Deconstructing the boundary between environmental sustainability and social justice:

Decision-making and obscured rationalities in government-led housing in Johannesburg

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1. **Culwick, C.**, & Patel, Z. (2020). Building just and sustainable cities through government housing developments. *Environment and Urbanization*, 32(1), 133–154. https://doi.org/10.1177/0956247820902661

2. **Culwick Fatti C.** (2022). Towards just sustainability through government-led housing: Conceptual and practical considerations. *Current Opinion in Environmental Sustainability*. 54. 101150. https://doi.org/10.1016/j.cosust.2022.101150

3. **Culwick Fatti C.** & Patel, Z. (2023). In pursuit of just sustainability: Decision-making and conflicting rationalities in government-led housing projects. *Local Environment: International Journal of Justice and Sustainability*. 28(3). 277-303. https://doi.org/10.1080/13549839.2022.2136636

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Abstract

The idea of 'just sustainability', which is based on the aspiration of aligning social justice and environmental sustainability imperatives, has become a focus among scholars and practitioners in addressing contemporary social and environmental crises. Despite claims that environmental sustainability and social justice can coexist, reconciling these goals proves challenging in theory and practice. The disjuncture between policy commitments and the practical achievement of just sustainability is rooted in the need for deeper engagement with how the boundary space between social justice and environmental sustainability is theorised. There's a growing acknowledgement among scholars of the need for a nuanced understanding of this boundary space for identifying trade-offs and understanding how conflicting rationalities impact decision-making within cities. Given that urbanisation, poverty, and climate change impacts are concentrated in cities in the global South, the challenge of building socially just and environmentally sustainable cities predominantly lies with Southern cities.

As a coalescing point for infrastructure and urban development, government-led housing has been linked explicitly to building just and sustainable cities. South Africa's government housing programme is responsive to both environmental sustainability and social justice concerns through improving access to shelter and basic services, and facilitating access to amenities and opportunities. However, there is little consensus among scholars or practitioners regarding how government in South Africa should balance the immediate need for housing while addressing unsustainable and unjust urban forms, resource constraints and high levels of inequality.

This project uses government-led housing in Johannesburg, South Africa, to examine the boundary space between social justice and environmental sustainability, and how knowledge and decision-making interact with this space. The study first examines the practical outcomes of government-led housing. Second, it considers the policy and decision-making processes involved in developing government-led housing projects, and third, it interrogates the theoretical challenge of bringing social justice and environmental sustainability together in Southern cities. This multidisciplinary study, which uses two case studies, Lufhereng and Pennyville housing projects, employs various analytical and data collection methods, incorporating qualitative and quantitative approaches, to undertake a dynamic assessment of government-led housing outcomes and decision-making processes. This research innovatively combines photo essays with traditional research methods, creating a unique synergy between objective and subjective perspectives on government-led housing projects.

By underscoring the intricate interplay between justice and sustainability in government-led housing projects, instances are revealed where outcomes are aligned in some instances and conflictual in others. The research argues that linear, reductionist relationships between social justice and environmental sustainability are unhelpful in building nuanced understandings of the interaction between these imperatives. Furthermore, Watson's (2003) concept of conflicting rationalities, which represents irreconcilable perspectives, is extended and applied in new ways. The idea of 'obscured rationalities' is developed to denote subtle conflicts within decision-making processes, and how these can influence outcomes, rather than obvious conflicts, such as those between social justice and environmental sustainability. The argument is made that developing nuanced understandings of the interplay between social justice and environmental sustainability is crucial for theory development, policymaking, and practical outcomes. Highlighting uneven knowledge approaches and addressing this through expanding theorisation from the global South is necessary for realigning the structural elements leading to inequality and unsustainability.

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Imogen, my PhD is now done. Let's go do those swimming lessons.

Dedication

To my parents, who instilled in me a love for the nature, taught me about justice and gave me the courage to pursue my goals. And to my daughters, who have taught me how to slow down and focus on what really matters.

Preface

This dissertation includes a substantial amount of content that has been published in peer-reviewed publications. The following provides a description of how the different chapters have been compiled and where content has been published elsewhere.

Chapter 1 This chapter contains content that was included in 'Chapter 1: In pursuit of just sustainability', in the publication entitled '*In pursuit of just sustainability*', which is a peer-reviewed publication that was published by the Gauteng City-Region Observatory (GCRO) in November 2021. I was the sole author of this chapter. The publication is accessible at the following link: https://www.gcro.ac.za/outputs/research-reports/detail/pursuit-just-sustainability/

I acknowledge the assistance of ChatGPT in editing this chapter, using the prompt "Edit for clarity and reduce repetition."

Chapter 2 This chapter contains content from two chapters of '*In pursuit of just sustainability*' (GCRO publication mentioned above) including 'Chapter 2: Just sustainability in cities', and 'Chapter 5: Deconstructing sustainability and justice in government housing developments'. I was the sole author of both of these chapters. It draws together the literature reviews presented in Chapters 5-7.

Chapter 3 This chapter contains content from 'Chapter 1: 'of '*In pursuit of just sustainability*' (GCRO publication mentioned above). It draws together and expands on the methods presented in Chapters 4-6. The case studies presented in this chapter includes primarily unpublished content, with a map that was published in Culwick Fatti and Patel (2023).

Photo essay 1 This photo essay contains original photographs taken during fieldwork. Neither the photographs nor the designed photo essay has been published elsewhere.

Chapter 4 This chapter was published in its entirety in the following journal article:
Culwick, C., & Patel, Z. (2020). Building just and sustainable cities through government housing developments. *Environment and Urbanization*, 32(1), 133–154. https://doi.org/10.1177/0956247820902661

Photo essay 2 This photo essay contains original photographs that I took during fieldwork. Neither the photographs nor the designed photo essay has been published elsewhere.

Chapter 5 This chapter was published in its entirety in the following journal article: Culwick Fatti, C. and Patel, Z. (2023). In pursuit of just sustainability: Decision-making and conflicting rationalities in government-led housing projects. *Local Environment: International Journal of Justice and Sustainability.* 28(3). 277-303. https://doi.org/10.1080/13549839.2022.2136636

Chapter 6 This chapter has included content from two chapters of '*In pursuit of just sustainability'* (GCRO publication mentioned above) including 'Chapter 2: Just sustainability in cities', and 'Chapter 5: Deconstructing sustainability and justice in government housing developments'. I was the sole author of both of these chapters. I acknowledge the assistance of ChatGPT in editing this chapter, using the prompt "Edit for clarity and reduce repetition."

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Chapter 8 This chapter concludes the thesis and contains primarily content that has not been published elsewhere.

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List of Abbreviations

BNG	Breaking New Ground
BRT	bus rapid transit
CBD	central business district
CoJ	City of Johannesburg
DPME	Department of Planning, Monitoring and Evaluation
EIA	Environmental Impact assessments
EJ	environmental justice
FFC	Financial and Fiscal Commission
GCRO	Gauteng City-Region Observatory
GTI	GeoTerraImage
IRP	International Resource Panel
MEC	Member of the Executive Council
MIG	Municipal Infrastructure Grant
NGO	non-governmental organisation
PDG	Palmer Development Group
PRASA	Passenger Railway Agency of South Africa
PZR	Pennyville Zamimpilo Relocation Pty (Ltd)
QoL	Quality of Life
RDP	Reconstruction and Development Programme
SD	sustainable development
StatsSA	Statistics South Africa
UN	United Nations
UNFPA	United Nations Population Fund
UN-Habitat	United Nations Human Settlement Programme

1 Introduction

The concept of just sustainability has gained prominence in global policy and literature, embodying the aspirational objective of bringing environmental sustainability and social justice into alignment. These commitments are based on the assumption that social justice and environmental sustainability can be aligned and are potentially mutually attainable. Many scholars go so far as to argue that social justice is a precondition of environmental sustainability (Agyeman, Bullard & Evans, 2002; McDonald, 2002; Agyeman, 2005; Swilling & Annecke, 2012; Heynen, 2013). Despite claims by scholars and practitioners that aligning these two imperatives is possible, this has proved challenging in reality (Agyeman, Bullard & Evans, 2003; Visser, 2004; Patel, 2006a; Vogel et al., 2016a; Swilling, 2019), with numerous examples where progress toward one of these imperatives undermines the other (Marcuse, 1998; Patel, 2006a; Bennett et al., 2019; Culwick & Patel, 2020). The difficulty in achieving just sustainability suggests a complex terrain where trade-offs between social justice and environmental sustainability[1] must be navigated (Culwick, 2015; Ciplet & Harrison, 2020; Newell, Geels & Sovacool, 2022).

Environmental crises and the social ramifications of urbanisation are two key features of our age (Parnell, 2018; Elmqvist et al., 2021), and it is increasingly evident that human impacts have significantly affect the Earth system, with dire consequences for society (Steffen et al., 2015; Allen et al., 2018; IPCC, 2021). Scholars argue that given the interconnectedness of social and environmental imperatives, efforts to mitigate climate change and build more environmentally sustainable cities will only be successful if these efforts are aligned with efforts to reduce poverty and inequality (Davis, 2010; Westman & Castán Broto, 2021). This pressure is especially pronounced for rapidly growing cities, primarily concentrated in the global South (Croese, 2021). These cities grapple not only with unprecedented growth rates but also contend with the inadequacy of prevailing urban development approaches, originating in the global North, in responding to the dynamics of urban development in the global South (Khosla & Bhardwaj, 2019).

Addressing poverty, inequality, and environmental crises is urgent, yet no city worldwide has adequately responded to this challenge. This inability is not indicative of a lack of commitment but underscores the need for deeper engagement with complexity and difficult trade-offs, and how

[1] Throughout the text, social justice and environmental sustainability are also referred to as justice and sustainability respectively.

these are navigated in decision-making processes (Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020; Culwick & Patel, 2020; Lu et al., 2021; Newell, Geels & Sovacool, 2022; Rockström et al., 2021). Furthermore, the disjuncture between policy commitments and the practical achievement of just sustainability is rooted in the need for deeper engagement with the theorisation of the boundary space between social justice and environmental sustainability. Refining this theorisation will not only provide a better understanding of the disjuncture but it will also provide new conceptual insights and tools to shape decision-making.

This thesis draws on the idea of a 'boundary object' (Star, 2010) to help understand the space between social justice and environmental sustainability. Boundary objects occupy "shared space, where exactly that sense of here and there are confounded" (Star, 2010: 603). Boundary objects allow complex understandings of the issue at hand without the requirement for agreement across the different sides of the boundary (Carlile, 2004). This thesis adapts this concept, and uses the idea of a 'boundary *space'* as a conceptual tool to build a better understanding of the areas of commonality between social justice and environmental sustainability. Rather than focusing on the overlapping boundaries of these separate concepts, the boundary space examines the connections between them, emphasising relationships rather than differences or similarities of the respective approaches or interpretations (Star, 2010). This research uses just sustainability as a boundary object to interrogate the space between social justice and environmental sustainability without assuming complete alignment or conflict between the two.

Social justice and environmental sustainability research have different origins and methodologies, which compounds the challenge of defining and assessing just sustainability. This research responds to the need to build a deeper understanding of just sustainability, given the current diverse set of interpretations that are based on different definitions and theoretical foundations Furthermore, the dominant discourse regarding just sustainability emanates from the global North (Hughes & Hoffmann, 2020), which has proved inadequate in responding to environmental and social challenges in the global South. Given that Southern cities face a disproportionate burden of the contemporary environmental and social crises, there is a need for research from the global South to deepen theorisation of what a just sustainable city encompasses. A better understanding of the social justice and environmental sustainability dynamics in Southern cities is important for empowering decision-makers to respond appropriately to build just sustainable cities.

One of the ways in which governments intervene in cities is through housing provision. Government-led housing[2] is designed to provide adequate shelter and access to basic services for people who otherwise could not afford to pay for them. While such endeavours play a crucial role in advancing social justice, it is essential to recognise that housing initiatives also carry potential adverse effects on environmental sustainability. There is a lack of clarity around how governments should balance the provision of housing and basic services with the costs and potential negative consequences of these developments. This challenge is considered through examining government-led housing projects in Johannesburg, South Africa. The city grapples with balancing the urgent need for housing with growing concerns over resource constraints and the imperative to transform its unsustainable and unjust spatial structure. This complex challenge of balancing multiple and sometimes conflicting considerations is evident within government-led housing in the city.

Two government-led housing projects in Johannesburg, are examined to understand the boundary space between social justice and environmental sustainability and how knowledge and decision-making interact within this space. This research is built on the premise that the differences between how social justice and environmental sustainability are investigated and understood influence both the theory and practical outcomes. Furthermore, given that decision-making shape social justice and environmental sustainability, and that there is poor understanding of how trade-offs are navigated between these imperatives, this research engages deliberately with where conflicts exist between social justice and environmental sustainability and how they are navigated within decision-making. A multidisciplinary approach is adopted, recognising that diverse knowledge bases and methods underpin the respective understandings of social justice and environmental sustainability.

This chapter lays out the rationale, context, and significance of the study, delineates the emphasis on government-led housing, and articulates the aims, objectives, and research questions. Additionally, it provides an overview of the thesis structure and the integration of the three standalone journal articles.

[2] Throughout this thesis the term 'government-led housing' is used to refer to housing that has been provided by the state for low-income people. Elsewhere this type of housing is also referred to as public housing, state-led housing, subsidised housing, government-subsidised housing. This is different from social housing, which refers to government rental housing.

1.1 Rationale

Social justice and environmental sustainability, recognised as global imperatives enshrined in South Africa's constitution, form the basis of commitment in vision and planning documents at various government levels. Implicitly assumed in many visions is the idea that social justice and environmental sustainability are mutually achievable, a concept echoed by scholars who argue that the success of one goal depends on the attainment of the other (Agyeman, 2005; Swilling & Annecke, 2012; Westman & Castán Broto, 2021). The notion of sustainable development gained prominence in the 1980s, notably with the Brundtland Commission Report (1987) which linked environmental, social, and economic sectors. However, concerns arose that this framework inadequately addresses social justice issues related to environmental sustainability (Walker & Bulkeley, 2006). In response, the field of environmental justice emerged, focusing on instances where environmental ills perpetuate poverty and inequality (Agyeman, 2005).

