system as an alternative, a system which they claimed was not functioning as it should. COSATU's Gauteng provincial secretary, Dumisani Dakile, argued that 'Gauteng does not have a public transport system that is reliable, safe or affordable' (Mail and Guardian, 2011), thus performing the e-tolls as a Gauteng matter and not as the national roads matter that SANRAL had previously focused on.

Tolling had originally been planned for a June 2011 start but was postponed indefinitely. In August of 2011, Cabinet announced new toll tariffs, exempting buses and taxis entirely (The Star, 2011). However, COSATU continued to speak out against the scheme and to plan strikes (IOL Business Report, 2011). In October 2011, a task team was appointed to look at the issue (News24, 2011). COSATU and the South African Transport and Allied Workers Union (SATAWU) continued to release statements during 2011 in opposition to the principle

Photograph by Alastair Mclachlan

and application of e-tolls. As the year progressed, concerns about lack of consultation and possible misappropriation of funds were added to opposition to the process (Craven, 2011). Concerns were also raised about individual affordability, a social issue which had not been mentioned in any of SANRAL's press releases to that point. These issues of procedural and distributional justice raised by the unions were issues which roads engineering practices were not able to imagine well at all, let alone predict and build into a road engineering project.

By March 2012, the validity of the user-pays principle, which had been vigorously defended by SANRAL, was being openly debated by members of the political parties and the unions. The National Union of Metal Workers of South Africa (NUMSA) claimed that

> pricing should [...] be redistributive, being sensitive to the deep inequalities that are embedded in our society. In other words, the pricing of such items should shift resources from the upper classes to the lower classes. That is why COSATU would continue to oppose the application of cost-recovery pricing on the working class, because such a pricing does not respond to the deep-seated inequalities that prevail in our society. (Irvin, 2012)

This matter of the appropriateness of the user-pays principle to cities bearing the spatial legacy of apartheid was something which the engineering fraternity was unschooled in and unable to engage with rigorously. Despite protests and debate, SANRAL pushed doggedly on. Meanwhile, the public opposition was only increasing in vitriol and fervour, with many citing SANRAL's arrogance and belligerent attitude.

In 2013, after a series of court applications, appeals and a Competition Commission investigation highlighting collusive practices by some of the construction companies involved, the courts ruled that e-tolling was legal and the system was re-launched (Venter et al., 2013). In mid-2013, there was a turning point in messaging from SANRAL, and a cleansing of many of their previous arguments. In this new, streamlined rationale, e-tolls aimed to 'assist the massive backlog road infrastructural development' requiring R340 billion for new and existing roads (Mona, 2013).

As the e-toll system finally rolled out at the end of 2013, the scheme became a focal point of opposition to national government. The Inkatha Freedom Party caucus leader, Bonginkosi Dhlamini, described the scheme as 'the most expensive blunder this leadership has ever done' (TechCentral, 2013). Democratic Alliance (DA) leadership flew a

banner over the routes declaring: 'Fight e-tolls, vote DA'. And the DA later posted billboards on several Gauteng freeways stating: 'E-tolls. Proudly brought to you by the ANC' (Mkentane, 2017). COSATU vowed to continue its fight, saying the government had demonstrated stubbornness, unwillingness to cooperate with workers and a refusal to listen. E-tolls represented 'a clear demonstration of cadres who have been power-drunk and believe that they could do as they so wish', according to Dumisani Dakile, COSATU's provincial secretary (TechCentral, 2013). OUTA Chairperson Wayne Duvenage also accused government of ignoring the views of society, and Justice Project South Africa accused SANRAL of being 'arrogant and evasive' (Nicolson et al., 2013).

Although SANRAL faced dissent from many quarters, some quiet voices of support for the principles of road pricing generally, if not e-tolling in particular, remained. In a partial defence of road pricing principles, independent economist Andrew Marsay noted the irony of COSATU's position. He reported how, when pressed, one COSATU member admitted that e-tolls were, in fact, a progressive tax but that they were now so unpopular that COSATU could lose membership if they supported them (Marsay, 2015).

The apparent contradictions in COSATU's position highlight the vexed social justice conundrums at the heart of urban transport pricing in South Africa. On one hand, the pricing of private vehicles is progressive as it internalises costs which are otherwise borne by society as a whole. In congestion pricing, the time delays due to congestion imposed by an additional vehicle are charged to that vehicle instead of being absorbed by all car users in the form of additional delay. In other forms of road pricing, it is environmental costs which are charged to the user, hence the user-pays principle. In terms of the overall population, the car-owning user is relatively wealthy, and this is used as a general argument for road pricing. On the other hand, the apartheid spatial legacy has created such poor conditions for commuters to use public transport and for walking/cycling that car ownership at even relatively low-income levels is common, and COSATU spoke out on their behalf.

SANRAL and government responses to opposition (2013–2017)

SANRAL continued to face widespread public opposition to e-tolls a year after the system went live, with the majority of Gauteng motorists not registered for e-toll tags in 2014. Gauteng Premier David Makhura announced in June 2014 that a panel would be set up to assess the socio-economic impact of tolls in the region, with the aim of finding a lasting solution (Mawela et al., 2016). The panel's extensive review recommended price reductions, a halving of the monthly toll cap and discounting for outstanding fees that were settled timeously (GPG, 2014). There were also suggestions to improve the alignment of public transport provision (managed by the GPG and the local municipalities) and national road provision (managed by SANRAL). Through the review, Premier Makhura presented the e-tolls as a provincial matter despite SANRAL still being the project lead and functioning at the national scale. SANRAL was still legally embedded in the role of national roads provider and, increasingly, as an agency needing to service considerable construction debt.

The e-toll project seemed to act as a lightning rod for many of the broader frustrations around perceived mismanagement of public funds under Jacob Zuma's government (2009–2018). Gauteng Premier Makhura spoke publicly of his policy intentions on two of the most pressing issues: to clean out corruption and address the e-toll matter (Makhura, 2014). Then Deputy President Cyril Ramaphosa led the work to move the new e-toll dispensation forward during 2015, while SANRAL continued to push for payment by whatever means it had available (Gqirana, 2015). In a January 2015 press statement following the acceptance of Premier Makhura's review findings, Ramaphosa (quoted in Gqirana, 2015) said:

> It [the revised scheme] addresses the concerns of Gauteng motorists, particularly those from low- and middle-income households, while ensuring that our approach to the construction and maintenance of a road infrastructure is sustainable. We have reaffirmed the user-pay principle as a fair, affordable and reliable mechanism to fund infrastructure development.

Note here that Ramaphosa talks of the Gauteng motorists from low- and middle-income households, an implicit alignment with the concerns of COSATU, while also maintaining a regressive focus on car owners over the travelling public more broadly. Ramaphosa (quoted in Gqirana, 2015) continued by saying:

> The new payment options safeguard the integrity of the fiscus and enhance the ability of the South African National Roads Agency to raise funds to meet its obligations. It will ensure that Gauteng has an excellent freeway network well into the future, while reducing traffic congestion, emissions, travel time and transport costs.

Thus, the plethora of objectives from project initiation were reduced to a focus on sustainable funding for the roads, allaying social justice concerns as raised by the public, and with a nod towards congestion and environmental sustainability.