More recently, the concept of just sustainability has broadened the focus to not only on where environmental degradation intersects with social issues but also on examining how actions to promote environmental sustainability might undermine social justice and vice versa (Agyeman & Evans, 2004; Swilling, 2019; Ciplet & Harrison, 2020; Mete & Xue, 2021). This research confronts the inherent contradiction within the theory and urban policy commitments to just sustainability that consistently remain unrealised in practice. Just sustainability, by definition, involves complex interactions among various factors across environmental and social systems, making implementation challenging, not necessarily due to a lack of effort, but because of the need to consider complex interactions and trade-offs. This research leverages the concept of conflicting rationalities (Watson, 2003), which was coined to describe situations where conflicts arise between government and communities that cannot be resolved through consensus-building processes. Conflicting rationalities arise when different worldviews or perspectives, which might be equally valid, stand in opposition to each other. In such cases, attempts to reconcile different perspectives might fail, not due to incompetence, but real difficulties in finding a middle ground. Conflicting rationalities may emerge between social justice and environmental sustainability imperatives that limits the development of solutions that can reconcile both imperatives (Patel, 2014). These situations are particularly difficult to navigate where it is not be rational to prioritise one perspective over another.

Decision-making processes in the face of trade-offs are explored through this thesis, acknowledging that conflicting rationalities and trade-offs exist between social justice and environmental sustainability. Conflicting rationalities influence decision-making and translate

into a difficulty in bringing these two imperatives together through policies and government plans. Emphasis is placed on the importance of understanding whose interests and agendas take precedence in decision-making and how these influence the boundary between social justice and environmental sustainability. In addition to potential conflicting rationalities, the inability to achieve social justice and environmental sustainability simultaneously has been partially attributed to an inadequate understanding of the complex interplay between social, economic and environmental factors.

In essence, the challenge of bringing social justice together is present in practical, theoretical and policy realms. These difficulties stem, in part, from data limitations and disciplinary constraints (Leach et al., 2018; Gupta et al., 2020), and thus highlight the importance of interdisciplinary research methods and broadening research approaches to build deeper and more complex understandings of the practical, policy and theoretical challenges (Kennedy & Hoornweg, 2012; UN-Habitat, 2016; Vogel et al., 2016a; Culwick et al., 2017, 2019). Culwick and Patel (2017) suggest that reframing challenges along non-traditional or disciplinary lines creates opportunities to establish new connections across diverse types of knowledge and approaches. In line with this perspective, a multidisciplinary methodology is adopted, incorporating a range of data and methods that are traditionally distinct.

The challenge of reconciling social justice and environmental sustainability extends beyond conceptual, policy and practical aspects to encompass methodological considerations. Research into the respective fields of environmental sustainability and social justice have traditionally drawn on different data and methodological approaches. Environmental sustainability research predominantly employs scientific data and model-based methods, aiming to rationalise complex systems into measurable, comparable, and generalisable results. In contrast, social justice research typically adopts qualitative approaches that aim to reveal power dynamics, experiences, perceptions and social practices, seeking to unveil power dynamics, experiences, perceptions, and social practices within specific contexts or situated cases (Willig, 2013). The inherent methodological and scalar differences between these approaches pose challenges in assessing the interconnections between environmental sustainability and social justice.

Despite these difficulties, there is a growing recognition of the need to integrate multiple methodologies, data, and approaches to gain a nuanced understanding of the current socio-ecological crises. The concept of just sustainability is employed as a boundary object, not only to bring together the two distinct concepts – social justice and environmental sustainability - but also

to integrate their respective methodologies. To address the methodological misalignment between social justice and environmental sustainability, this study considers both measurable, quantitative outcomes and qualitative perspectives, including the rationalities influencing decision-making. By incorporating various data types and knowledge sources across different scales—from individual to regional—this research actively engages with the complexity inherent in the pursuit of just sustainability.

Building socially just and environmentally sustainable cities is a task that predominantly lies with cities in the global South, where issues such as urban population growth, poverty, and climate change impacts are concentrated. The paradox of global North-based solutions for issues specific to the global South is challenged here by examining the complex task of furthering just sustainability within Johannesburg, a Southern city facing problems similar to other cities in the global South. It advocates for a broadening of research approaches, emphasising the integration of contrasting data and methodologies to address the unique complexities of Southern cities. Recognising the importance of robust theory in addressing policy and practice conundrums, this study seeks to advance our understanding of the interaction of social justice and environmental sustainability in urban contexts in the global South.

1.2 Research relevance and necessity

Globally, there is a growing emphasis on addressing climate change and advancing environmental sustainability. South Africa has underscored the crucial need for this transition to environmental sustainability to be socially just (Presidential Climate Commission, 2022), and the country has been praised for initiating a targeted programme towards a just transition (Ismail, 2023). Given South Africa's historical commitment to addressing social injustices, it is well-positioned to lead global discussions on this front. However, much of the attention has been directed at transitioning the energy sector to reduce carbon emissions, with limited consideration for other sectors or the role of cities in achieving just sustainability (Ismail, 2023). The focus on the intersection of environmental sustainability and social justice within the housing sector in urban South Africa, is thus not only timely, but necessary for informing contemporary debates around just sustainability. This research contributes to a field that is rapidly evolving, both in academia and practice, and it is thus able to speak into contemporary debates and potentially influence thinking around reducing poverty and inequality, and fostering environmental sustainability within cities.

The rapid urban population growth in the global South has occurred without a concomitant economic growth, as observed during industrialisation in the global North. Consequently,

supporting housing provision through government initiatives has become a prevalent policy objective (Lemanski, Charlton & Meth, 2017). As a result, a substantial and expanding segment of urban dwellers resides in housing supported by government subsidies (Lemanski, Charlton & Meth, 2017). Government-led housing initiatives serve as a crucial mechanism for improving the living conditions of the economically disadvantaged (Caldeira, 2017; Mitlin & Bartlett, 2020; Mete & Xue, 2021). Attention to government-led housing in a global South context is relevant as many cities are grappling with how to meet the needs of their growing populations, in a way that is sensitive to environmental and social crises.

Numerous studies have investigated different components of government-led housing in South Africa, some reflecting on the inclusiveness of the process and allocation of houses to poor people (Rubin, 2014), and the lived experience of residents in government housing projects (Charlton & Meth, 2017), while others have focused on the comparative cost implications related to the location of housing developments (Biermann, 2005; Biermann & van Ryneveld, 2007), and the extent to which government-led housing is resilient to climate change (Okem et al., 2019). Despite the richness that these and other studies bring to understanding government-led housing in South Africa, the interaction between environmental sustainability and social justice within government-led housing is poorly understood and under-theorised (Adegun, 2018). This research thus contributes to addressing this gap by examining the boundary space between social justice and environmental sustainability in government-led housing.

This study focuses primarily on distributional justice, given that this form of social justice underscores a commitment to ensuring a fair and equitable allocation of resources, benefits, and burdens within society, and thus links clearly to environmental sustainability objectives. This focus on distributional justice is particularly pertinent in the South African context, where the environmental ills have been concentrated among already poor and marginalised communities, and in some cases deliberately so by the apartheid government. Nevertheless, the importance of other forms of social justice is acknowledged, including procedural justice, which emphasises fair decision-making processes, and justice of recognition, which centres on acknowledging diverse identities.

Further to assessing the practical outcomes of government-led housing on environmental sustainability and social justice, this study explores the decision-making processes and how power, politics, vested interests and different types of knowledge and data influence decisions. These different considerations are especially important where conflicts exist between different

imperatives and trade-offs are necessary. The decision-making processes, who has power, what knowledge influences decisions and how trade-offs are negotiated, are inadequately understood with respect to Gauteng's government-led housing developments. This study responds to this research gap by considering decision-making and what factors influenced plans and outcomes of the two government-led housing projects.

Global research into just sustainability is dominated by scholarship from the global North, as discussed above, limits the ability to inform how cities in the global South respond to current social and environmental crises. This research responds to the urgent need for case studies and theorisation from the global South that contribute to building new bodies of thought (Bhan, 2019) and 'geographies of imagination (Roy, 2009). Although this study has relevance for other contexts, it acknowledges that this single bounded study from one South African city cannot, nor tries to, be representative of or speak for cities more generally – Southern or other, Rather, this study uses empirical evidence to build the theoretical understanding of just sustainability in ways that engage with the role of Southern perspectives in 'de-centering' global urban theory (Caldeira, 2017), and through applying multiple and alternative methodologies (Parnell & Pieterse, 2016).

1.2.1 Government-led housing in South Africa

The South African government has actively worked to improve the living conditions for underprivileged groups through a comprehensive government-led housing programme. This initiative allows eligible citizens to benefit from either fully- or partially-subsidised houses or rental units (Myeni & Okem, 2019). South Africa's government housing programme aims to address both environmental sustainability and social justice. The 1997 National Housing Act outlines these imperatives, emphasising the importance of convenient access to jobs, healthcare, education, and other amenities. It encourages higher-density housing for efficient land use and economic investment while considering environmental impacts. These principles align with the post-apartheid government's objective of spatial restructuring to promote equality, especially in urban areas (Parnell & Crankshaw, 2013; Adebayo, 2021). These plans draw together environmental sustainability and social justice within housing developments through improving accessibility, reducing resource requirements and land transformation.

Despite government commitments to environmental sustainability and social justice through housing provision, post-apartheid government-led housing has been criticised for exacerbating inequality and exclusion, and entrenching inefficient land-use patterns by locating houses far from opportunities (Myeni & Okem, 2019). Despite policy commitments, the prevailing low-density

housing developments have worsened urban sprawl and trapped cities in a trajectory characterised by high resource consumption due to long infrastructure networks and far distances between residential and economic areas. It has been argued that the low-density housing developments, which despite the policy commitments, remain the dominant form of housing, have exacerbated urban sprawl and locked cities into a high resource consumption trajectory (Financial and Fiscal Commission (FFC), 2011; Mubiwa & Annegarn, 2013). Although critiques and assessments of government-led housing have considered both social and environmental outcomes, this has seldom been done in tandem. This research helps to address this oversight by examining together the environmental sustainability and social justice elements of government-led housing projects, as per the Housing Act (Republic of South Africa (RSA), 1997).

1.2.2 Johannesburg in context

The City of Johannesburg (CoJ) has embraced spatial development frameworks aimed at advancing environmental sustainability through urban efficiency, accessibility, and the strategic integration of housing developments across diverse population and income groups, as well as land uses (Todes, 2012). The CoJ has envisioned government-led housing as an important means of building inclusivity, through providing basic services and enabling access to economic opportunities (Charlton, 2010). The City's 2008 Growth and Development Strategy 2040 explicitly outlines objectives to eradicate poverty, construct liveable communities, ensure resource security, promote environmental sustainability, achieve social inclusion, and identifies city-led housing developments as pivotal in attaining these goals (City of Johannesburg, 2011).

In Johannesburg, the limits of natural resources and the negative impacts of urban development have become increasingly urgent. The City has experienced water shortages due to drought and infrastructure failure, electricity 'load shedding' (scheduled electricity cuts) has become commonplace when national electricity demand outstrips supply, wastewater treatment plants are over-capacitated with raw sewage flowing into natural watercourses, and air pollution often exceeds global health standards. The CoJ faces the challenge of balancing the immediate need for housing and basic services, with the need to respond to these environmental challenges while addressing unsustainable and unjust spatial form and high inequality. This research brings these various considerations into conversation, examining how the multiplicity of issues interact in the context of government-led housing in the City, and how these are engaged with in decision-making.

There have been tense debates at government forums and in scholarly literature around how the government in Johannesburg and Gauteng (the broader province in which Johannesburg is

located) should address the substantial housing need (Ballard et al., 2017) and balance environmental and social outcomes. At times this debate has been polarised with proponents of infill development conflicting with proponents of urban expansion (Ballard et al., 2017). The majority of provincial government's recent and proposed housing projects in Gauteng are mostly urban expansion projects, and which have been critiqued for leading to long commutes and trips in search of jobs, and exacerbating unsustainable urban form. CoJ, in contrast, has explicitly aligned its spatial plans towards supporting strategic infill development, arguing that this approach has greater potential to support socially just and environmentally sustainable urban development. However, infill developments have been critiqued for their inability to address the scale and urgency of the housing demand (Angel et al., 2011; Charlton, 2014). This research juxtaposes two government-led housing projects in Johannesburg: one infill development and the other an urban expansion project. This approach facilitates the examination of the diverse logics and arguments that underpin each of these approaches, specifically assessing their implications for social justice and environmental sustainability.

Despite the City's commitments to densification, government housing projects in Johannesburg continue to be planned on the urban edge. This contradiction suggests a possible disconnect between plans, evidence and their application. It also suggests that knowledge and visions are not the only influencing factors in decision-making processes. Myeni and Okem (2019) propose that competing demands and conflicting rationalities play a role undermining South Africa's government-led housing programme's ability to achieve its objectives. In response to this proposition, this research considers not only the plans and outcomes of two government-led housing developments, but also the decision-making processes and what knowledge influences the planning and implementation of government-led housing in Johannesburg.

Decision-making in Gauteng occurs in the context of a limited understanding of the comparative costs and benefits, and trade-offs between social justice and environmental sustainability objectives. Culwick et al. (2017) flag that the lack of necessary data required for comprehensive analyses of resource flows hindered the assessment of how the costs and benefits of resources are distributed across Gauteng. This limitation, in turn, hampers the ability to evaluate environmental sustainability objectives and the equity of resource consumption. Although there is significant emphasis on ensuring government-led housing developments are well-located, Studies have raised concerns about how terms such as 'well located' and 'inclusive' have been defined and used to assess the social justice implications of housing developments (e.g. Charlton, 2014; Cross, 2014). This research draws on a range of data sources – both quantitative and qualitative, and primary and

secondary – to enable an assessment of a range of environmental and social outcomes of government-led housing in Gauteng, which has not been done systematically before. Furthermore, the analysis engages deliberately with different definitions of 'well-located' and considers the impact that these have on assessed environmental sustainability and social justice outcomes.

Two contrasting government-led housing projects in Johannesburg as case studies, namely Lufhereng and Pennyville, have been selected to represent the two extremes of the recent debates, which have centred on whether urban expansion or infill development is most appropriate for new government-led housing projects. Pennyville is, located close to the Johannesburg central business district (CBD), and Lufhereng, on Johannesburg's urban boundary. These cases have been deliberately chosen because they are very different from each other in terms of size, location and urban design. These differences mean that they can be compared and contrasted against each other, and enable the development of rich, multi-perspectives insights. The use of two cases provides a balance between the benefit of multiple case studies against the value of drawing on a range of data and methods in each respective case.