In 2017, the government proposed the SANRAL Amendment Bill, which gives provincial and municipal governments more power to implement e-tolling (Monama, 2017). This came at a time when data showed that only 30% of SANRAL's invoices for the scheme generated over a 24-month period had been paid (BusinessTech, 2017). SANRAL, meanwhile, acknowledged the severe strain they were under due to the lack of e-toll payment to date and were said to have halted the construction of three roads with the intention of servicing debt instead (Fin24, 2017). SANRAL acknowledged that it was finding collecting the tolls very difficult and that there was ongoing resistance. OUTA claimed that SANRAL collected only R870 million in 2017 but had billed R2 billion (Tema, 2017). The earlier performances of social and environmental objectives had been fully lost in this public stress-test of SANRAL's performance. Now SANRAL's position was clear: it was a strained and indebted public roads agency focusing on issues of finance.

6.5 Conclusion

Transport is an important sector to consider in debates about social justice and environmental sustainability. Some of the complexities of the idea of 'just sustainability' are laid bare in the sector. This case study considers how environment and social arguments were enrolled in the debates about the GFIP, a major road scheme in Gauteng. Throughout, the national roads agency, SANRAL, struggled to see the opposition's points of view.

The traditional approaches to transport and road engineering, embodied by SANRAL, have prioritised economic objectives since the 1960s and have only relatively recently started to take environmental and social objectives into account. In this particular case, social justice objectives and, to a lesser degree, environmental sustainability objectives were dropped in favour of other arguments for the scheme. The GFIP e-toll project is located in the complex urban context of Gauteng – not long-distance, inter-urban roads as per SANRAL's expertise. The extent of SANRAL's concerns (in economic efficiency, primarily, and in fundraising for national roads) conflicted dramatically with the concerns of their key clients, the Gauteng motorists (who were concerned with congestion, affordability, transparency and fairness) and the group representatives such as COSATU.

Social justice objectives and, to a lesser degree, environmental sustainability objectives were dropped in favour of other arguments for the scheme

Furthermore, the legal frameworks which constitute SANRAL as an agency require it to sustain itself financially. Had investment in transport in Gauteng been initiated from an environmental sustainability and social justice policy stance, it would have delivered very different infrastructure with more focus on road-based public transport, public transport interchanges, pedestrian and cycle routes, differentiated pricing schemes according to income, multi-institutional agency cooperation and the cross-subsidisation of income to general transport revenue. The mandate of SANRAL, though, to provide national road infrastructure and to be financially self-sustaining, precluded the success of such an approach in building towards just sustainability.

Viewing 'SANRAL' as the effect of relations, some of which were rooted in the disciplines of road and civil engineering, helps us to understand the road agency differently. The material-semiotic sensibility, with its emphasis on practices, helps us to make better sense of the apparent intransigence, arrogance and struggles of the road agency. It also helps us to reflect on social and environmental statements by SANRAL as promotional rather than as embedded analytical practices.

Although the opposition to e-tolling has somewhat demonised SANRAL and the ruling ANC, the case presented here does not give politics or specific organisations the primary explanatory role. Rather, it highlights the limits and dangers of long-standing and obdurate so-called technical disciplines such as road engineering. More importantly, the case highlights the problems of generalising concepts like 'environmental sustainability' and 'social justice' and even 'roads'. The focus of agencies such as SANRAL, for example, is on the physical, material manifestation of roads. If the analytical repertoire has this physical, material focus then a rural road and an urban road have many similarities. It makes sense, in this perspective, to employ the same tools in an urban context as one would employ in a rural one.

However, broaden the concept of 'road' to embrace the socio-political realities which a road enacts as it is used, and the picture is very different. Urban roads are enmeshed in far more ideological and political complexity than rural roads, with diverse and changing constituencies, and with different demands from their rural counterparts. From the narrow perspective of higher-income car users in Gauteng, for example, SANRAL's claim that e-tolling would reduce emissions (due to less road traffic congestion) was justifiable. Calling e-tolling environmentally sustainable as a general claim, however, given the emissions record of car use in general across the transport sector, was unreasonable. From the perspective of the poorest car owners, e-tolling was a regressive tax. Across the population as a whole, if cross-subsidisation of e-tolling into transport for the poorest (non-car owners) had been possible, then e-tolling could be reasonably argued as progressive.

In a setting as inequitable as South Africa, we need to read such concepts with more focus on *whose* 'environmental sustainability' and 'social justice' we are referring to, as well as which 'poor' in which user-group, and what 'road' in what geographic context is under discussion. We also need to reconsider 'road' and look beyond material similarities and into the social, political and technical hinterlands of practices which produce them and which they produce.

The 'conceptual smoothing' work done by general terms such as 'environment' and 'social' serves only to hide the inequities and divisions inherent in South African society. Similarly, a 'just sustainable transition' is a hopeful and likely necessary rallying cry, a call to action beyond narrow normative agendas. However, as an analytical lens, the idea of a 'just sustainability' hides much, including the very diversity of experiences which a socially just transition requires us to expose, and more deeply understand, if polemic is to translate into effective action.

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Photograph by Clive Hassall

Photograph by Christina Culwick Fatti

Chapter 7

'Why should we build cycling lanes? For what?' Building a socially just bicycle programme in an unequal city: The case of Johannesburg

GAIL JENNINGS

Abstract

On the face of it, the dual agendas of sustainability and justice seem to be in balance in the promotion of bicycle mobility. Cycling is a low-carbon transport mode with limited other environmental impacts, and being a low-cost mode, it also has the potential to improve access as a pro-poor transport option. Yet in documenting this case, the utility bicycle programme in the City of Johannesburg (CoJ) between 2010 and 2017, this chapter surfaces a number of assumptions regarding bicycle mobility's transformative social justice and poverty alleviation potential, alongside its environmentally sustainable framing. This chapter draws on a variety of data sources to track the evolution of bicycle policy in the CoJ and the political rhetoric that surrounded the bicycle programme. This chapter reveals how an intervention that might appear self-evidently just and sustainable has generated highly conflicting narratives, and has led policy-makers, politicians and implementers to confront the dissonance between South Africa's political rhetoric and legacy of distributive injustice, and climate and sustainability imperatives that have largely been framed within international agendas. This case surfaces questions about justice for whom and in what form, about environmental sustainability at what scale, and has shown that achieving just sustainability through cycling is neither straightforward nor a given.

7.1 Introduction

This chapter, which focuses on the transportation sector, considers one particular case in the Gauteng City-Region (GCR) where, on the face of it, the dual agendas of sustainability and justice seem to be in balance – the promotion of bicycle mobility (cycling as a mode of transport, or everyday utility cycling). Cycling is framed as an environmentally sustainable mode of transport because it is low carbon. It is also argued to further social justice by improving access and reducing transport costs, while having a range of other social, economic and health benefits. Yet in documenting this case, the utility bicycle programme in the City of Johannesburg (CoJ) between 2010 and 2017, this chapter surfaces a number of assumptions regarding bicycle mobility's transformative social justice and poverty alleviation potential, alongside its environmentally sustainable framing.

In this case, an intervention that might appear a self-evident public good has generated highly conflicting narratives, and has led policy-makers, politicians and implementers to confront the dissonance between South Africa's political rhetoric

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and legacy of distributive injustice, and climate and sustainability imperatives that have been largely framed within international agendas. This chapter peers below the discursive surface of the utility cycling narrative to reveal how both tacit and explicit ideologies around social justice and environmental sustainability contribute towards conflicting rationalities. The case highlights the complexity and nuance of justice and sustainability trade-offs, and how different perspectives and scales of analysis have influenced decision-making around cycling in the CoJ.