1.3 Research Design

The aim of developing a better understanding of the complex interplay between social justice and environmental sustainability, using government-led housing developments as an analytical lens, is supported by the objective of understanding the boundary space between social justice and environmental sustainability, and how knowledge and decision-making interact with this space.

The following questions guide the enquiry:

1. What are the social justice and environmental sustainability implications of two government-led housing projects?
2. How have social justice and environmental sustainability been conceptualised and operationalised in the two government-led housing projects?
3. How can the conceptualisation of just sustainability be developed to support just and sustainable housing delivery in Southern contexts?

This thesis, its conceptual framework and the subsequent chapters are structured around these questions.

1.4 Chapter outline

The arguments presented in this thesis are developed through three published journal articles, each as standalone chapters, in addition to a number of introductory and concluding chapters that position the study and draw together the findings and contribution of the respective journal articles into a single coherent doctoral thesis. Although the inclusion of published papers brings value to the thesis, and demonstrates the relevance of the research, this format results in some unavoidable repetition. Effort has been made to minimise duplication as far as possible.

The thesis begins with this introductory chapter (Chapter One) that presents the justification for and relevance of this research, laying out the design and structure of the thesis, and briefly introducing the case studies. The second chapter builds on the justification for this research and draws on relevant literature to build an overarching conceptual framework for the research. This chapter demonstrates the theoretical and conceptual context of the research and deliberately draws connections, both through the literature and framework, between the practical, policy and theoretical boundary between social justice and environmental sustainability, as well as how understanding these elements is fundamentally influenced by research methodology. Importantly, Chapter Two connects the theoretical concepts around just sustainability, with how these relate to the practical case of government-led housing, the role of decision-making and conflicting rationalities in building towards just and sustainable cities.

With the importance of the methodological approach being established in the conceptual framework, Chapter Three goes into the details of how the study identified appropriate methodologies, data sources and analytical tools to best respond to the research aims and questions. Although the multidisciplinary approach adopted enabled a complex understanding of the boundary between social justice and environmental sustainability to be developed, various ethical considerations and challenges were faced during the study, and these are discussed. This chapter also includes a background to the two case studies and demonstrates why these cases are appropriate for responding to the research aims and objectives. Chapters Four, Five, and Seven comprise the main empirical and theoretical contributions of this research, and take the form of reproduced journal articles, which were published between 2020 and 2023. Each of these chapters deals with a different element of the conceptual framework, and the multidisciplinary approach represents a methodological boundary between the practical, policy and theoretical elements.

Chapter Four investigates the first research question to examine the practical outcomes of government-led housing developments and utilises empirical data from the GCRO's Quality of Life

V (2017/18) survey and resident interviews in Lufhereng and Pennyville. The survey data offers an overall view of government housing developments in Gauteng Province, while the resident interviews provide detailed insights into the lives of people in these communities. Together, the data and interviews shed light on factors such as access to services, accessibility, and the income and employment status of residents. The findings indicate that residents in government-led housing have significantly better access to basic services and amenities. However, compared to those living in informal settlements and other parts of Gauteng, these developments are often poorly located in relation to economic opportunities, forcing residents to seek alternative income sources or bear high transport costs. The chapter highlights the dual impact of these housing projects on social justice and environmental sustainability, showing both positive and negative outcomes. It challenges the assumption that social justice and environmental sustainability are always aligned or oppositional, suggesting instead that both can be true simultaneously. This complexity underscores the importance of nuanced assessments of government housing projects, recognising the diverse and sometimes contradictory impacts on urban development. The chapter makes a significant contribution to the understanding of how government-led housing can simultaneously advance and hinder social justice and environmental sustainability, emphasising the need for careful consideration of these multifaceted outcomes in policy-making.

Chapter Five addresses the second research question by drawing on key informant interviews and document analysis related to the Lufhereng and Pennyville projects. This chapter considers the boundary space between social justice and environmental sustainability within the policy realm, and focuses specifically on how conflicting rationalities within conceptual, institutional, and implementation realms influenced each project. It investigates how diverse logics and motivations shape the outcomes of these government-led housing projects and how conflicting rationalities hinder efforts to establish both just and sustainable housing. While Watson (2003) initially explored conflicting rationalities in state and community engagements, this chapter extends this concept to examine conflicts across conceptual, institutional, and implementation realms, enriching contemporary urban planning in the context of tensions and trade-offs. The chapter uncovers how institutional dynamics, politics, and conflicting rationalities have steered both housing projects away from their intended goals. Notably, the study reveals that discrepancies between theory and practice are not solely driven by conflicts between social justice and environmental sustainability but by more nuanced factors, prompting the introduction of the notion of 'obscured rationalities'. This concept, building upon Watson's framework, highlights hidden conflicts influencing processes and outcomes. The chapter argues against overemphasising

overt conflicts, suggesting that attention focused on these may obscure the cumulative impact of the subtle, practical processes that undermine progress toward social justice and environmental sustainability.

With the project's empirical findings presented in Chapters Four and Five, Chapter Six analyses and reflects on the respective findings in reference with the conceptual framework. This chapter deliberately draws connections across the three main elements of the research, which correspond to the research questions, namely practical, policy and theoretical elements, and speaks back to the literature presented in Chapter Two.

Chapter Seven serves as a theoretical contribution of the thesis and addresses the third research question. This chapter reflects on the findings of both of the empirical chapters and the subsequent analysis chapter, and draws insights from these into the ways that boundary between social justice and environmental sustainability are conceptualised. This chapter explores how the conceptualization of just sustainability can enhance the delivery of just and sustainable housing in Southern contexts, focusing on the interplay between social justice and environmental sustainability. This chapter examines the interconnectedness between the conceptual and practical challenges of integrating social justice and environmental sustainability. It uses South African government-led housing projects as a lens through which to explore these challenges. The chapter discusses the potential of auto-constructed dwellings to support both social justice and environmental sustainability, emphasising the need to understand the trade-offs and structural barriers to achieving just sustainability. It argues that these challenges necessitate a deeper conceptualisation of the boundary between social justice and environmental sustainability. The chapter's key theoretical contribution is its demonstration that applying just sustainability in practice requires addressing uneven knowledge approaches and engaging with conflicting rationalities through transdisciplinary research. It stresses the importance of broadening the geography of knowledge by incorporating perspectives from the global South to advance understanding and progress toward socially just and environmentally sustainable housing. By drawing direct links between theory, practice and research methodology, this chapter closes the loop between the conceptual framework, the empirical evidence and the theoretical contribution of this thesis.

The final chapter, Chapter Eight, draws out the main conclusions from this research and identifies potential avenues for future research. Furthermore, it situates the relevance of the research within the literature and presents the relevance and implications of the study for theory, practice and

methods. The chapter lays out the respective contributions in line with the elements of the conceptual framework.

1.5 Photo essays

Photographs from the field have been curated into two photo essays and these are positioned alongside the first two journal article chapters. These essays explore access to housing and services, as well as the lives of Lufhereng and Pennyville residents, and contribute to building narratives and reinforcing arguments within the broader thesis. The photo essays function as a methodological boundary object that builds connections between statistical and generalised data on government-led housing, and the lived experience of residents. In this way, the photo essays ground the synthesised statistical analyses with the tangible reality of housing developments, providing a deeper understanding of the lived experiences of government-led housing residents. The first photo essay is entitled *Homes: Bridging the boundary between people and the city*, and foregrounds the first empirical chapter assessing the practical outcomes of the two government-led housing cases. This placement is deliberate as it gives the reader a visceral sense that these places are not merely structures with services, but intimate parts of peoples' lives. The second photo essay, entitled *People, faces and lives: humanising the statistics,* introduces the reader to some of the people who have built communities within these developments and navigate the complexities of life in these places. These photo essays present an important methodological innovation in this project that supports a deeper understanding of the boundary between social justice and environmental sustainability within government-led housing developments.

1.6 Notes on the use and evolution of key concepts

Two of the key concepts used in this thesis require some notes around their use and evolution through the thesis, these include 'social justice', and the 'boundary space' between social justice and environmental sustainability.

Social justice

Social justice is a foundational concept in this thesis, and one of the key arguments made in the theoretical section is the importance of incorporating the different components of social justice when framing the boundary space between social justice and environmental sustainability. These components include distributive, procedural, restorative and recognitional justice, and these are discussed in section 2.1. Although incorporating all elements into the research design would have been ideal, the project's complexity—encompassing environmental sustainability, social justice,

multiple methods, and diverse data sources—necessitated a more focused approach. Therefore, the study was bounded to concentrate solely on distributional justice. This decision was made for several reasons. First, distributional justice is most directly related to environmental sustainability concerns, particularly the distribution of resources. Second, the data from the Quality of Life (QoL) survey and resident interviews were best suited for analysing distributive justice over other forms of justice.

While these decisions were practically necessary to manage the study's extensive and complex scope, excluding procedural, restorative, and recognitional justice is not ideal and does not fully align with the theoretical arguments presented in the research. I am addressing this limitation in my ongoing research, collaborating with broader research teams to consider these additional elements when examining the intersection of social justice and environmental sustainability.

Boundary space

The concept of a boundary space between social justice and environmental sustainability has evolved throughout this thesis. In the earlier stages of the research, I drew on well-known models (e.g. Raworth's (2012, 2017) doughnut model and the planetary boundary models (Rockström et al., 2009; Steffen et al., 2015)) that describe the meeting point of social justice and environmental sustainability as a single reconcilable boundary that can be attained through sufficient effort. In this conceptualisation, conflicts between social justice and environmental sustainability are deviations away from the boundary. Although the idea of a neat boundary appealing in some respects, and potentially useful in garnering support for finding solutions that bring social justice and environmental sustainability into alignment, this concept is limited in its ability to theorise the real trade-offs and complexities of their interaction. The idea of a boundary space, as used in this thesis, better captures the intricate and often messy ways in which social justice and environmental sustainability intersect, providing a more nuanced understanding than the notion of a simple meeting point between the two.

Given that this concept of a boundary space, rather than just a boundary, evolved over the course of the thesis, there are instances within the published journal article where the intersection between social justice and environmental sustainability is described along the lines of a 'boundary' rather than a boundary space. In all other instances, I have ensured that the use of the term aligns with the evolved idea of a boundary space between social justice and environmental sustainability.

1.7 Conclusion

This research makes a valuable contribution to the discourse on just sustainability by highlighting the intricate challenges involved in simultaneously building environmentally sustainable and socially just societies. The study recognises the complexity of balancing trade-offs between environmental sustainability and social justice imperatives, emphasising the importance of intentional planning and engagement with potential outcomes and conflicting rationalities within decision-making. The focus on government-led housing in Johannesburg provides empirical evidence on how government intervention can impact both environmental sustainability and social justice, and sheds light on the dynamic processes that influence outcomes.

By employing multidisciplinary methods, the research delves into the outcomes of government-led housing developments and the decision-making processes that shape them. The examination of institutional dynamics, politics, and conflicting rationalities offers insights into the translation of project visions into tangible results. The study emphasises the significance of understanding trade-offs and structural barriers to just sustainability, advocating for a nuanced conceptual understanding of the interlinkages between social justice and environmental sustainability. Furthermore, it underscores the interconnectedness of practical, policy, theoretical and methodological elements, and the need to deepen theorisation from the global South.

2 Conceptual framework

The relationship between social justice and environmental sustainability has been theorised in various ways over time, and these theories vary across different disciplines and sectors. Sustainable development has been and remains the dominant concept that attempts to bring human and environmental considerations together, and has been widely incorporated into global plans and policies (Mohamed, 2019). The 1987 Brundtland Commission report, *Our Common Future*, established the idea of sustainable development, which centres around the principle that current generations should develop and consume resources in such a way that not only meets their social and economic needs but also protects environmental systems, and ensures that future generations can meet their needs. Under sustainable development, 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). Despite widespread and growing commitments to sustainable development, bringing social justice and environmental sustainability together is a persistent challenge.

This chapter draws on literature to build an understanding of the boundary space (cf. Star, 2010; Akkerman & Bakker, 2011; Patel, 2022) between social justice and environmental sustainability. It responds to the four gaps identified in the previous chapter and develops a conceptual framework to guide the research. The chapter focuses first on the need to deepen the theorisation of the boundary space between social justice and environmental sustainability. This section considers how definitions and models of this boundary space have evolved and the way(s) in which they account for trade-offs. Second, in response to the gap identified in understanding how trade-offs between social justice and environmental sustainability are navigated, the chapter considers the role of decision-making processes, knowledge and power in determining outcomes. Third, given the challenge of achieving just sustainability in practice, this chapter explores the complexity of aligning environmental sustainability and social justice within cities. Government-led housing is used as a lens to explore the practical considerations, and to ground the conceptual and policy discussions. Fourth, this chapter connects the challenge of bringing social justice and environmental sustainability together in theory, policy and practice, with the relative paucity of research from the global South. The conceptual framework presented at the end of this chapter demonstrates how the conceptual, practical and policy challenge of achieving just sustainability are interconnected with methodological approaches to knowledge production. This conceptual framework lays the foundations for the methodological approach and data analysis for this

research, and draws the respective journal articles together to form an integrated and coherent study.

2.1 Theorising the boundary space between social justice and environmental sustainability

Just sustainability explicitly refers to interconnections between justice and sustainability (Agyeman & Evans, 2003), and focuses on broader issues than local cases of environmental ills. Just sustainability first emerged from within the environmental justice movement (Agyeman et al., 2016), and specifically the labour movement's concerns about job losses resulting from the shift towards environmentally sustainable production (Mummery & Mummery, 2019). Where the original discourse was bottom-up, contemporary ideas around just sustainability draw together top-down and bottom-up approaches (Ziervogel, 2019). This discourse emphasises the role of global action to uproot the economic and social systems that lead to both environmental crises and inequality, while acknowledging the importance of local actors in effecting change and ensuring accountability (Ziervogel et al., 2022).

Just sustainability is based on the premise that addressing current environmental crises and tackling poverty and inequality are interconnected (Roy et al., 2018; Pasgaard & Dawson, 2019; Rockström et al., 2021). Social justice and environmental sustainability are intertwined drivers and outcomes of the global system (and change within it) (Leach et al., 2018; Westman & Castán Broto, 2021), and scholars argue that unless environmental and social issues are addressed in tandem, they will both persist (Agyeman, Bullard & Evans, 2002).