Methods and chapter outline

This chapter draws on a variety of data sources, including public policy, personal interviews with city officials, speeches, city reports and online media.[1]

The chapter first presents the theoretical framework for just sustainability, introducing how this relates to transport and cycling in particular. The chapter draws on the recent work of bicycle justice scholars (e.g. Golub et al., 2016; Martens et al., 2012), laying the groundwork for exploring how the environmental sustainability and social justice opportunities that utility cycling presents have at times been taken on board uncritically by advocates and planners.

The chapter then introduces justice and sustainability in South Africa's transport policy frameworks, describing the way in which South Africa's overarching environmental and mobility policies place the eradication of inequity above climate mitigation. This is followed by a presentation of an overview of South Africa's non-motorised transport policy environment, which explicitly engages an environmental and pro-poor narrative of rights, needs, justice and sustainability. Cycling was not immediately, post-1994, presented in the policy discourse as an environmentally sustainable intervention, but by 2018, this was regarded as its primary potential impact (Jennings, 2021).

The case of Johannesburg's bicycle intervention programme, from 2010 until 2017, is presented in the following section, which describes the motorised and non-motorised transportation context of the city. In this congested megacity, walking and high-volume public transport as well as unscheduled paratransit services are the major transport modes. This section notes the long distances and journey times that characterise travel in Gauteng, and the low cycling mode share. This sprawling environment with poor accessibility is not one in which utility cycling can easily flourish (Jennings et al., 2017).

Next, the chapter describes the early and international influences of the CoJ's bicycle policy renaissance, including its initial pro-poor rather than sustainability goals. It goes on to consider the incongruent presentation of the impact of bicycle travel as a just or sustainable intervention, and the use of a coercive or impositional discourse that largely fails to change perceptions and promote the mode.

The chapter then introduces the rhetoric between political parties competing during the 2016 local government elections, which signalled bicycle mobility's contested framing as an elitist form of exercise, or as a transport mode for the poor. This rhetoric suggests that bicycle mobility exemplifies the complex intersection between a green agenda and social justice.

The chapter concludes that bicycle intervention programmes are neither inherently just nor unjust; nor do they necessarily advance the sustainability agenda. Although bicycle mobility has the potential to deliver on both desired outcomes, these outcomes do not follow automatically from a vision or stated goals, and require rigorous interrogation of the possibility of meaningful carbon mitigation and transport justice.

1 Interviews cited in this chapter were conducted during 2017, and the central analyses and policy and literature review were undertaken during the course of 2017 and early 2018.

7.2 Theoretical framework for just and sustainable cycling

Contextualising just sustainability

Increasing attention has been paid in the literature to the concepts of just sustainability and just transitions. Just sustainability builds on the 1987 Brundtland definition of sustainable development by placing particular emphasis on ensuring equity and justice for the present society as well as for future generations (Agyeman, 2008; Agyeman and Evans, 2004) (for more detail, see Chapter 2 of this volume). It merges the agendas of environmental sustainability and social justice – where the outcome of low-carbon or environmentally sustainable interventions cannot inadvertently or thoughtlessly increase or entrench disadvantage, or redress inequity only marginally. In this case, just and sustainable transport provides equitable and sufficient mobility in an environmentally sustainable way and in a way that has been achieved through just processes.

This chapter engages in particular with issues of distributive justice and procedural justice. As highlighted in Chapter 2, distributive justice refers to the fair distribution of resources, benefits and costs, whereas procedural justice encapsulates a decision-making process that is democratic, inclusive and deliberately ensures that the voices of those who are affected are taken seriously.

With transport being one of the primary sectors that contribute to global carbon emissions, the principal focus of environmentally sustainable transport relates to reducing emissions through alternatives to internal combustion engines, renewable fuel energy sources, and supporting high-volume and low- or no-carbon options (e.g. public transport, walking and cycling). In addition to carbon emissions, the transport sector also contributes to environmental issues such as noise pollution, the transformation of land and impacts on ecosystems (Banister et al., 2011). This chapter focuses on cycling, which is a high-volume, low-carbon mode of transport, and which has low impacts on other environmental systems.

Within the burgeoning field of transport justice, although there are no universally accepted definitions of transport poverty or disadvantage, these concepts are closely linked to social justice, and refer to circumstances where people or households are unable to make the journeys necessary to meet their needs (whether for employment or income generation, healthcare or other needs, or to participate in society). This may be due to financial limitations, spatial planning, land use, mobility impairment, age or other reasons. A consequence is likely to be transport-related social exclusion, and a reinforcement of poverty and its associated deprivations (Venter et al., 2017).

Broadly, transport justice requires redressing transport disadvantage by reducing (1) inequitable benefits from investments in transport, (2) inequitable burdens imposed by transport infrastructure, such as road safety, noise and air quality, and (3) inequitable participation in planning/determining (Golub, 2016; Martens, 2012; Martens et al., 2012). The first two concerns are by and large known as distributive justice, where benefits and burdens are fairly distributed, and the third as process or participatory justice – the 'democratiz[ed] decision-making' to which the National Department of Transport refers (NDoT, 1996, Policy goals and objectives). South Africa's transport policies commit to the delivery of both forms of transport justice, and imply that increasing and improving bicycle mobility is one way in which to do so.

Just sustainability and utility cycling

There is a large body of international literature, the most recent being the Intergovernmental Panel on Climate Change *Special report on global warming of 1.5 °C* (Masson-Delmotte et al., 2018), which sees private-car-limiting policies and bicycle mobility as key to reducing single-occupancy vehicles and reducing the CO_2 emissions of road traffic. The role of

Bicycle intervention programmes are neither inherently just nor unjust

bicycling as a social justice intervention is a relatively new framing (see, e.g., Golub et al., 2016), although early work by Kane (2001) points to the inequitable use of public resources in the 'new' South Africa by a continued focus on motorised rather than non-motorised modes, which constitute the majority of trips (as either a main or secondary mode), and the lack of planning for cycling (Kane, 2001).

When considering utility cycling, scholars caution that many assumptions and underlying arguments for bicycles as pro-poor or socially just 'have been left unexamined' (Martens et al., 2016, p. 86), and suggest that the degree to which bicycling (and bicycling infrastructure) advance social justice is unclear. Martens et al. (2016) state that where public resources are being used, a just bicycle intervention is one that effectively and efficiently promotes and enhances accessibility for those with sub-standard accessibility levels. Bicycle mobility can only effectively do so if those with current sub-standard levels of accessibility (1) know how to cycle, (2) are amenable to cycling rather than other modes of travel, and (3) where land-use patterns, topography and travel distances enable cycling to meaningful or useful destinations. In this line of argument, using public funding to provide bicycle lanes as an alternative for car owners (relieving congestion and reducing CO_2 emissions) is environmentally sustainable but does not necessarily redress inequity – and could thus be considered unjust. On an infrastructure note, distributive justice would require that in order to build bicycle lanes, road space is taken from motorised vehicles, never from pedestrians (Martens et al., 2016).

This chapter emphasises that just and sustainable transport requires not only distributive justice but also procedural justice, where the process by which environmentally sustainable interventions were planned and introduced must be negotiated and legitimate (Newell and Mulvaney, 2013). Before a bicycle programme can make claims of being socially just, it must ensure inclusive participation and grassroots advocacy; invest in existing communities (rather than as a precursor to or effect of gentrification); recognise and plan for the diversity of cyclists and cycling travel patterns and uses; and integrate cycling into broader community development processes (Golub et al., 2016).

This chapter explores how promoting bicycle transport for those who have no desire to ride, for whom bicycle mobility does not substantially improve access, and for those who currently rely on low- or zero-carbon modes, is neither necessarily environmentally sustainable nor just.

7.3 Justice and sustainability in South Africa's transport policy frameworks

South Africa's apartheid-era cities explicitly created transport poverty, disadvantage and injustice. Poverty and access to transport options are inextricably linked in a dynamic process that reinforces poverty: the poor are more likely to live in areas that have inadequate transport services, and therefore have insufficient access to the advantages and opportunities to reduce poverty that these services may bring (Jennings, 2016a).

From the outset, South Africa's post-1994 transport policy recognised the transformative and redistributive possibilities of public transport, with the potential to redress spatial injustice and social exclusion, and to alleviate poverty. In addition to this, South Africa's Bill of Rights (1996)[2] guaranteed the right to an environment that was not harmful to health or well-being, and implicitly placed access and mobility at the centre of the guaranteed rights to healthcare, education, food and clean water (Coggin and Pieterse, 2015).

At the same time, however, the Bill of Rights recognised that these goals might prove to be in opposition, and provided that legislative and other measures to secure sustainable development were to be *reasonable*, promote *justifiable* economic and social development, and be *subject to the state's*

2 https://www.gov.za/documents/constitution/chapter-2-bill-rights#27

capacity for provision (Bill of Rights, 1996). The White Paper on National Transport Policy (NDoT, 1996) entrenched these limitations. Trade-offs were foreseen and delimited, while decisions regarding the removal of mobility constraints and the provision of transport were to be 'consistent with [national interest, such as] meeting basic needs, growing the economy, developing human resources, and democratising the state and society' (NDoT, 1996, Policy goals and objectives). These goals were to be accomplished while being environmentally and economically sustainable as well as financially viable. The earlier policy framings of necessary compromise were updated in South Africa's Draft Green Transport Strategy (NDoT, 2018). This document emphasised that economic and social benefits should be maximised while minimising associated environmental, social and economic costs – by including an objective to facilitate the sector's 'just transition to a climate resilient and low carbon economy and society' (NDoT, 2018, p. viii).

In its submission for the 2016 Paris Agreement,[3] the South African government reiterated its commitment to just sustainability, where people's needs and climate change imperatives are both met. However, the submission is unambivalent that when there are trade-offs to be made, the overriding priority is to eliminate poverty and eradicate inequality. Key actions identified to mitigate carbon impacts included increased public transport use and shifts to bicycle travel (DEAT, 2008, 2005).

South Africa's cycling frameworks

The role of cycling as both a sustainable and equitable mode that can increase urban as well as rural access appears in policy and strategic statements in both the environmental and transport directorates (National Planning Commission, 2016; GDRT, 2012a, 2012b; NDoT, 2007; DEAT, 2004).

In 1999, the NDoT published a guiding document entitled *Moving South Africa,* which made a clear connection between low residential densities and the resulting barriers to walking, cycling and public transport viability. In this document, efficiency and mobility rather than the environmental impacts of transport were the driving force for change (Kane, 2001). The document introduced six categories of transport user based on their willingness or necessity to travel by public transport: stubborn (only use a car); selective (can afford a car, willing to use public transport); sensitive (captive to the best option of public transport); survival (captive to the cheapest public transport mode); stranded (cannot afford public transport); and strider (prefer to walk) (NDoT, 1999). Regarding cycling, for the first two categories of user, a shift to bicycle mobility would deliver a carbon-mitigating, sustainable impact; for the latter four, who already use low-carbon modes, a shift to bicycle mobility – given the right circumstances and depending on spatial form and travel needs – could contribute to poverty reduction (Nkurunziza et al., 2012; Cox, 2010; Khayesi et al., 2010; Pendakur, 2005; Rwebangira, 2001; Howe and Bryceson, 2000). Cycling is considered to contribute towards alleviating poverty by improving access and reducing the cost of transport.

The 2008 Draft National Non-Motorised Transport Policy explicitly envisions cycling as an energy-conserving, environmentally protecting and sustainable mode of transport. Both walking and cycling are claimed to reverse inaccessibility and inequity, meet the mobility needs and improve the quality of life of marginalised peoples, bridge the economic and social gaps between first and second

Poverty and access to transport options are linked in a dynamic process that reinforces poverty

3 http://cait.wri.org/indc/#/profile/South%20Africa

economies, and play a role in economic development and poverty alleviation (NDoT, 2008).

South Africa's Green Transport Strategy, signed by Cabinet in October 2018, regards cycling primarily as a sustainable, carbon-neutral mode but entirely omits poverty reduction and social redress as a benefit of cycling (NDoT, 2018).

Utility cycling might at face value seem to be a just and sustainable transport option – it is both low carbon and low cost – that requires no trade-offs between these imperatives. The theoretical and policy frameworks presented above demonstrate that cycling interventions are not clearly conceptualised as either socially just or environmentally sustainable; these messages blur, and the interventions are prone to miss both targets, as this chapter explores.

7.4 The case of cycling in Johannesburg

Despite policy shifts over recent decades, Johannesburg (and South Africa more generally) remains beset by a dichotomous transport conundrum: carbon intensive, congested and private-car dependency on the one hand; and long commutes, poor-quality mobility and transport disadvantage on the other.

The CoJ's (2011a) Growth and Development Strategy speaks frankly of the ever-increasing complexity of challenges, having to navigate climate change, inequality and natural resource scarcity. The inequality is exacerbated by spatial disparities, where people living in less affluent areas have to travel great distances to get to work (CoJ, 2011a). Nevertheless, the Growth and Development Strategy engages the narratives of social inclusion, social cohesion and sustainability in its challenge to overcome the legacy of apartheid and make the trade-offs between the present costs of transport provision and a future green economy. A focus on bicycle mobility could contribute to both imperatives.

Johannesburg has two largely separate transport systems, reflecting its income disparity and extreme inequality. Within the city, two-thirds of households do not own a private vehicle and use minibus taxis or public transport. For these commuters, travel times are long and the cost of public transport is rising – this in the context of more than a third of people in South Africa having to choose between food and transport (Nicolson, 2015; GDRT, 2014). In 2014, the average travel time in Gauteng was 46 minutes per day (GDRT, 2014).

Utility cycling, while once relatively common in Johannesburg (Morgan, 2018), although never as popular as in other African cities (Vanderschuren and Jennings, 2017), now barely registers in household travel surveys and traffic counts. In 2003, five years before the CoJ began contemplating bicycle transport in earnest, cycle trips represented less than 1% of the morning peak trips in Gauteng (GDRT, 2003). Gauteng's 2013 Household Travel Survey (GDRT, 2014) reflected 0.8% of commuters cycling to work in the province. The survey revealed cycling to be the main mode for 1% of the north-western region of Johannesburg, and 0% elsewhere in the city. Overall, bicycle planning is hampered by a lack of detailed data on cycling behaviour and trends – the literature reveals 'little or no comprehensive dataset' that describes cycling patterns in Johannesburg (Musakwa and Selala, 2016, p. 898).