Environmental sustainability defines the changes in human behaviour that are required to keep within planetary boundaries and mitigate the negative environmental outcomes of development. It draws on principles of maximum efficiency, where the needs of society are met through the least possible environmental impact. It includes actions to conserve ecological systems, minimise land-use change and degradation, ensure that resources are used sparingly and reused where possible, minimise the production of waste, and ensure that waste disposal does not damage ecological systems (IRP, 2018; Steffen et al., 2018; IPCC, 2019). The climate change discourse has raised global awareness around the need to reduce greenhouse gas emissions and increase resilience to climate-related disasters. It has elevated environmental considerations into decision-making fora at all scales – from neighbourhood and city scales all the way up to national, regional and international scales. The sustainable development discourse has to a large extent initiated and driven the uptake of ideas around bringing social and environmental sustainability concerns

together. However, the sustainable development discourse only implicitly includes ideas around social justice, and scholars emphasise that an explicit engagement with social justice is critical for effective environmental sustainability responses (Hughes & Hoffmann, 2020; Westman & Castán Broto, 2021).

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). Social justice incorporates various elements including distributive, procedural, recognitional justice (Schlosberg, 2004; Fraser, 2008; Leach et al., 2018; Ciplet & Harrison, 2020; Menton et al., 2020). Distributive justice refers to the equitable distribution of resources (including both benefits and costs) and aims to reduce or redress existing inequitable distribution. Global issues related to inequality and poverty are the most obvious examples of the unjust distribution of resources. Procedural justice refers to decision-making and conflict resolution processes, and to ensuring that the means by which an outcome is reached or conflicts are resolved is fair. Procedural justice tends to be synonymous with inclusive and democratic processes that include adequate participation, particularly with those most affected by the issue under consideration. Recognitional justice acknowledges individual identities and values, and reacts against cultural or political discrimination. Recognitional justice ensures that all people are treated the same regardless of race, sex, nationality, LGBTQIA+ status etc. Martin (2013) argues that these three elements of justice are connected in that identifying what a just distribution entails, is possible only through ensuring inclusive participation where all people are respected and considered regardless of individual identities or associations. 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 (Harvey, 2003; Davies, 2011). Different ontological perspectives or worldviews 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). There are instances where procedural and distributional (in)justice align – for example, 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 (i.e. an unfair process resulting in an unfair outcome) (Davis, 2010). However, it is possible that a just process might not result in a just distribution of resources (Harvey, 2003; Newell, Geels & Sovacool, 2022; Ziervogel et al., 2022), or for an unjust process to result in equitable distribution. Newell et al. (2022) discuss the tension between the need to take rapid action to counter climate change, and that the robust participatory processes necessary for achieving just sustainability tend to slow down decision-making processes. 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, or where there is disagreement around what would be considered just (Martin, 2013). 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.

Disadvantaged groups tend to bear the burden of the negative impacts of urban development and those with power and wealth protect themselves against these burdens (Agyeman & Evans, 2004). 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 and ensuring procedural justice (Schlosberg & Collins, 2014). However, ensuring procedural justice does not necessarily result in distributional justice, and in some cases, the affected groups can't participate in decision-making (e.g. future generations) (Harvey, 2003). The distribution of resources is a key determiner of quality of life, poverty and inequality. In South Africa, the apartheid government deliberately restricted access to resources as a means to oppress Black people. Furthermore, resource distribution and consumption are central concerns within environmental sustainability, and addressing inequitable resource distribution is necessary for social justice. This research thus focuses on distributive justice as the most obvious intersection between environmental sustainability and social justice. This research does however acknowledge the equal importance of procedural and recognitional elements of social justice.

The dominant socio-economic-political system prioritises individual interests and wealth accumulation over ensuring equitable distribution and environmental stewardship (Roberts, 2003; Swilling, 2011). Shifting this current system is critical for bringing social justice and environmental sustainability together. Although sustainable development has furthered ideas around the

interconnectedness between social, environmental and economic systems (Campbell, 1996; Agyeman & Evans, 2003) (Mohamed, 2019), it does not challenge the dominant systems (Hodson & Marvin, 2017; Castán Broto & Westman, 2019). In addition to this, sustainable development has endured since the 1980's because it has evolved in response to contestation and implementation (Campbell, 2013), and its interdisciplinary nature has resonated across multiple disciplines (Kremer, Haase & Haase, 2019). Although acknowledging that environmental, economic and social components are necessary considerations in sustainable development, this framing has allowed the distinct fields of research to remain siloed (humanities, sciences and business). Furthermore, there has been limited systematic investigation into the interaction between sustainability and justice (Leach et al., 2018; Kremer, Haase & Haase, 2019; Ciplet & Harrison, 2020). This is in part because the fields of environmental sustainability and social justice have different histories and trajectories of thought (Campbell, 2013).

Critiques of sustainable development include that it is top-down, disproportionately favouring those in power. The emphasis on future generations over immediate justice concerns is a persistent concern (Agyeman, Bullard & Evans, 2002; Menton et al., 2020). Scholars argue that the 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. Sustainable development has been critiqued for downplaying questions of justice and equity (Walker & Bulkeley, 2006), which has motivated scholars and activists to pursue environmental justice (Agyeman, 2005).

Environmental justice is concerned with the uneven distribution of environmental ills and how these tend to be disproportionately borne by the poor (Roberts, 2003; Davis, 2010; Gupta et al., 2020; Malloy & Ashcraft, 2020; Menton et al., 2020; Pineo, 2022; Rockström et al., 2021). Environmental justice has been especially concerned with locational injustice with respect to environmental ills (Holifield, Porter & Walker, 2009). Drawing primarily on local and community scale case studies, environmental justice argues that addressing environmental ills will concurrently address the associated social justice issues. Ensuring participatory justice and including communities in decision-making processes is argued as a critical means of addressing environmental injustice. Climate justice, a subset of environmental justice, has received growing attention (Mummery & Mummery, 2019; Ziervogel, 2019; Malloy & Ashcraft, 2020; Westman & Castán Broto, 2021) because of the dynamic where poor and marginalised groups are not only most vulnerable to climate change the are also least responsible for its causes, and the ability to influence decision-making is skewed against the most vulnerable (Hughes & Hoffmann, 2020; Westman & Castán Broto, 2021). In contrast to environmental justice, climate justice places particular

emphasis on restorative justice in addition to distributive and procedural justice (Schlosberg & Collins, 2014).

Despite assertions in these fields that by solving the environmental ills will improve the quality of life for the least advantaged in society – a socially just outcome (Davis, 2010; Schwarz et al., 2015), scholars warn that although there are indeed cases where social justice and environmental sustainability align, tensions between these imperatives could result in one, but not the other being achieved (Swilling, 2019; Ciplet & Harrison, 2020). A transition towards environmental sustainability that is unjust is a strong possibility (Marcuse, 1998; Swilling, 2019), and similarly, addressing poverty and inequality could result in planetary boundaries being overshot (Leach et al., 2018; Ciplet & Harrison, 2020). Numerous examples exist of where progress towards one of these imperatives undermines the achievement of the other (Marcuse, 1998; Patel, 2006a; Culwick, 2015). It is possible for a transition to environmental sustainability to occur in a way that maintains or entrenches existing systems of capital accumulation and inequality (Bennett et al., 2019). For example, if wealthy consumers invested in off-grid renewable energy sources, public utilities that depend on the revenue of wealthy consumers to cross-subsidise services for the poor might be left with insufficient revenue to ensure universal electricity access.

In the context of a potentially unjust but sustainable transition, Hallowes and Munnik (2019) call for expanded imaginaries around potential future outcomes that disrupt the current status quo. Urban political ecology has developed as a framework to explore the socio-ecological production of urban change that results in the uneven spread of environmental injustices (Swyngedouw and Heynen, 2003). Scholars emphasise the importance of looking beyond a particular example of inequality (as in the case of environmental justice) to explore the power dynamics, agendas and processes embedded in the capitalist system that has produced the current environmental and social crises (Swyngedouw & Heynen, 2003; Lawhon, Ernstson & Silver, 2014).

This research pulls together ideas from sustainable development to frame the interconnectedness between social, environmental and economic systems, from environmental justice to focus specifically on the disproportionate burden of development on the poor, and from urban political ecology to look beneath the superficial outcomes to the decision-making processes and axes of power that determine outcomes.

2.1.1 *Modelling the boundary space between social justice and environmental sustainability*

Various models have been developed to represent the intersection between environmental sustainability and social justice. Raworth's (2012) doughnut model has been used widely within scholarly and policy documents (Raworth, 2017) and 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 (e.g. Rockström et al., 2009; Steffen et al., 2018), where resource use and environmental impacts increase outwards 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 resource consumption is secured for all people to enable a quality of life while staying within planetary boundaries She refers to this as ensuring a minimum 'social foundation' while not exceeding the 'ecological ceiling' (Raworth, 2017: 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. This model counters the critiques of the early planetary boundary concept that placed social justice and environmental sustainability necessarily in conflict (Steffen & Stafford Smith, 2013).

Models and metaphors such as Raworth's (2012) doughnut model are designed as visual representations of the interconnection between social justice and environmental sustainability to garner support for a just sustainability transition. 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 (Leach et al., 2018) where, on one side, scholars frame the two as interdependent, where equity is a precondition for attaining a truly sustainable society and vice versa (Agyeman, Bullard & Evans, 2002; McDonald, 2002; Agyeman, 2005; Swilling & Annecke, 2012; Heynen, 2013). These scholars argue that because environmental resources and ecological systems are critical for human well-being, environmental sustainability is a precondition for attaining social justice. On the other side of the spectrum, the two goals are considered as opposing, where the one can only be attained at the expense of the other (Marcuse, 1998; Patel, 2006a).

Leach et al. (2018) propose that a balance between these perspectives is needed, and that there is a dynamic zone of 'desirability', where environmental 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 model – there are many subjective elements, influenced by context and open to interpretation, as well as spaces of conflict between social justice and environmental sustainability. Scholars have cautioned that assumptions around common needs and minimum standards of well-being ignore differentiated interpretations of what is just (Pasgaard & Dawson, 2019). Rather than assuming a single interpretation is possible, it is important to incorporate different interpretations of justice (distributional, procedural and recognitional justice) into models and assessments (Leach et al., 2018; Bennett et al., 2019; Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020; Menton et al., 2020).

Assuming a simple alignment is possible between social justice and environmental sustainability both 'depoliticises' social differences (Thörn et al., 2020), and can result in the perception that progress is being made towards just sustainability, despite structural tensions remaining in place (Campbell, 2013). There is a highly complex relationship between and within social justice and environmental sustainability (Patel, 2006a; Vogel et al., 2016b; Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020), where interactions can be oppositional or non-linear (Marcuse, 1998; Patel, 2006a; Leach et al., 2018). Holifield et al. (2009) posit that as social and environmental crises evolve, we will likely see both an intensification of environmental inequality and progress towards just sustainability. Examining tensions and trade-offs between and within the different forms and interpretations of social justice and environmental sustainability is increasingly considered as generative for furthering just sustainability in both theory and practice (Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020; Culwick & Patel, 2020; Lu et al., 2021; Newell, Geels & Sovacool, 2022; Rockström et al., 2021). Oversimplification and the inability of models to engage with the tensions between social justice and environmental sustainability, is considered one of their key weaknesses (Rockström et al., 2021). Although simplifications can help garner support for just sustainability (Jankó et al., 2020; Tyler & Cohen, 2021), they can restrict analysis (Leach et al., 2018), inhibit debate (Krueger, Freytag & Mössner, 2019) and obscure where real conflicts exist that need to be engaged with.

Ciplet and Harrison (2020) argue that the aspirational rhetoric associated with commitments to just sustainability can undermine critical engagement with this composite goal, thus allowing the tensions that arise within just sustainability to remain hidden. The definitions and interpretations of social justice in relation to environmental sustainability have a critical impact on how trade-offs are managed and the ability to further just sustainability (Pasgaard & Dawson, 2019). Roberts (2003), argues that while it is important to further theoretical debates (e.g. through refining

definitions), it is also necessary to move beyond abstract ideals and into the practical challenge of transitioning towards just sustainability.

This research adopts a complex framing of the boundary space between social justice and environmental sustainability that allows both conflict and alignment to exist simultaneously. Rather than attempting to rationalise conflicts, this research focuses on the importance of engaging with them and understanding how these can be navigated through policy and decision-making processes.

2.2 Decision-making, conflicting rationalities and just sustainability

Urban development and the spatial configuration of infrastructure fundamentally influence environmental sustainability and social justice. Thus, decision-making that determines the form and location of development and infrastructure directly shapes social justice and environmental sustainability (Khalil & Rubin, 2021). This section builds on the proposition in this research that aligning social justice and environmental sustainability requires interrogating how decisions are made, by whom and to what end (Patel, 2006a).

Government officials and urban planning processes are assumed to be rational and not influenced by political motivations (Murdoch, 2000; Watson, 2003). However, this assumption obscures the influence of individual worldviews and power in decision-making, as well as the non-linear nature of decision-making processes. Numerous factors, including knowledge, power, politics and different philosophical positions, influence decision-making (Patel, 2006b), and different rationalities can pull decision-making in opposing directions. De Satgé and Watson (2018: 26) describe a rationality "as a view, a 'way of seeing', a position or perspective, an argument, a way of making sense of the world and a set of values, or perhaps a worldview, of actors in a particular setting". Mete and Xue (2019) argue that depending on the rationalities and paradigms that feed into the decision-making process, achieving justice and sustainability will mean different things. For example, under a de-growth paradigm, raising the quality of life for the poor requires the wealthy to reduce consumption through proactive redistributive policies with strong market regulation. Alternatively, other approaches (e.g. ecological modernisation) are based on 'greening' the current systems of capital accumulation by introducing technologies to reduce the environmental impact.

The inability to align social justice and environmental sustainability in practice is not necessarily rooted in a lack of commitment or vision, but rather because of the multiplicity of actors and logics

that shape urban development (Ballard, Hamann & Mosiane, 2021). Where motivations and logics come into conflict, trade-offs must be made between opposing (but sometimes equally valid) positions (Campbell, 2013; Pasgaard & Dawson, 2019). Understanding where and how conflicts arise is critical for moving beyond normative assumptions and simplifications regarding what constitutes just sustainability, and thereby supporting decision-making (Pasgaard & Dawson, 2019). The use of binary framings (e.g. just and unjust) or attempts to resolve conflicts through identifying 'shared values' and mutually constructive solutions (Lu et al., 2021) can not only oversimplify complex interactions, but overlook where real conflicts exist. Rather, scholars argue that engaging deliberately with diverse contexts and rationalities can build a deeper understanding of conflicts and expand the scope for alternative solutions (de Satgé & Watson, 2018; Kremer, Haase & Haase, 2019; Lu et al., 2021). In cases where conflicts exist, navigating towards just sustainability requires an ongoing, multifaceted process of political negotiation between potentially competing imperatives (Leach et al., 2018; Newell, Geels & Sovacool, 2022).