Building foundations for utility cycling: Early influences

South Africa's first bicycle programme, Afribike, was founded in 1998 as a non-governmental organisation funded by the Danish Development Agency and the United Nations Development Programme, and managed by the then United States-based Institute for Transportation and Development Policy in its Gauteng office (Cox, 2010). Afribike relied on donor bicycles largely from the United Kingdom. The NDoT's own bicycle project, Shova Kalula, was founded in 2001, ahead of the Johannesburg-hosted World Summit for Sustainable Development in 2002. Shova Kalula drew on Afribike's work, with partnerships in Europe, the United States and Canada (Mahapa, 2003). It hoped to improve mobility and access to basic needs as well as social and economic opportunities for people, especially in rural, remote and poorly resourced areas. Women, girls and learners who walked long distances to school were the key target groups (NDoT, 2014). Although this project sought distributional justice

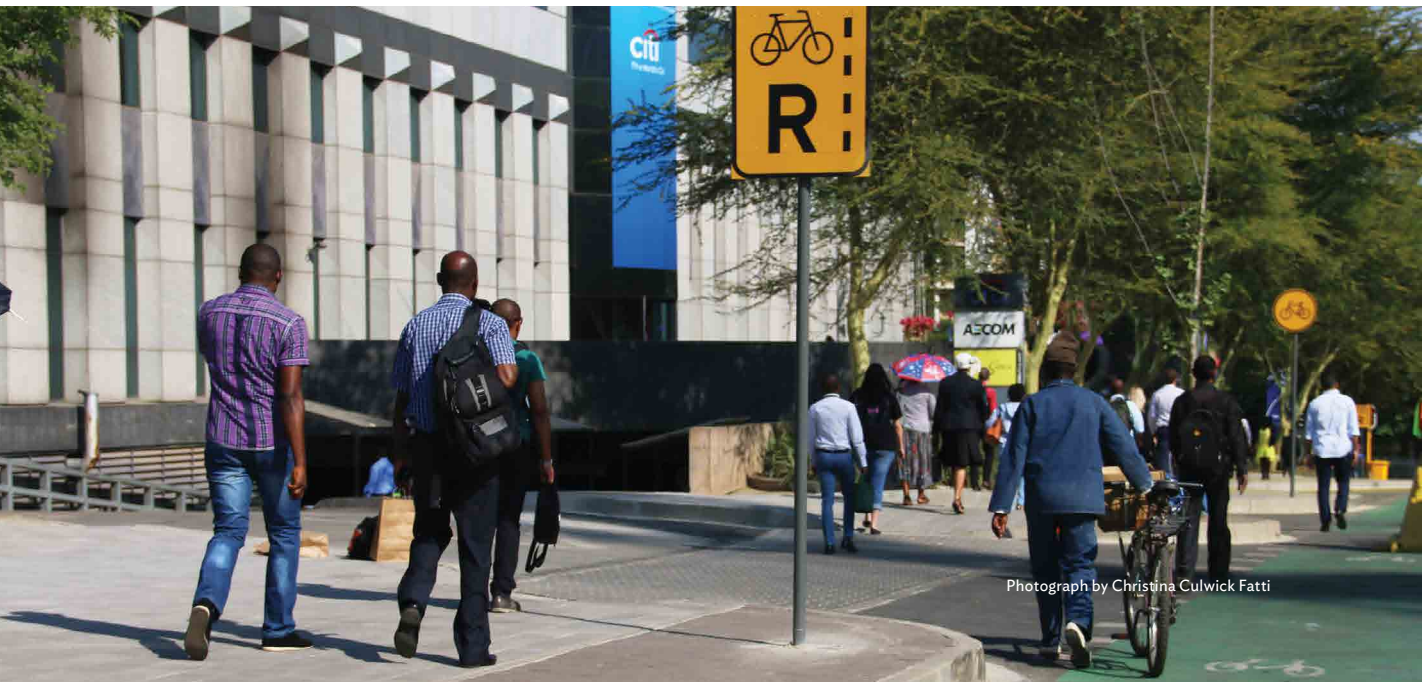
through improving access for the least advantaged, the programme was not procedurally just as 'stakeholder participation at local level was non-existent' (Mahapa, 2003, p. 20).

The CoJ received international support from a Dutch-based network, Interface for Cycling Expertise, which also formed the Bicycle Partnership Programme with Cape Town partners. This programme aimed, among other objectives, to develop cycling as a non-motorised strategy for urban mobility and contribute to the achievement of Millennium Development Goals (particularly poverty alleviation) (Bicycle Empowerment Network, 2010).

Both despite and because of the low cycling rates in the city, the CoJ followed national government policy direction and took advantage of international interest, with local cycling advocacy emerging later, spearheaded by the Johannesburg Urban Cyclists Association (JUCA) in 2012. The CoJ framed cycling 'as an affordable and environmentally sustainable alternative mode of transport to the motor vehicle [...] and to improve access to the city's opportunities for all communities' (CoJ, 2009, p. 13).

The CoJ published a high-level Framework for Non-Motorised Transport (NMT) in 2009, which identified bicycle mobility as environmentally sustainable and socially just (through poverty alleviation), naming potential utility cyclists as both car owners ('choice users') and people unable to afford public transport ('captive users'), categories first introduced in earlier national documents (NDoT, 1999). Among the Framework's goals were the establishment of a dedicated network of high-quality cycling routes and an increase in the numbers of cyclists. Benefits were seen to be environmental (including helping the CoJ meet its climate targets), improved accessibility, improved health and quality of life, economic development, and increased activity and vibrancy in the street environment. The Framework for NMT also focused on promoting cycling as a feeder mode to public transport to improve access and reduce travel time (CoJ, 2009). Cycling would permit 'access to the opportunities in the city via basic low-cost mobility and independent movement [...] benefits which are especially relevant to marginalised communities' (CoJ, 2009, p. 4). Congestion reduction and environmental management, tourism, health and recreation were secondary objectives, after scholar and commuting trips.

The Framework, which aimed to build the foundation for a comprehensive, city-wide plan for guiding NMT implementation, established an NMT Forum, including sports organisations/clubs, event organisers, urban designers, traffic engineers and



Photograph by Christina Culwick Fatti

access experts, and engaged stakeholders such as local, provincial and national transport and land-use directorates. However, largely missing from the attendance registers and meeting invitation lists were the intended beneficiaries or their representatives.

How to 'make Jo'burgers pedal their way to work'

The opportunity to focus on bicycle mobility more substantively arrived with South Africa's first global mega-event, the 2010 FIFA World Cup. Like many of the host cities in South Africa, Johannesburg anticipated that spectators would walk or cycle to match venues (DEA, 2009). Thus infrastructure development in Johannesburg was kick-started by the National Department of Environmental Affairs in 2010, in partnership with the German Development Bank. This partnership launched a National Greening Programme throughout South Africa and called for suitable proposals for infrastructure development.