Campbell (2013) uses the idea of 'conflicting urgencies' to interrogate the tensions between addressing either justice or sustainability, especially where it is not reasonable to focus on one of these before the other. He argues that forcing a balance between these imperatives can obscure structural conflicts between them (Campbell, 2013). Watson (2003) coined the term conflicting rationalities to refer to the divergent perspectives that emerge within state and community engagements, which cannot be resolved through consensus building processes. She argues that misaligned perspectives can derive from deep differences in worldviews and competing goods rather than misunderstandings or a lack of will to find consensus. In such cases, assuming that consensus can be reached or that perspectives can be brought into alignment can trivialise where real difference exists. Drawing on Harvey, Watson (2006: 43) explores how "there could be no universally acceptable notion of social rationality but rather many different rationalities depending on social and material circumstances". This research applies Watson's (2003) idea of conflicting rationalities, and extends it beyond application to government-community engagements, to explore trade-offs between social justice and environmental sustainability, as well as conflicts that arise between and within a range of actors and contexts. This application develops theory and the understanding of urban decision-making in the context of trade-offs.

A key area of potential conflict in furthering just sustainability is defining what the constitutes, especially where procedural and distributional justice do not align (Campbell, 1996). Furthermore, an equitable distribution of one resource can undermine that of another, and an equitable distribution within society now can limit the potential for future generations to meet their needs.

Visser (2003) argues that it is much easier to identify instances of injustice (and likewise environmental ills), than planning development that is truly socially just (or environmentally sustainable) in reality, because of the range of potential interpretations and contestations. Definitions around social justice and associated plans are often presented as truths or scientific facts, but in reality, these are influenced by different rationalities, whose justice matters within decision-making and the interests of those with power (Martin, 2013). Defining what is concurrently socially just and environmentally sustainable is both political and subjective (Pasgaard & Dawson, 2019), and this fundamentally influences the actions that are required. For example, defining social justice as the equitable distribution of resources and risks suggests that intervention should focus on realigning distribution, rather than addressing the structural processes and systems that resulted in inequitable distribution (Walker & Bulkeley, 2006). The political economy of decision-making thus plays an important role in influencing which definitions of social justice are prioritised over others, especially where different understandings come into conflict (Martin, 2013).

Justice and injustice are "normative claims based on contextual – even localised – understandings as to how things should be" (Mummery & Mummery, 2019: 6), as well as how 'proper' distribution and procedures are defined. Urban development visions and policies are based on the idea that it is possible to create universally beneficial plans and outcomes. However, assuming that a single approach can be universally beneficial undermines the diversity of needs and desires across society, and can miss real trade-offs and conflicting rationalities (Watson, 2003). For example, South Africa's renewable energy transition is arguably universally beneficial as it reduces carbon emissions, improves air quality, creates a more stable electricity grid and creates jobs. However, this transition undermines the livelihoods of communities dependent on the coal value chain. Thus, assuming that only one approach can lead to either social justice or environmental sustainability is likely to result in one-sided policies that overlook important considerations and perspectives.

Policies are necessarily normative and tend to use quantitative data to assess outcomes, as these are measurable and can track progress against defined indicators. However, objective measures can hide implicit assumptions about what 'good' urban development is (Pieterse, 2011; Haferburg, 2013), and aggregated data can hide inequalities at individual and community scales (Gupta et al., 2020). Furthermore, broad-scale plans and indicator-based assessments can overlook the structural challenges that prevent real progress from being made towards just sustainability (Nastar et al., 2019). Swyngedouw (2021) cautions that "access to and presence of knowledge and facts does not guarantee effective intervention". Decision-making processes are not only based on

research, they are also influenced by power and desires to sway outcomes in particular ways (Watson, 2003). For example, although quantitative data and models inform housing and service needs assessments, how these needs are met is influenced by subjective factors. The location and form of housing developments as well as who is allocated as recipients are influenced by political agendas, individual interests. Although these factors fundamentally influence outcomes, they can be "decontextualized from the spaces where the building will ultimately take place" (Murdoch, 2000: 505), and undermine the achievement of policy objectives.

Making progress towards just sustainability requires that conventional wisdom and dominant logics be challenged (Cock, 2019). The inertia of existing logics and practices can pose significant barriers to achieving just sustainability (Duminy, Odendaal & Watson, 2014). May and Perry (2017: 28) highlight that in some cases "city officials practise anticipatory decision-making: that is, fear of having no voice or influence unless conforming to dominant priorities". In this way, dominant systems (including injustice) can remain unchallenged, despite acknowledgement of their existence and need for change (Swyngedouw, 2021). Structural change is further hampered where government departments and spheres have different incentives and objectives. Despite common conceptualisations, the state cannot be considered as a single, unified actor but rather is a complex network of stakeholders, with different governance arrangements, objectives and motivations (Rubin & Charlton, 2019).

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 (Swyngedouw & Heynen, 2003; Koch, Vogel & Patel, 2007). Understanding the multi-faceted institutional dynamics within government can illuminate how and why some ideas are given precedence over others, and what role institutional factors and conflicting rationalities play in shaping decision-making processes and outcomes (Pasgaard & Dawson, 2019). Patel (2006a: 691) argues that 'in situations of competing rationalities, critical questions around the universality of ethics and whose ethics should prevail inevitably arise'. Exploring how conflicting rationalities are debated, is important 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 (Watson, 2003). Watson (2003) calls for analysis not merely of the differences in perspective but also the underlying power, politics and cultural factors that influence different perspectives.

Given that knowledge is not neutral and decision-making processes are influenced by political agendas, urban planning philosophies and individual perceptions, there is growing attention to the

importance of drawing on multiple forms of knowledge and perspectives in decision-making to effect transformative change (Culwick & Patel, 2017; Culwick et al., 2019; Ziervogel et al., 2022). 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 – deliberately or unintentionally.

Mtapuri and Myeni (2019) reveal how politically motivated actions, which are intended to be in the interests of people without housing, often result in poor outcomes or perpetuate poor living conditions. The political value of government-led housing and services can contribute to negative outcomes or unintended consequences (Mtapuri & Myeni, 2019). In many cases, poor individuals and communities that become housing beneficiaries have limited influence over the decision-making processes that influence the respective government-led housing projects (Mtapuri & Myeni, 2019). Charlton (2010) highlights the importance of inclusionary approaches and principles in cities, and particularly those in the global South that have high proportions of poor people. Despite the fundamental impact on residents' daily lives, the lived experiences of residents in government-led housing remains under-researched (Lemanski, Charlton & Meth, 2017) and tends not to be incorporated into broader assessments of the success of government-led housing.

In addition to conflicts between different stakeholders, conflicts can also arise across different scales, where each is influenced by different priorities and objectives (Lu et al., 2021). Additionally, furthering social justice and/or environmental sustainability at one scale can have different impacts at other scales (Lawhon & Patel, 2013). Scholars argue that focusing on regional and national scales is the most effective way to address trade-offs between social justice and environmental sustainability (Lu et al., 2021). However, case study research reveals that there are fundamental disconnects between regional level dynamics compared to the local community scale (Pasgaard & Dawson, 2019). Additionally, the scale of social and environmental challenges tends to be different from the scale of government responses. Thus, this research supports propositions that achieving the dual goal of just sustainability requires multi-scalar perspectives and assessments across a range of dimensions (Ziervogel, 2019). Furthermore, strategies to further just sustainability need to be dynamic and responsive to context changes over time (Lu et al., 2021), because choices that further social justice and environmental sustainability now, might not do so in the future.

This research examines how urban decision-making is influenced by a range of factors, institutional dynamics and vested interests, which can sometimes result in conflicting

rationalities. A multi-scalar approach is adopted, which deliberately considers multiple perspectives, to build an understanding of what factors shift decisions and outcomes, and how these influence the boundary space between social justice and environmental sustainability.

2.3 The practical boundary space between social justice and environmental sustainability

Despite policy commitments and scholarly assertions that, with sufficient care, environmental sustainability and social justice can be achieved simultaneously (i.e. just sustainability) (Rockström et al., 2009; Raworth, 2017; Westman & Castán Broto, 2021), translating the theoretical alignment into practice has proved very difficult (Visser, 2004; Patel, 2006a; Vogel et al., 2016b). Walker and Bulkeley (2006) argue that universal ideas of justice can come into conflict with the multiplicity of interpretations and notions of justice in practice, and thus it is critical to examine the interaction between social and environmental issues in context. This section examines the literature on the practical boundary space between social justice and environmental sustainability, and especially how this manifests within cities.

The growing attention to addressing global environmental and social crises has come at a time when urbanisation is a primary feature of human development. More than half the world population lives in cities, and by 2050 some 60% of the world's population will likely live in cities (United Nations, 2014). At the same time, 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 (Dodman, Diep & Colenbrander, 2017; OECD/SWAC, 2020; Croese, 2021). The current urbanisation that is underway, and concentrated in the global South, is fundamentally different in rate and form compared to the urbanisation that took place in the global North. In Africa, urbanisation is decoupled from industrialisation, and the provision of services and housing is undertaken by residents and is not necessarily initiated or regulated by government (Croese, 2021).

The physical shift in population distribution towards the urban has been mirrored by a policy shift that recognises the significance of cities in global transitions (Castán Broto & Westman, 2019). Cities are widely considered the only viable means of meeting the needs of a growing population in a resource-constrained world (Davis, 2010). Given that cities are where resource consumption and environmental impacts are concentrated, and they are where poverty and inequality are most severe, urban areas will play a critical role in addressing the current environmental and social

crises (Revi et al., 2014). The way in which cities develop fundamentally shapes space, society and the environmental systems on which life depends (Pieterse & Parnell, 2014; IRP, 2018). Explicit attention to cities has been made through various international agreements (Pieterse, Parnell & Haysom, 2018), including the 2030 Agenda for Sustainable Development (United Nations (UN), 2015) and the New Urban Agenda (UN-Habitat, 2016).

These, and other international agreements (e.g. UNFCCC's Paris Agreement and Sendai Framework for Disaster Risk Reduction) emphasise the importance of attaining social justice and environmental sustainability imperatives simultaneously, and how cities play a critical role in achieving these goals (Croese, 2021). Scholars argue that although these agreements acknowledge the specific challenges facing cities in the South, the agreements are normative in their visions of what a just sustainable city is, and rather, application of these visions must be sensitive to local conditions and contextual interpretations (Buyana et al., 2022). This is particularly important because the practical determination of what is just is variable and influenced by sectoral interests, individual priorities and agendas, and who has power in relevant decision-making (Martin, 2013). These decisions translate into how cities are built and infrastructure is developed.

Urban infrastructure networks directly influence resource consumption patterns (IRP, 2018) and urban inequality. Thus, transforming urban infrastructure networks is a critical way in which the commitments towards building socially just and environmentally sustainable cities can be realised (Bulkeley et al., 2011). Many cities have been locked into resource-intensive trajectories because they were built at a time when resource availability was not a constraint, and there was little understanding of the environmental and social costs of pollution and ecological degradation. Cities with shorter infrastructure networks per capita are considered more environmentally sustainable because they require fewer resources for infrastructure construction (IRP, 2018), they are associated with fewer losses (e.g. through water leaks) and require less ongoing maintenance. They are also argued as enhancing access to services and amenities, for urban residents and thereby reducing the social and financial costs. Khalil and Rubin (2021 [abstract]) argue that there is "a recursive relationship between service provision and inequality: that lack of public services is not only a manifestation or measure of inequality, but also a producer of social inequality, embedding and entrenching inequality within cities through a set of provision practices".

Many urban development approaches are based on the idea that the city is made up of a set of building blocks that cumulatively influence the city's overall achievement of environmental sustainability and social justice (Sharifi, 2016). By implication, if neighbourhoods (small building

blocks) are built in an environmentally sustainable and socially just way, the city as an accumulation of these neighbourhoods will also be socially just and environmentally sustainable. However, the linear scalability of the environmental sustainability and social justice implications cannot be taken for granted because decisions that are environmentally sustainable and socially just at a neighbourhood scale, might not result in the same outcomes at the city-scale (Rubin, 2021).

Building cities that are socially just and environmentally sustainable requires that both the benefits (e.g. resources) and costs of development are distributed equitably, and for existing inequality to be reduced or redressed. Considering the distribution across social, temporal and spatial elements can facilitate assessments of the boundary space between social justice and environmental sustainability and to what extent feedbacks across these dimensions either further or undermine just sustainability (Leach et al., 2018). Importantly, this can also reveal conflicts between social, temporal and spatial scales.

2.3.1 Spatial, social and temporal considerations

Advantage and disadvantage are often geographically determined, where the distribution of the benefits and costs of development are spatially uneven. For example, toxic waste disposal sites (landfills, mine dumps, etc.) can lead to contaminated air, soil and water, and have consequent health issues for adjacent communities. Poor and marginalised, rather than wealthy, communities tend to live alongside these sites for various reasons. Polluted areas tend to have low market value thus making them affordable for poor communities. New toxic waste sites are more likely to be placed in low-income areas because these communities tend to have limited influence over decision-making processes that guide the establishment and management of these sites, and it is less likely that these sites will negatively influence property prices (and the associated rates base). Furthermore, the environmental racism literature in the United States has demonstrated that hazardous waste facilities are deliberately located in areas in which minority groups live (Bullard et al., 2008). Cock (2019) argues that environmental ills perpetuate existing inequality, and in South Africa, these are highly racialised and gendered, with women and Africans bearing disproportionate burdens. Scholars posit that to compensate for these inherent dynamics, environmental justice in South Africa requires that poor and disadvantaged groups do not bear the externalised costs of development or the consumption patterns of the wealthy (Leonard, 2018).

Guibrunet and Castán Broto (2016: 163) argue that 'the production of social inequality is correlated to the use of resources'. For example, electricity consumption is higher in wealthier households because they can afford non-essential appliances that enhance efficiency, convenience and quality

of life (e.g. dishwashers, microwaves, laptops), whereas poorer households consume less electricity (both in absolute terms and per capita) because of the costs associated with electricity consumption and appliances. This dynamic demonstrates how a greater level of access to resources creates an advantage that further perpetuates inequality.