> All we had to do was talk about cycling and we'd get the funding. With the soccer World Cup – there were opportunities knocking at our door. Everyone was giving us money. We could not say, don't give us your money, we are still consulting. South Africa was flooded with money for infrastructure. (CoJ interview, 29 November 2017)

The CoJ had successfully proposed a demonstration bicycle project in Soweto, from Noordgesig to Madlala Street in Orlando West. The project goal was framed as both just and sustainable: to facilitate 'equitable access for the marginalised sectors of our society' and to serve as 'a proof of concept to extend similar facilities across the city' (CoJ, 2011b, p. 1). The Orlando project, which was launched in 2014, entailed a 5.5 km route of segregated bicycle lanes and focused on integrating public transport, routes to schools and tourism. The project team took a top-down approach, noting that 'there is currently a very low percentage of cyclists in the area. As such the project would introduce cycling as an alternative mode of transport in Soweto and begin to *build* a cycling culture in the area' (CoJ, 2011b, p. 1, emphasis added). It was anticipated that the modes of transport that cycling would likely replace in Soweto would include walking and minibus taxis (the high-volume, relatively low-carbon paratransit mode).

Despite being identified as a means of achieving multiple social, mobility and poverty alleviation gains, bicycle transport is not popular in the city. 'The advantages are obvious: not everyone can afford a vehicle and there's the fitness element, but many people are reluctant because they are terrified [...] The problem is you're likely to get killed, and that's a huge deterrent' (Stones, 2013). The Orlando West Project Management Unit conceded that very few people in the city actually cycle, and that key challenges with the programme included insufficient engagement with cycling stakeholders and the 'piecemeal' nature of implementation rather than the systematic development of a network or a master-planning approach (SMEC-SA, 2014).

Nevertheless, CoJ officials have been determined to increase the numbers of utility cyclists and promote the mode. In 2013, transportation experts from COWI (a Danish consultancy) were given the task to 'come up with recommendations on how to *make* Joburgers pedal their way to work' (State of Green, 2013, emphasis added).

In 2012, the CoJ published terms of reference for a bicycle route between the universities of Johannesburg (UJ) and the Witwatersrand (Wits) (CoJ, 2012). Stakeholder engagement with university facilities' management, protection

Despite potentially achieving multiple social, mobility and poverty alleviation gains, bicycle transport is not popular in the city

services, transport providers and advocacy groups revealed that cycling was a marginal mode. At the UJ Kingsway campus, stakeholders reported that only two students cycled to the venue. The impetus for the university bicycle route project seemed to be motivated not by a broad-based student demand but rather for administrative financial and safety reasons; the universities wished to reduce the cost of providing bus-based student transport between campuses, and to limit security risk to students using relatively isolated public parks as short-cuts to campus.

The infrastructure and route drew ridicule from the media and curiosity from the research community. In one example, a journalist proposed that 'people on bicycles in the city itself are as rare as men in 12-inch heels' (Smith, 2015). A 2017 study by UJ researchers was 'driven by the empty cycling lanes that have been around for almost two years since their completion and have mostly been under-utilised' (Thaba and Jacobs, 2017, p. 2) – the researchers also wished to investigate why there had been 'less than expected' participation by the public.

Since 2014, additional walking and cycling facilities have been built across the city, for example linking passengers to Bus Rapid Transit stations in lower-income areas (Enoch, 2018), while more cycling facilities were planned. Designs were prepared for a cycling lane from the low-income suburb of Alexandra to the high-income, high-status suburbs around Sandton. Sandton was the hub of the 2015 EcoMobility World Festival, during which personal vehicle access to Sandton's central business district was restricted. Johannesburg's car users were encouraged to try alternative transport, where '[w]orkers, residents and visitors to Sandton *will leave their private cars at home* and make use of a wide range of alternative transport options to gain access to the precinct' (Brophy, 2015, emphasis added). Although attaining global media coverage, the Festival's attempt to 'change perceptions that walking was only for the poor' (Dixon, 2015) was not unanimously lauded as successful – 'The festival [was] supposed to encourage people to cycle or walk, despite the heat, but the lanes dedicated for cyclists and pedestrians for the most part are empty' (Dixon, 2015).

To improve access to bicycles, the CoJ distributes bicycles to disadvantaged school learners every year through the non-governmental organisation Qhubeka. In 2016/17, in partnership with UJ, 274 bikes were distributed in low-income areas, such as Orlando, Alexandra and Noordgesig. Substantial numbers of bicycles were distributed in 2018.

7.5 Justifying a bicycle programme in an unequal city

> When every road in Johannesburg is tarred, maybe then we will look at bicycle lanes again. (CoJ Executive Mayor Herman Mashaba, quoted in Tandwa, 2016)

Inserted into this highly motorised environment, with little commuter support for bicycle travel, bicycle mobility became a visible issue in South Africa's 2016 local government election.

The CoJ's then opposition party, the Democratic Alliance (DA), and its coalition partner the Economic Freedom Fighters (EFF), told voters that a vote for them would ensure the end of the bicycle programmes (discussed above) which had been introduced by incumbent African National Congress (ANC) executive mayor of the CoJ, Parks Tau. The DA/EFF coalition framed cycling as an elitist activity, and committed to directing funds earmarked for bicycle lanes to the needs of the city's marginalised groups instead.

For its detractors,[4] bicycle mobility is yet another choice for the wealthy, delivered at the expense of the more pressing needs of the majority. Tarred roads, piped water, flushing toilets, electricity and housing – for the poor – were said to have

4 Which include the ANC in response to DA-led bicycle lane development in Cape Town (see Jennings, 2016b).

been sacrificed for bike lane budgets. In reaction, the EFF announced:

> We are taking the bicycle lanes; we are going to give the people of Alexandra water, the money is there [...] I want the white people of Sandton to fight and say 'this government is taking away from us' [...] Why [in fact,] should we build cycling lanes? For what? (Julius Malema, quoted in Isa, 2016)

The cycling advocacy response – that 'the vast majority of Joburg bike riders are poor' (du Preez et al., 2016) and that 'black people need cycle lanes too' (Mathekga, 2016) – was swift, but warrants interrogation. Social justice is about more than poverty alleviation. For activists, the benefits of bicycle mobility are self-evident and, within its pro-poor framing, a bicycle is surely an obvious solution for those who cannot afford public or private transport: 'Most of the time I cycle to work in the morning, the majority of fellow cyclists I come across are black folks trying to get to work [...] they cycle to work as a way to save money that would otherwise be spent on transport' (Mathekga, 2016).

Succeeding in his election bid, the new executive mayor, DA-backed Herman Mashaba, cancelled the infrastructure build programme in his victorious inaugural speech. Defending his actions as pro-poor, Mashaba 'was concerned to note that R70m has been set aside over the next three years for the development of bicycle lanes around our city. I intend putting a halt to this project' (quoted in Tandwa, 2016), preferring to direct resources to the immediate needs of road maintenance and road sealing. The DA/EFF coalition noted that even if some utility cyclists were indeed poor, the infrastructure only benefited a few individuals, and had to be cancelled to implement projects to benefit many more people instead (Mqadi, 2016).

Julius Malema (EFF leader) had earlier argued that bicycle lanes were a symbol of privilege, being rolled out at the expense of other basic needs, and infringing on primary rights. When launching his party's election manifesto in April 2016 in Gauteng, he had promised that, should his party (or coalition) win, 'We won't build bicycle lanes when people live in shacks' (quoted in TMG Digital, 2016).

The party-political rhetoric encapsulates a number of justice debates, and it is easy to see the many sides of the story. But the opportunity for polarising rhetoric was enabled by ad hoc decision-making, confounding and generic messaging, and a bicycle programme that, as it stands, substantively advances neither sustainability nor social justice.