As cities focus on improving residents' quality of life in the context of resource constraints, it is necessary for higher resource users to reduce consumption to ensure equitable access to resources across society, thus ensuring distributional justice (Davis, 2010; Hickel et al., 2021). Some argue, however, that improving 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, given that current resource consumption patterns are already unsustainable, it is critical to reduce overall consumption to enable access for those with 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. Raworth argues, however, that to achieve a socially just and environmentally sustainable outcome, a minimum level of resource consumption is required for everyone to access acceptable living conditions (Raworth, 2012, 2017).

While there is a strong argument to prioritise current generations and addressing existing injustice over a potential future injustice, it is nevertheless important to acknowledge that actions taken now will have an impact on the ability of future generations to meet their needs. The current environmental and social crises have to a large degree resulted from historical actions and decisions that have had long-term consequences and resource trajectories. Temporal considerations and trade-offs between prioritising immediate (social) needs versus longer-term (environmental) consequences are particularly pertinent in this research. Furthermore, it is critical to understand how urban development and infrastructure choices have long term implications for both social justice and environmental sustainability. For example, apartheid spatial planning in South African deliberately restricted access to services and economic opportunities for Black people. The resulting spatial form has had lasting effects on both environmental sustainability and social justice. Nearly three 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 poor and previously disadvantaged groups (Mubiwa & Annegarn, 2013; Culwick & Patel, 2020). Leonard (2018) argues that despite the common causes of social and environmental issues in South Africa, the respective activism remains distinct, with social movements unconscious of environmental

issues and environmental activism uncritical of social conflicts and dynamics. This undermines the potential to harmonise efforts across social and environmental struggles. Given the interconnectedness of temporal, spatial and social scales, and that these dynamics result from existing social, economic and political systems, a deep transformation within these systems is required to achieve both social justice and environmental sustainability (Bennett et al., 2019).

Despite the interconnectedness of spatial, temporal and social scales, conclusions about social justice and environmental sustainability tend to be made at one scale rather than considering multiple scales or the associated impacts for other elements. For example, local community assessments tend to neglect city-wide and intergenerational scales, or wider-scale interventions that overlook local implications (Adegun, 2018). This research deliberately adopts a multi-scalar approach, where the micro and individual scale is brought alongside aggregated city-scale analysis. It further acknowledges the interconnected temporal, social and spatial dynamics at play and considers these elements separately and together. This allows both the synergies and conflicts across scales to be surfaced, and builds a complex understanding of socially just and environmentally sustainable government-led housing.

2.3.2 Socially just and environmentally sustainable government-led housing

The boundary space between social justice and environmental sustainability is productively engaged by focusing on a particular case as this allows the multifaceted interaction between social justice and environmental sustainability to be explored in practical, rather than hypothetical terms. This research uses government-led housing as a means of exploring the boundary space between social justice and environmental sustainability because government-led housing plays an important role in improving access to shelter and services for the poor, and has implications for both social justice and environmental sustainability. This is especially true in Africa, where the vast majority of people cannot afford even the cheapest 'formal' housing (Khalil & Rubin, 2021), and government intervention is critical for ensuring adequate living conditions.

Inadequate housing contributes towards poverty, poor health and disaster vulnerability (Zerbo, Delgado & González, 2020). Thus, government-led housing raises the quality of life of poor citizens by providing shelter and access to basic services such as electricity, water and sanitation (Chiu, 2000; Shapurjee & Charlton, 2013; Turok, 2016a; Caldeira, 2017; Charlton & Meth, 2017; Adegun, 2019; Mitlin & Bartlett, 2020; Culwick Fatti, 2021; Mete & Xue, 2021). Housing influences a range of factors related to social justice and environmental sustainability due to its direct and indirect

impact on the environment, resource consumption, access to economic opportunities and urban amenities, and overall quality of life (Chiu, 2000; Shapurjee & Charlton, 2013; Turok, 2016a).

Environmental sustainability considerations of government-led housing include resource consumption, waste production, and land transformation, which increases impervious surfaces, damages ecological systems and can cause environmental degradation. Because housing has significant impacts on land transformation (Waters, 2016), minimising the land required per household is a major consideration for environmental sustainability (IRP, 2018). This can be done by increasing population and building density, and the ratio between floor area of dwellings and the land on which they are built (Waters, 2016). For example, high-rise buildings are very efficient in terms of land consumption, because population and building density are high, and there is significantly more floor area than the land area on which the buildings are built. Other types of resource consumption include the materials required to construct houses and infrastructure, and the post-construction residential consumption of water, energy and other resources (Chiu, 2000; IRP, 2018). Hickel et al. (2021) argues that retrofitting and maintaining existing buildings rather than building new developments, and reducing average dwelling size are important ways of increasing resource efficiency.

Government intervention in ensuring adequate housing for the urban poor, and particularly those living in informal dwellings, is important for social justice (Caldeira, 2017; Mtapuri & Myeni, 2019; Mitlin & Bartlett, 2020; Mete & Xue, 2021). Government-led housing takes many different forms: including new greenfield[3] developments, brownfield[4] redevelopment and informal settlement upgrading; it occurs at multiple scales from small to large; and traverses a range of tenure types from rental, partially subsidised rental, partially subsidised ownership and fully-subsidised ownership (Ballard, 2017; Lemanski, Charlton & Meth, 2017; Adegun, 2019). Housing and basic service provision can include re-blocking and in situ informal settlement upgrading, relocation to serviced sites, or relocation to fully constructed houses (Adegun, 2019). The material structure of houses is widely considered as only one aspect of housing provision, with numerous other critical components. Scholars emphasise the role of a housing in building a sense of place and belonging (neighbourhoods) (Haferburg, 2013), considering a "house as a home" (Newton, 2013), as a place to develop identity and status (Newton, 2013), and a way to build social cohesion (Haferburg, 2013;

[3] Greenfield developments are located in natural or previously untransformed areas.

[4] Brownfield developments comprise the redevelopment of built up areas such as industrial sites, existing buildings, parking areas.

Newton, 2013), eradicate poverty (Shapurjee & Charlton, 2013) and facilitate inclusion (Adebayo, 2021). Housing can be associated with enhancing safety (Newton, 2013), enabling access to economic opportunities and can serve as an economic and financial asset in its own right (Adebayo, 2021). Housing provision is considered important for securing tenure (Mtapuri & Myeni, 2019), land ownership and is linked with associated property rights and wealth creation (Adebayo, 2021). It can be considered as a form of 'citizenship' through access to services and a formal dwelling (Lemanski, 2019; Adebayo, 2021), and as a way of enacting the right to the city (Turok & Scheba, 2019). However, government-led housing can have complex and contradictory outcomes with regards to many of these benefits (Charlton & Meth, 2017).

Improving living conditions and access to infrastructure for the poor has implications for environmental degradation and resource consumption – both during construction and after occupation (Mete & Xue, 2021). Furthermore, government-led housing, particularly at the scale of the South African National Housing programme, shapes urban form and infrastructure networks. These large developments create path dependencies with long-term implications for resource consumption (Turok, 2016a; IRP, 2018; Mahendra & Seto, 2019; Mete & Xue, 2021; Pineo, 2022). Furthermore, the form of housing developments influences residents' access to urban amenities and opportunities (Adebayo, 2021). Waters (2016: 13) posits that the form of development is important primarily for its ability to facilitate "connectivity, social vitality and convenience". Assessing the social and environmental outcomes of housing requires the consideration of access to services, amenities and economic opportunities (Turok & Borel-Saladin, 2016), which are influenced by the location and form of housing (Rode & da Cruz, 2018; Culwick & Patel, 2020).

Dispersed and sprawling urban form increases land consumption and the embedded resource costs of infrastructure provision (Camagni, Gibelli & Rigamonti, 2002; Sinha & Griffith, 2019). Housing developments on the urban edge require new infrastructure networks, which are not only costly (Ballard, 2017), but result in long infrastructure networks with high maintenance costs and resource wastage (e.g. water leakages increase with the length of piping). Sprawling urban form reduces the viability of public transport and makes accessing amenities such as schools and hospitals more onerous (Rode et al., 2014). Despite the benefits of government-led housing in improving access to shelter and basic services, developments tend to focus disproportionately on the housing structure and basic services, with insufficient attention to ensuring access to amenities, services and opportunities (Visagie & Turok, 2020).

Rode et al. (2014) argue that accessibility and resource efficiency can both be improved through building compact developments that are designed around public transport. The length of commutes or daily trips can be used as a proxy for environmental, social and economic impacts. Longer average trip are associated with greater infrastructure requirements, higher resource consumption and pollution, all of which have negative environmental impacts. Long trips also increase the social and financial costs of accessing services and economic opportunities (Financial and Fiscal Commission (FFC), 2011). Suzuki et al. (2013: 165) highlight 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.*

The literature emphasises that good access to services and opportunities is a prerequisite for both socially just and environmentally sustainable outcomes. However, ensuring good access is not simple, in part because there are different types of accessibility, including proximity- and mobility-enabled access (Mete & Xue, 2021). Proximity-enabled access depends on high density and mixed-use areas, where residents can reach everything they need within a short distance. Mobility-enabled access relies on affordable and convenient transport (typically public transport). Urban development approaches that facilitate proximity-enabled access are considered the preferable option to foster just sustainability given that short-distance trips support both environmental and social outcomes (Mete & Xue, 2021). In cases where different types of access, and access to various services and opportunities, are not well aligned, different priorities and means of assessment can influence how developments are planned, what outcomes are achieved and whether the development can be considered as furthering just sustainability or not (Chan & Adabre, 2019).

Two of the dominant and contrasting urban development approaches that are used to balance social justice and environmental sustainability include infill development and urban expansion. Infill developments are located within the existing urban fabric, supporting compact urban form, and can be either brownfield or greenfield developments. Urban expansion projects are located beyond the existing urban boundary and are typically greenfield developments. Environmental sustainability favours brownfield and infill developments over greenfield developments and especially over greenfield developments on the urban edge (Aquino & Gainza, 2014; Sharifi, 2016).

Compact development is often framed as the 'ideal' urban form for fostering inclusive and sustainable cities, because of the associated infrastructure efficiency, public transport viability, proximity-based accessibility and limited impact on agricultural and other land beyond the urban edge (Gordon & Richardson, 1997; Camagni, Gibelli & Rigamonti, 2002; Suzuki, Cervero & Iuchi, 2013; Seeliger & Turok, 2015; Smets & Lindert, 2016; IRP, 2018). Infrastructure costs can be lower in infill developments, especially where the existing infrastructure can handle additional load (Steinacker, 2003).

The 'Weight of Cities' report critiques blanket support for increased density and argues that increased urban densities are only useful where they enhance the efficiency, sustainability and inclusiveness of cities (IRP, 2018). Compact development can be associated with land transformation, urban green space reduction, increased impermeable surfaces, exacerbated heat island effects, dark and cramped living conditions, and exacerbated exclusion due to high land and housing prices (Neuman, 2005; Aquino & Gainza, 2014; Krupp & Acharya, 2014; IRP, 2018; Mueller, Hilde & Torrado, 2018). 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 COVID-19 pandemic, concerns were raised that high-density areas were most vulnerable to the spread of the virus.[5] Neuman (2005) critiques the compact city movements for their inability to address concerns around overcrowding and unhealthy living conditions. Furthermore, 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.

Urban expansion projects are often argued as the most cost-effective way to build a large number of houses quickly, benefiting from economies of scale (Ballard, 2017) and fewer administrative barriers (Biermann & van Ryneveld, 2007; Cirolia, 2014) - thus enhancing the achievement of the right to housing and basic services. Furthermore, it is argued that if growing cities plan for their 'inevitable expansion' they can better control the form of urban growth to ensure both environmentally sustainable and socially just outcomes (Angel et al., 2011; Mtapuri & Myeni, 2019). However, these potential benefits must be weighed against increased resource consumption, urban-based pollution, congestion, environmental degradation, land use segregation, the cost of

[5] Infection data, however, has 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, Sabouri & Ewing, 2020) and the quality of living and communal spaces.

infrastructure, services and transport (Camagni, Gibelli & Rigamonti, 2002; Mubiwa & Annegarn, 2013). Externalising the costs of accessing urban opportunities has the potential to marginalise residents, and undermine poverty alleviation efforts (Chapman, 2007; Goebel, 2007; Crane & Swilling, 2008; Adegun, 2018; Mahendra & Seto, 2019; Turok, Visagie & Scheba, 2021).

Marcuse (1998: 105) notes that "[h]ousing and urban development are conflict-laden arenas: what benefits one hurts another". On the surface, housing development decisions can seem to be choices between ensuring enough adequate housing to meet the demand (through urban expansion) and reducing resource consumption and environmental impacts (through infill). High density areas with good accessibility tend to have higher housing prices, which forces poor residents into areas with poor accessibility and higher transport costs (IRP, 2018). Consequently, there is significant pressure to build government-led housing in well-located areas with centrally located developments and those in close proximity to central business districts (CBDs) tending to be considered as 'well-located' (Landman, 2010). However, Biermann (2005: 1172) argues that

> *...no clear evidence has emerged which conclusively supports the assertion that central locations are better than peripheral locations. For each piece of evidence which suggests a relationship between centrality and least cost and greater benefits, there are as many, if not more, pieces of evidence which negate that relationship... It is certainly not clear that a compact city alone will be significantly better for poor households than a more sprawled pattern of development.*

Furthermore, Charlton and Meth (2017: 96) contend that the proximity to the CBD "is not always a reliable indicator of locational disadvantage or advantage". Although job opportunities are often concentrated around CBDs, employment is influenced by a number of other factors such as education and skills, not just proximity to job opportunities. Furthermore, there can be a mismatch between job opportunities and the skills of people living in the surrounding areas (Cross, 2014).

There is no scholarly consensus on how to assess which areas are well-located, and simplified location-based assessments have proved insufficient to measure the real impact of development – regardless of form. However, assessing which areas are well-located can be complex, especially where being well-located to economic opportunities is not aligned to being well-located to amenities and services (Culwick Fatti, 2021). The timing of when assessments are made can also influence results regarding the quality and level of access, especially because access to services, transport and economic opportunities changes over time, especially as new developments become more established. Furthermore, Aquino and Gainza (2014: 5877) argue that the scale of assessment

is also important, where for example "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". Assessing a wide range of impacts, including quality of life, access to economic opportunities and urban amenities together can provide a more nuanced understanding of where would be considered well-located and in terms of what outcomes (Aquino & Gainza, 2014).

This research adopts a multi-scalar approach to understand the various impacts and whether conclusions at the project scale translate to the broader urban scale. A range of different types of access are assessed, including material access to housing and basic services, overall quality of life, access to amenities and economic opportunities, and subjective opinions. Finally, given the contention between infill development and urban expansion, this research considers both forms of development and assesses how the positives and negatives of each play out in relation to social justice and environmental sustainability. Importantly, this research is conscious of the need to critically examine the relevance and applicability of the dominant interpretations of a socially just and environmentally sustainable city, as these have developed primarily in response to cities in the global north, and are not necessarily applicable for southern cities (Dempsey & Jenks, 2010).

2.4 Researching Southern cities and expanding knowledge approaches

Previous sections of this chapter demonstrated how African urban development is taking place in forms and a rate that are fundamentally distinct from cities in the global North. Cities in the global North developed under the assumption of abundant resources and largely before awareness of the impact of development on the environment. Conversely, Southern cities are not only growing faster than their Northern counterparts did, but cities in the South are also under pressure to respond to climate change, resource scarcity, poverty and inequality. Sharifi (2016: 2) argues that Southern cities "can learn from successes and failures of previous movements and be directed into more sustainable pathways to avoid lock-in into non-sustainable patterns". However, there is a growing literature noting the inadequacy of urban development approaches from the global North in responding to urban development in the global South (Dempsey & Jenks, 2010; Parnell & Pieterse, 2016).

Southern urbanism has emerged from the need to develop theories of the urban that are sensitive to the dynamics of Southern cities, and which more accurately describes the processes at play in these contexts. Urban development approaches that claim to be universally applicable tend "to be disconnected from local issues" (Croese, 2021: 3), thus limiting their relevance for responding to local contexts and transform the systemic causes of environmental and social ills. Southern

scholars argue that normative and universal framings are weak bases for decision-making at local scales, and emphasise the importance of expanding knowledge bases to include a wider geographical focus (Robin & Castán Broto, 2021). Despite critiques of global North scholarship and urban development approaches, Southern urbanism does not aim to reject established and dominant theories, but rather to include a wider set of analysis and contexts, and by so doing build a more complex understanding of what shapes cities (Roy, 2009; Parnell & Pieterse, 2016). Roy (2009) calls for a plurality of approaches to develop new conceptual frameworks that not only reveal insights into the 'exceptions' to dominant urban theory, but also enhances the ability to theorise *all* cities.

Similar to theories of the urban, just sustainability literature is also dominated by global North scholarship (Hughes & Hoffmann, 2020; Croese, 2021) which has proved inadequate in describing and guiding transitions within the global South (Khosla & Bhardwaj, 2019). Innovations that are based on global North assumptions rather than local understandings, tend to fail and allow environmental and social issues to persist or worsen (Jasanoff, 2018; Bond et al., 2019). Appropriated best practice ideas and plans that are argued as being 'in the best interest of society' can obscure vested interests (de Satgé & Watson, 2018) with potentially negative implications for social justice and environmental sustainability. The planetary boundaries discourse that is highly influential in global framings of the environmental crisis responds directly to the environmental sustainability challenges in the global North, and specifically their need to reduce over consumption. In contrast, the environmental crisis in the global South is less a problem of over-consumption, and rather a lack of formal infrastructure, which adds to the risk and vulnerability burden of communities in informal contexts. Thus, there is a need to reposition global framings around sustainability and what just sustainability encompasses, to ensure that the contexts and needs of communities in the global South are prioritised.

Definitions of just sustainability are contested in both the literature and among practitioners. It is often framed as a neat and bounded concept that encompasses the boundary space between social justice and environmental sustainability in a concise and accessible way. However, this boundary space is neither neat, uncomplicated nor constant over time. Uncritical use of the term 'just sustainability' (and arguably any similar term) to describe this boundary space can be problematic as it hides instances where conflicts and contestations exist. This research thus shies away from using this 'just sustainability' in favour of the more open (if less concise) framing of the 'boundary space between social justice and environmental sustainability'. Despite the relative usefulness of the idea of a 'boundary space', this framing also has limitations in its ability to provide a concept

that encompasses all complexity within the interaction between social justice and environmental sustainability.

The envelope of the 'desired' state that is socially just and environmentally sustainable, is bounded by numerous social, ecological and socio-ecological limits, which are determined by culture, biophysical and social elements - thus open to interpretation and shifts (Leach et al., 2018). The way in which these limits are defined and what is meant by just sustainability, fundamentally influences research outcomes and decision-making processes (Newell, Geels & Sovacool, 2022). Jasanoff (2018) calls for humility when considering what a transition to just sustainability entails, and what is necessary to effect transformative and systemic change. Without a unifying definition, different actors interpret just sustainability differently and in ways that align with their particular interests, agendas or capacities. Dominant actors and most influential voices tend to overshadow alternative interpretations. Inevitably this results in the adoption of biased and narrow definitions of social justice or environmental sustainability, which inadvertently perpetuate the systems that have caused the environmental and social crises.

The way we understand the city and how we interpret environmental sustainability and social justice can either enable or hinder just sustainability transitions in cities. Robin and Castán Broto (2021: 7) argue that it is necessary to look "outside dominant circuits of knowledge and market-led interventions" to make progress towards just sustainability. The growing literature on just sustainability increasingly emphasises the importance of addressing knowledge biases, knowledge co-production, engaging with a range of perspectives and challenging universalised assumptions (Campbell, 2013; Mummery & Mummery, 2019; Pasgaard & Dawson, 2019; Hughes & Hoffmann, 2020). In line with Southern urbanism, scholars argue that normative ideas around social justice and environmental sustainability need to be repositioned and the notion of the just sustainable city must be reimagined (Castán Broto & Westman, 2019).

Research from the global South and based on a range of knowledge approaches can challenge universalised notions of the city and what sustainable development means, and thereby prompting innovative solutions or approaches (Castán Broto & Westman, 2019). Acknowledging difference across space opens up possibilities for different end points and pathways - that aren't linear or limited by a single imagination of what 'developed' means (de Satgé & Watson, 2018; Jasanoff, 2018). This not only enables greater openness and the potential to learn from different contexts, but it also does not as obviously place Southern cities on the back foot with respect to global North cities and.

It is increasingly clear that traditional modes of social engagement and urban planning are insufficient to address the contemporary challenges, particularly in highly unequal cities (Ziervogel, 2019). Cities are recognised as playing an important role in furthering just sustainability (Malloy & Ashcraft, 2020), however, urban projects that are designed to address climate change and foster environmental sustainability often entrench inequalities, and axes of privilege and disadvantage (Robin & Castán Broto, 2021). Scholars emphasise the importance of bringing environmental sustainability considerations into debates on just cities, and moving beyond merely identifying injustices to engaging more deeply with the social, political and institutional elements that shape urban trajectories (Hughes & Hoffmann, 2020).

To make real progress towards socially just and environmentally sustainable cities, it is necessary to address the root causes of environmental degradation and injustice, because addressing the symptoms or superficial issues through short term solutions can potentially exacerbate unsustainable and unjust outcomes (Malloy & Ashcraft, 2020; Swyngedouw, 2021). This is particularly important because in order to further justice and sustainability simultaneously, new imaginaries are needed that challenge the dominant systems, which have facilitated negative outcomes (Hallowes & Munnik, 2019). It is also necessary to understand how different stakeholders navigate trade-offs between and within social justice and environmental sustainability and how decision-making can privilege one form over another to serve their vested interests (Newell, Geels & Sovacool, 2022). Newell et al. (2022) cite examples of how stakeholders with vested interests in carbon-based industries have motivated for procedural justice through increasing participation in order to delay more fundamental shifts in towards environmentally sustainability and a just distribution of resources.

There is a dynamic interplay between injustice and environmental issues that is fundamentally linked to uneven knowledge approaches and the exclusion of non-dominant perspectives (Gupta et al., 2020; Hughes & Hoffmann, 2020). Rectify uneven knowledge approaches is a prerequisite for realigning the structural elements that lead to inequality and environmental ills (Hughes & Hoffmann, 2020). If the Southern turn is to help build new imaginaries and build new theories of the urban, it's important that the gaps in the existing theory are properly conceptualised and that the things that are problematic (e.g. dominant knowledge that silence other perspectives) are realigned. Considering a plurality of perspectives, including those from the global South together with those from the global North, can be considered a form of justice of recognition.

2.4.1 *Interdisciplinary research*

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: 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".

Croese (2021) and others argue that developing appropriate understanding of African urbanisation requires both addressing the paucity of research on Southern cities and expanding the methods and forms of knowledge. Parnell and Pieterse (2016: 241) note that:

> *it is inordinately difficult, using only established research methods, to research the African city and use the findings of research from Africa to destabilize urban theory formation. Either Africa must be ignored or the theory, method and data of urban studies must change. The former is not possible and so we need to better understand the barriers to finding appropriate new methods of (African) urban research.*

Interdisciplinary research and knowledge co-production have been identified as important means of expanding research and knowledge approaches, and are common in Southern urbanism research. Interdisciplinary research transcends traditional disciplinary and sectoral boundaries, and thereby gains deeper and more nuanced understanding complex systems, that can inform strategies to address complex challenges. This type of research has gained wide support for its potential role in understanding socio-political-environmental challenges such as climate change, sustainable development and urban related issues (Petts, Owens & Bulkeley, 2008; Robinson, 2008; Culwick & Patel, 2017; Culwick et al., 2019). It enables the multidimensional elements of socio-ecological systems to be considered, including both quantitative data regarding 'what is' and qualitative analysis of the underlying socio-political assumptions and power dynamics – how it came to be.

Ziervogel (2019) demonstrates how applying a hybrid set of approaches that straddle the formal/informal divide and that are both bottom up and top down can transform how things are done. Interdisciplinary research requires not only integrating different types of knowledge, but also shifting epistemologies around knowledge, power and how different methods influence research findings and in turn decision-making processes. This is important where conflicting rationalities exist because decision-making in the context of competing interests is influenced by power and politics (Murdoch, 2000; Watson, 2003). Interdisciplinary research can reveal understandings and surface conflicting rationalities that are important for informing decision-making (Lu et al., 2021; Pineo, 2022). Furthermore, 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.

One of the values of drawing on multiple methods and numerous data sources is the ability to triangulate the evidence and help to draw robust conclusions. This lessens the risk of the research being biased by one type of data or perspective (Yin, 2009). In addition, case studies are strengthened when evidence is obtained not only from multiple sources and methods, but also at different scales (Yin, 2009).

This research focuses on exposing the complex interactions between environmental sustainability and social justice, 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 in 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.

This study steers away from simple and binary conclusions of government-led housing to reveal nuance in the interaction between social justice and environmental sustainability. Multiple methods are thus deliberately employed to reveal the richness and messiness of everyday experiences of residents (Charlton & Meth, 2017; Lemanski, Charlton & Meth, 2017), and bring them into conversation with synthesised data regarding overall outcomes at the settlement and city-region scales. Furthermore, the study brings together reflections from both residents and those involved in the decision-making around the respective housing projects. This plurality of approaches to knowledge generation enables a nuanced understanding of the intersection between justice and sustainability to be revealed, as well as the decision-making processes that influence

justice and sustainability outcomes. It further facilitates a multi-scalar assessment of government-led housing – at the household, project and city-region scales– that has been lacking in other studies.

2.5 Conceptual framework

Despite the growing emphasis on building cities that are both just and sustainable, no single framing can address all aspects of this goal. This chapter has presented how the boundary space between social justice and environmental sustainability has been framed in theory, engaged in policy and decision-making, assessed in practice, and understood through research. The interconnectedness of these four elements, is the basis of the conceptual framework, and is presented in Figure 2.1.

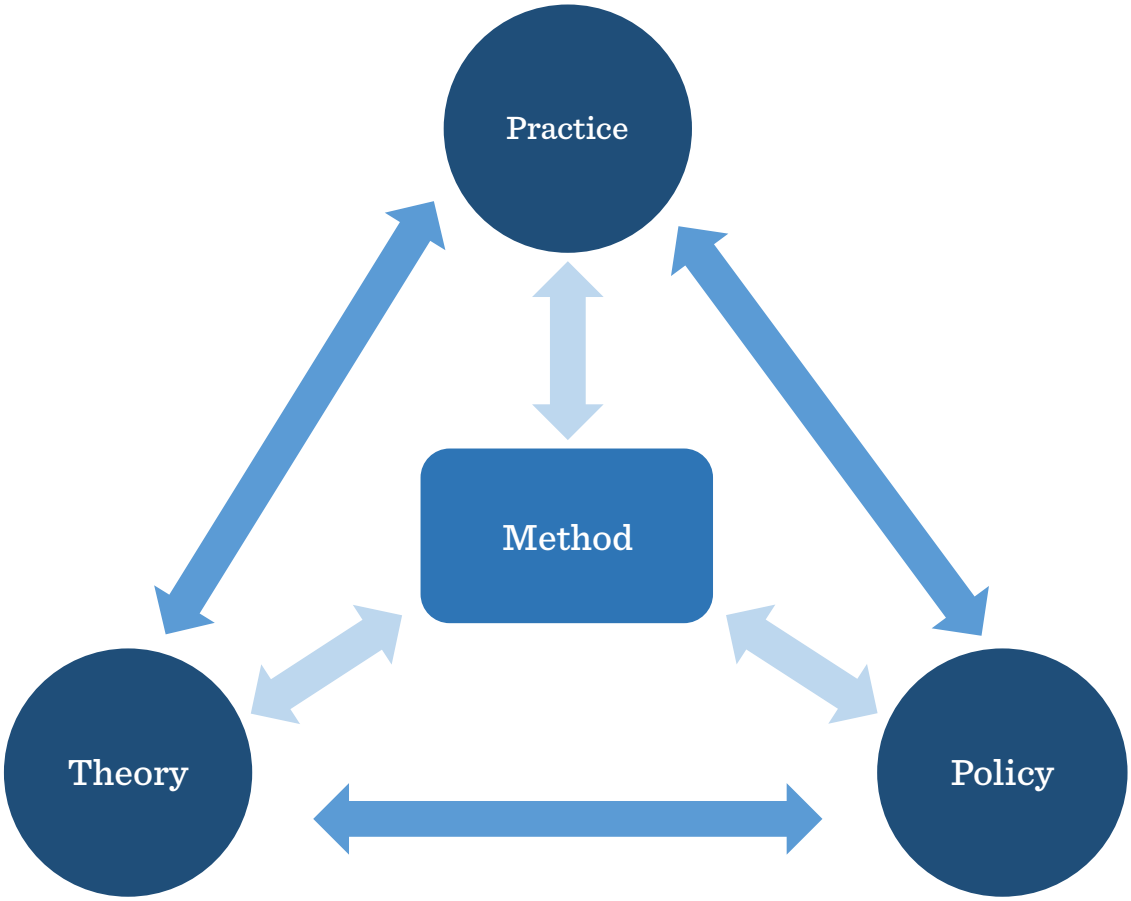

Figure 2.1: The conceptual framework showing how understanding the practical, policy and theory of the boundary space between social justice and environmental sustainability are not only interconnected with each other, but are fundamentally influenced by the methodology used to research these dynamics.