7.6 Interrogating justice and sustainability in Johannesburg's bicycle programme

South Africa's NMT policy looks beyond cost, seeing cycling as able to reduce inaccessibility and inequity, and meet the mobility needs and improve the quality of life of marginalised peoples (NDoT, 2008). Both transport and social justice facilitate social cohesion, involve public engagement, and produce a fair distribution of burdens and benefits (Golub et al., 2016; Martens et al., 2016; Chipkin and Meny-Gibert, 2013). If we are to defend bicycle infrastructure and programmatic spending in an environment of multiple deprivation and need, it makes sense to consider more critically whether bicycle mobility is both sustainable and just, and how to ensure both legitimate and desirable outcomes.

This section asks who the intended beneficiaries of Johannesburg's bicycle programme were, how bicycle planners envision justice or rights, and for what specific transport disadvantage bicycle mobility was deemed an appropriate intervention. This section problematises the simplistic low-carbon, low-cost framing of bicycle mobility in Johannesburg and suggests that such framing contributed to the failure of the programme in furthering just sustainability.

Cycling as just and sustainable in Johannesburg

In developing bicycle programmes, CoJ officials took advantage of international interest and funding support, as well as the mayor at the time's interest in cycling: 'as officials on the ground, we do whatever we want to do to make [today's priorities] happen [...] When you are a practitioner in a political environment, you must strike while the iron is hot.

If there is support, you must do it, as politics change' (CoJ interview, 29 November 2017).

In the view of a CoJ planner, cycling is a basic right and without question environmentally sustainable: 'It is a right that we need a sustainable transport system. It is a must that our government give us a sustainable transport system' (CoJ interview, 29 November 2017).

Yet, while it is not impossible to argue that utility cycling constitutes the 'passenger transport' to which we have a right, with its low mode shares, gender barriers (CoJ, 2009; Mahapa, 2003) and a widespread desire for improved public transport, this argument may fall foul of the utilitarian framing which detractors invoke: that only a few people choose, or wish, to cycle. Cycling itself is not a stated right, although it may offer an opportunity to better exercise 'freedom of movement'. High-quality segregated bicycle lanes could be argued to improve users' 'right to life'; and cycling's promotion may be an example of distributive justice (as a reallocation of road space) and a way in which to deliver on South Africa's environmental rights, should a substantial shift from high-carbon to bicycle mobility take place.

However, while the bicycle programme began with a sound policy direction, achieving social justice also requires a clear understanding of the 'goods' that will accrue to beneficiaries. In a bid to promote cycling in lower-income areas by weakening its often-cited association with poverty, cycling has been framed as environmentally sustainable. In the example of the Orlando West bicycle route, the primary modes of transport in Soweto are walking and minibus taxis, and the few who do cycle report public transport savings as their reason for cycling. The Orlando bicycle lanes were developed as a poverty-alleviation strategy and school learner programme to improve school attendance. Yet in launching the bicycle facility in 2014, Mayor Parks Tau was photographed on an electric bicycle, beyond the budget of the majority, 'endorsing eco-mobility'. He spoke of making Johannesburg cycle-friendly, giving residents *an alternative to private cars*, reducing greenhouse gas emissions, promoting renewable energy sources and facilitating broad climate change awareness (Magangane, 2014).

Of the same infrastructure, then Gauteng Member of the Executive Council for Roads and

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Transport Ismail Vadi spoke of the wellness benefits of cycling. The programme was reported as one to reduce traffic congestion and fuel costs, and to promote a healthy lifestyle. The press covered these bicycle lanes as meaning 'residents of Soweto [will] find it easier *to leave their cars at home'* (Graaff, 2014, emphasis added).

There are a number of challenges with this approach to 'destigmatising' bicycle mobility. Attempts to signify bicycle mobility as aspirational (JDA, 2015) can muddy the waters, where narratives of congestion reduction, health, fitness, eco-mobility and climate consciousness identify it as priority for the privileged (Aldred, 2013). For a publicly funded programme to be socially just, to meet the conditions for distributive justice (the equitable allocation of public financing and other resources) (Martens et al., 2016), it must provide primarily for the 'captive', 'survival' or 'stranded' user (NDoT, 1999). Yet this category of transport users already travels relatively sustainably, through walking or using public transport. For them, while the cost of public transport is onerous, their emissions impact is limited, and their accessibility needs are great.

While the activist narrative employs the bicycle as a metaphor for freedom (Jennings, 2016b), the transport ministry instead frames 'having a car [as] freedom' (Ndebele, 2009). Cycling is something users do only when unable to afford anything else (NDoT, 2008); 'confined' to a bicycle when they would rather 'enjoy a car' (CoJ interview, 29 November 2017). City planning officials capture the conflicting discourse thus:

> The issue of bicycles is a class issue. I understand what people are saying. We grew up in poverty, and now suddenly we have jobs, and if I have to buy a car you say I must ride a bicycle. Why must I ride, when I've been sweating at university to live better … [For years] I've been seeing white people driving big cars – now when I'm at the door of getting that, you're taking me back to poverty. (CoJ interview, 29 November 2017)

Bicycles can, and do, alleviate individual poverty, and are embraced by those who choose to use them for this purpose. But social justice is about more than poverty alleviation; it is also about participating in deciding what best meets your needs.

The demand for cycling lanes in Johannesburg has not been clamorous. Cycling has historically not been part of the transportation rights or justice movement because 'equal access to first-class mobility [not second-class cycling] has always been the primary goal of transportation justice advocates' (Golub, 2016, p. 20). In Cape Town, low-income communities have historically demanded the provision of better-quality, safer and more affordable public transport services (the core of South Africa's transport transformation programme), and have viewed the provision of bicycle facilities as primarily elitist rather than pro-poor (Jennings, 2016b).

Although reluctant, there is acknowledgement among activists and researchers that Johannesburg does not have the 'cycling culture' (Morgan, 2017) to which Malema refers (see above). For such a culture to exist, it 'needs' to be promoted (JDA, 2015). The development of a bicycle culture requires – more than bicycle lanes – the development of positive symbolic meanings (including that of poverty alleviation), higher levels of bicycle ownership, and robust, legitimate actor networks and stakeholder support (Morgan, 2017). Even where cycle lanes have been built in Gauteng, less than half (46%) of respondents in the Gauteng City-Region Observatory's Quality of Life IV (2015/16) Survey expressed interest, within the catchment, in using them (GCRO, 2016).

Here, this chapter again draws from Martens et al.'s (2016) argument that bicycle mobility can only meet justice claims if the intended beneficiaries are, firstly, able to and wish to cycle, and secondly, if decisions regarding bicycle interventions involve inclusive participation and engagement. The CoJ itself, along with implementing agencies, has conceded that public engagement was insufficient:

> Somewhere in-between private cars and public transport lies bicycle mobility, this new form of transport we [CoJ] were trying to introduce. But I don't think we had enough time to go to communities and convince them. We took it

> for granted that [communities] would accept it. (CoJ interview, 29 November 2017)

Driven by a combination of policy and personal conviction, they pressed on with promoting a not-yet-popular mode of transport.

> *We should have gone out to our stakeholders and started the debates, the robust discussions, and seriously engaged [...] Heard the different views and the conflict [...] Not starting at a rush [...] But we want cycling as part of the mix.* (CoJ interview, 29 November 2017, emphasis added)

The need to initiate change and shift mindsets is a recurring motif within Johannesburg's policy and institutional discourse. Global imperatives and best practice – from cities with substantially different climate and equity concerns, enabling spatial forms and cycling cultures – have been influential in fast-tracking cycling onto the policy agenda. The numbers and the narrative suggest that, currently in Johannesburg, there is only a marginal desire to cycle among intended beneficiaries, although this may in part be because they are unable to do so. The drive to promote bicycle mobility, however well intentioned and climate conscious, can then appear coercive and prescriptive.

'Cycle lanes for what?' Meaningful bicycle-related accessibility

In order to redress transport disadvantage and inequity, it is access, not necessarily mobility, that must be distributed in a fair way. This access must be meaningful in enabling people to do what they really need to do (Martens et al., 2012). Just and sustainable bicycle mobility has to consider whether the combination of elements (e.g. infrastructure, intended beneficiaries) that comprise the intervention deliver both sustainable and justice outcomes.

In its NMT Framework, the CoJ identified cycling as a potentially 'meaningful mode of transport for workers and learners who live between 2.5 and 6 km from their places of work or learning, or further if integrated with public transport' (CoJ, 2009, p. 6). However, such integration has proven elusive: 'While more people are beginning to commute by bike [...] this is a sprawling city with hills, nobody is ever going to do it by bike unless they can take it on the bus or train' (Stones, 2013).

In high-density or compact multi-modal cities, with a good mix of neighbourhood destinations and opportunities for local enterprise, and short distances between home and work, bicycles are faster than walking (or motorised transport modes) and offer cheaper access than short public transport trips. This is the urban environment that has enabled the high rates of people who walk and cycle in the exemplar European 'bicycling cities' such as those in the Netherlands. Yet in a presentation at Gauteng's Cycling Indaba in October 2014, officials noted that Johannesburg is a 'very low-density city' and that 'most work to home trips are longer than can comfortably be cycled'. Even children often do not attend school in their neighbourhoods, as parents search for better schooling for them – thus cycling to school is not a usual practice (CoJ, 2014).

The bicycle infrastructure network as built (and planned) in Johannesburg has not had sufficient coverage to improve meaningful local or neighbourhood access. This shortcoming had been identified early on by project consultants, and the CoJ determined to use the hiatus in infrastructure implementation to prepare a full guideline document for project implementation (CoJ interview, 29 November 2017). Whether bicycle transport can ever

Johannesburg is a 'very low-density city' and 'most work to home trips are longer than can comfortably be cycled'

have a substantial impact on mobility in a sprawling city is a difficult question to answer. Research that moves beyond the potential of cycling to examine the actual outcomes of bicycle transport as a low-cost, sustainable accessibility intervention is limited, as is the literature that quantifies its role in long-distance mobility (Jennings, 2016b). The CoJ itself has conceded that 'a modal shift change from private to public transport is the only answer for the future city of Johannesburg' (CoJ, 2011a, p. 70).

7.7 Conclusion

The discourse in South Africa around bicycle mobility's potential – low carbon and low cost – has fuelled a polarising, confusing narrative, and surfaced a highly visible public debate around the trade-offs between sustainability and transport justice.

Since at least 1996, public passenger transport in South Africa has been recognised as a basic need – implicitly as much a right as housing and water. Globally, the sustainability and justice transportation imperative has shifted to include that of bicycle mobility, albeit in substantively different urban, emissions and equity contexts. Cycling has formed a significant part of the developed world's urban, air quality and climate response (Peet et al., 2016), and South African national and local transport and urban policy has largely taken this on board.

Yet in South Africa, in a bid to mitigate its image as a low-cost mode for the poor, utility cycling has been positioned as an aspirational mode – a mode of transport used in 'world-class' cities. Framed as extending basic, affordable mobility, increasing access, and alleviating poverty and inequity, and as being 'green', 'healthy' and car-competitive, the public discourse around cycling's impact and benefits is a conflictual one, and one that conflates discrete users. The political landscape in South Africa thus wavers between support, ambivalence and overt hostility to utility cycling. Even when intended for the poor, it has been rejected as a fanciful waste of public resources at the expense of other, more important services. Among users, however, cycling is primarily described as a cost and travel-time saver.

This chapter argues that while bicycles are an environmentally sustainable means of travel when replacing high-carbon, low-volume modes, bicycle programmes that intend to replace walking or public transport are less able to make these claims. The personal, flexible, low-cost, equitable characteristics of bicycle mobility make it a contender when considering just and sustainable transport interventions, redressing transport disadvantage and reducing the harmful burden of high-carbon modes. However, the degree to which bicycling can, and does, advance such just sustainability is not clear in a city with overwhelming public transport challenges, an unequal spatial form that results in long travel distances, and targeted beneficiaries who are not necessarily inclined toward cycling. Meaningful accessibility benefits have not been achieved through the programme to date. When distances are long, and only a minority are likely to ride, arguments are better made on reducing the cost of mobility than on promoting social inclusion, redressing spatial inequity, extending access and promoting sustainability.

The impetus for much cycling advocacy in South Africa has primarily come not from intended beneficiaries but from international consultancy, policy transfer and global 'best practice'. Stakeholder engagement in the Johannesburg bicycle programme was not as extensive or inclusive as it could have been. Formal forum structures comprised a relatively privileged and influential lobby for this minority mode, and the built facilities were of lower standards than these stakeholders requested (Suleman, 2013). As a result, the legitimacy of a just transition to bicycle mobility as an environmentally sustainable mode of transport has been called into question.

In South Africa's highly unequal cities, the value of bicycle mobility is not broadly shared (Martens et al., 2016). Bicycles straddle a peculiar position, serving as symbols of both privilege and poverty, of freedom and of continued oppression, of inequitable resource distribution and disenfranchisement (Irlam and Zuidgeest, 2018). Strategic bicycle promotion is directed at shifting this – 'changing mindsets' and developing a bicycle culture, attempting to increase the 'propensity to

cycle'. But lifestyle, fitness or well-being narratives have marginal resonance when utility cycling is an outcome of poverty, a consequence of high fares and low wages, a 'choice' made over inadequate, unaffordable and unreliable public transport. The arguments for cycling as an environmentally sustainable mode are undermined by the already low-carbon modes used by the intended beneficiaries. For cycling to enhance environmental sustainability in Johannesburg, interventions would need to be directed at the wealthy.

This chapter has highlighted that bicycle programmes are neither inherently just nor unjust, nor do they necessarily advance the sustainability agenda. Although bicycle mobility has the potential to deliver on both intended outcomes, these outcomes do not follow automatically from a vision or stated goals – or a passionate belief in the benefits of cycling. Despite the theoretical alignment between social justice and environmental sustainability in bicycle mobility, this case study has revealed disjunctions between distributive, procedural and spatial justice, and environmental sustainability. In addition, this case has surfaced questions about justice for whom and in what form, and environmental sustainability at what scale – and has shown that achieving just sustainability through cycling is neither a given nor straightforward.

This chapter has opened up the tacit social justice and environmental sustainability ideologies of bicycle policies to closer scrutiny, which might enable planners and politicians to better negotiate the multiple justice agendas and mobility needs.

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Photograph by Nonzuzo Gxekwa

Photograph by Clive Hassall

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CHAPTER 1

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