This research posits that developing complex understandings of how social justice and environmental sustainability interact is important for theory development, policy and decision-

making, and practical outcomes (Simon et al., 2016; Leach et al., 2018). The three corners of the framework represent the three key elements of the research, including theoretical, policy and practical elements. There is a bi-directional arrow between each of these elements to represent their interconnectedness. The three questions in this research represent each of these elements in turn, with the methodological approach binding them together.

Understanding practical outcomes through interrogating infrastructure and forms of development is helpful in understanding the interactions between social justice and environmental sustainability as these both influence how resources, and the benefits and costs of development are distributed across society, time and space. However, these practical outcomes are fundamentally influenced by decision-making and policy processes. Furthermore, the understanding of the practical outcomes in turn influences decision-making and policy approaches.

The Sustainable Development movement has demonstrated how the theoretical framing of the boundary space between social and environmental systems can have a fundamental influence over local and international policy. The process of debating and engaging the theory in policy development can further refine theoretical framings. At the same time, better understanding case studies and how dynamics play out in practice is important for refining theory.

The conceptual framework centres around the importance of knowledge production methods in how the boundary space between social justice and environmental sustainability is framed in theory, translated into policy and implemented in practice. However, knowledge production does not exist in a vacuum and is influenced by the dynamics and factors at play within each of these other realms (theory, policy and practice). A bi-directional arrow between each of these elements is used to represent these interconnections.

A multidisciplinary research approach is adopted that incorporates qualitative and quantitative methods. Given the distinct methodological practices within social justice and environmental sustainability research, this research deliberately draws on a range of data and methods, including, statistical, open and closed-ended interviews, case study and photographic methods Furthermore, this thesis includes two photo essays, which provide a tacit understanding for the reader of the different housing developments. These visual representations, through story-telling techniques augment the statistics, policies and quotes from residents and key informants,

Although deep and specialised knowledge is important for addressing contemporary wicked problems, there is a growing emphasis on the role of interdisciplinary approaches and multiple

forms of knowledge (Culwick and Patel, 2017; Vogel et al., 2016). Rather than focusing on what can be gained from specialised technical skills and deep interrogation within a single field, this research explores what is revealed when different types of knowledge and perspectives are brought together. Although this research contributes to and draws primarily from the field of Geography, multiple other disciplines have been drawn on in this research, for which the findings would also be relevant. In examining the implications of housing developments, this study draws on Urban Studies and Urban Planning. The particular focus of this research on conflicting rationalities, although initially introduced into the Urban Planning field, draws on ideas from Anthropology and Political Science to help understand decision-making processes and how different motivations and interests influence decisions and outcomes. The conceptualisation of the boundary space between social justice and environmental sustainability is informed by Sustainable Development, Environmental Sciences, Climate Change, Ecology, Sociology and Development Studies. By incorporating elements of these disciplines into a single Geography study, enables rich insights to emerge and offers new opportunities for the field of Geography to better understand the interaction between social and environmental systems.

2.6 Conclusion

Examining the boundary space between social justice and environmental sustainability can help to develop a better understanding of how and where conflicts emerge, and how progress towards just sustainability can be made (Hughes & Hoffmann, 2020; Westman & Castán Broto, 2021). This research responds to the relative paucity of research into just sustainability transitions within urban contexts (Hughes & Hoffmann, 2020).

A key epistemological contribution of this research is in connecting the ways in which knowledge and understanding are developed in the boundary space between environmental sustainability and social justice fundamentally influences how we view just sustainability. This research asserts that an interdisciplinary approach is necessary to build a robust and nuanced understanding of the boundary space, and that single disciplinary approaches will inevitably lead to blind spots and incomplete understandings that are likely to perpetuate social injustice. To understand what influences decisions and in turn outcomes, it is critical to interrogate both what knowledge guides decisions, as well as the underlying assumptions and the different philosophical, ethical and moral positions of decision-makers (Patel, 2006a).

3 Background to the study and methodological approach

In the previous chapter, I demonstrated how approaches to research and knowledge production play an important role in just sustainability transitions. This research has been designed deliberately in response to this, and adopts a multidisciplinary approach to examine just sustainability from multiple perspectives, thereby avoiding the limitations of single disciplinary approaches. The research is innovative as it integrates statistical, qualitative and visual datasets to develop a complex understanding of the boundary space between social justice and environmental sustainability. The purpose of this chapter is to present the context for the research and provide detail into how the research has been designed and conducted, and to explain why the methodological approach is appropriate for addressing the overall objective and research questions. Each of the three research questions considers a different element of the boundary space between environmental sustainability and social justice, including practical, policy and theoretical considerations.

The practical outcomes of government-led housing for residents, related to social justice and environmental sustainability, are considered in both aggregated statistical terms and the personalised lived experiences of residents. An examination of the steps each of the two case study projects went through – from conceptualisation and development to implementation – is informed by insights from key informants. This analysis reveals how government-led housing projects envisioned to foster social justice and environmental sustainability were realised in practice. By juxtaposing these analyses, it is possible to reflect on the interlinkages and disconnects between the practical outcomes and policy processes. The points of friction that are revealed between the policy processes and practical outcomes reflects, in part, where the current theoretical framings of the boundary space between environmental sustainability and social justice need to be refined.

This chapter provides a background into government-led housing in South Africa as the broad sectoral focus of this research. It then describes how the thesis has been carefully curated to ensure that appropriate data and methods are used to examine practical, policy and theoretical elements, and to enable connections to be drawn between each of these findings. The research is underpinned by the belief that the methodological approach plays a critical role in shaping findings and conclusions, and that adopting a multidisciplinary methodology is necessary to build a complex and nuanced understanding of the interaction between social justice and environmental sustainability. In undertaking this research, various ethical considerations related to the respective methodologies have been navigated and these are discussed in detail.

3.1 Government housing in Johannesburg, South Africa

Apartheid left in its wake a housing crisis, which was coupled with increasing rates of urbanisation (peaking at nearly 5% in 1987) that resulted South Africa's population being 54% urban in 1994 (World Bank, 2018). South Africa's post-apartheid government established the national housing subsidy programme as a primary welfare package targeted specifically to help people living in informal dwellings to access adequate shelter and basic services. This housing programme was considered one of the primary tools to redistribute resources and benefits to previously excluded groups (Charlton & Meth, 2017; Myeni & Okem, 2019; Adebayo, 2021). It was also designed as a tool for urban spatial restructuring, and to reduce inequality and marginalisation (Parnell & Crankshaw, 2013).

In South Africa, the housing programme has established a range of options to support different segments of the low-income market. Citizens in the lowest income group (R0-R3 500 per month) can qualify for full subsidies include a free house, which is typically a free-standing or semi-detached houses within a broader housing development. Households in the 'gap' market earning between R3 501 and R15 000 per month can apply for partial subsidies that either reduce the cost of buying a house (e.g. through the Finance Linked Individual Subsidy Programme), or provide access to serviced sites or building materials for citizens to construct their own houses (Department of Human Settlements, No date). The government also supports affordable rental opportunities through the Social Housing programme, for low-income citizens (R1 500 - R7 500 per month) (Department of Human Settlements, No date). Residents who do not qualify for these government subsidies must rely on market-led housing, through bonded or rental options, or self-built housing (Jenkins & Smith, 2001; Newton, 2013).

The housing programme is seen as an opportunity to support people onto the housing ladder (Newton, 2013), with a key intention of changing the ownership profile of property in South Africa (Rubin, 2014). The housing programme is strongly tied to the promises of a society free from apartheid oppression, and was emphasised in the election campaigns both pre- and post-democracy. It stresses the importance of land or home ownership (Newton, 2013) as a means of wealth creation and facilitating urban inclusion (Adebayo, 2021). The South African constitution provides the right to adequate housing (section 26) and places responsibility on government to take reasonable action to ensure that this right is realised (Republic of South Africa (RSA), 1996). In response to this directive, South Africa's post-apartheid government has delivered approximately 3 million housing opportunities, which have benefited an estimated 10 million people since 1994 (Turok, 2016a; Adebayo, 2021). The housing programme has achieved this mostly through

relocating residents into newly constructed housing developments, and to a lesser degree in situ upgrading of informal settlements.

During apartheid, South African cities were deliberately designed to exclude Black people through separating residential areas from economic opportunities and urban amenities (Adebayo, 2021). This resulted not only in structural inequality where Black people had disproportionately worse access to resources and opportunities, but also in an unsustainable spatial form with a large urban development footprint that entrenched a dependence on long commutes. In 2004, the national government released the 'Comprehensive Plan for Housing Delivery: Breaking New Ground' (BNG) in response to critiques that the housing programme had been unsuccessful in its aim of addressing the housing backlog (DPME, 2014; Adebayo, 2021). This plan explicitly brings social justice and environmental sustainability imperatives together in setting out that its "key objective is to integrate previously excluded groups into the city and the benefits it offers, and to ensure the development of more integrated, functional and environmentally sustainable human settlements, towns and cities" (Department of Human Settlements, 2004: 19). The BNG acknowledges the need for integrated housing developments[6] in well-located areas, where the needs of residents, beyond merely housing and services, could be met (DPME, 2014). The policy specifically focuses on urban areas, and emphasises the role of increasing settlement density and building integrated housing developments to improve access to services and economic opportunities (Department of Human Settlements, 2004). It highlights that, where possible, informal settlements should be upgraded in situ, through re-blocking and with the participation of residents (Mitlin & Bartlett, 2020).

Early in South Africa's democracy, debates focused on whether government-led housing should deliver a basic house to as many people as possible, or to build better quality housing for fewer people (DPME, 2014). Over time, both of these logics have been applied within the human settlements programme. Initially (and in some cases this emphasis has remained) there was a focus on the number of units rather than quality; however, there has been a shift (with BNG) towards a more integrated approach. Despite the intentions for the programme to be procedurally just, beneficiaries have generally not been included in decision-making processes (Charlton & Meth,

[6] Integrated housing developments, according to the 2004 Breaking New Ground (BNG) housing policy, focus 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: 17).

2017). Furthermore, the process for applying and allocating houses has been described as opaque at best (Rubin, 2011), and fraudulent and corrupt at worst (Tissington et al., 2013).

There is a substantial bank of literature that engages with different elements of government-led housing in South Africa. Many of these elements relate to either social justice or environmental sustainability, although the focus on environmental sustainability is less common (Adegun, 2018). Some of these studies include the location-based cost implications of government-led housing (Biermann, 2005; Biermann & van Ryneveld, 2007), how the location and form of government housing impact on just spatial form (Haferburg, 2013), the lived reality of residents of government-led housing (Charlton & Meth, 2017), the inclusivity of the house allocation process (Rubin, 2014), and the impact of government-led housing on inclusion (Adebayo, 2021). A few studies have deliberately considered both environmental and social implications of government-led housing developments (e.g. Irurah & Boshoff, 2003; Goebel, 2007; Adegun, 2019). Despite the number of studies both locally and internationally, few have considered the interaction between social justice and environmental sustainability in relation to government-led housing (Adegun, 2018). A few of the studies that do provide insight into both social justice and environmental sustainability are discussed below.

Studies have asserted that poor planning has caused negative outcomes for government-led developments and undermined the ability of these developments to further environmental sustainability (Mtapuri & Myeni, 2019). In response to concerns over problematically located settlements, Goebel (2007) proposes that in-situ upgrading and increased rental opportunities could provide opportunities for better-located housing that caters to the needs of the poor while addressing environmental sustainability imperatives. Other South African studies have examined government-led housing in relation to sustainable development and climate change (Mtapuri & Myeni, 2019; Okem et al., 2019), but have done so in a general way (Mabin, 2021) without materially enhancing the understanding of the boundary space between environmental sustainability and social justice.

Despite widespread critiques of housing on the urban edge (e.g. Oldfield, Parnell & Mabin, 2004; Turok, 2011; Cirolia, 2014), and the government's policy preference for integrated, efficient and sustainable housing, urban expansion continues to be prioritised for various reasons. Land on the urban edge is typically cheaper, which means that less of the housing subsidy is spent on land, thus maximising the number of housing units that can be constructed from the subsidy. Additionally, in centrally located areas, higher income property owners and municipal rate structures create

disincentives for infill developments (Adebayo, 2021). Other reasons include the urgency of the housing need and that land on the urban edge generally has fewer administrative and legal constraints, and that those who need to be housed are already in peripheral locations (Charlton, 2014). Infill projects, in contrast, are considered to be more expensive and administratively burdensome.

Biermann and van Ryneveld (2007) assessed the modelled costs and affordability of different approaches to housing developments, and which costs are borne by the government and which by households. The study aimed to identify the most cost-efficient location and typology for government-led housing, based on costs for land, housing units, engineering services, environmental services, social amenities, retail (consumer) and transportation. The study found that overall, the cost of the developments decreased with increasing density. However, housing unit costs increased significantly with increasing density, to the extent that these costs outweighed the benefits of reduced land consumption and infrastructure efficiencies (Biermann & van Ryneveld, 2007). The study concluded that although higher densities incurred significantly lower costs, these costs are indirect, whereas the higher unit cost has a direct 'cash' implication, and is thus likely more influential in government decision-making. Furthermore, while better located, dense developments improve employment potential, they do not improve earning potential, and people in central locations without income are worse off because of the higher cost of housing (Biermann & van Ryneveld, 2007). The mixed outcomes of this and other studies reveal both the complexity of beneficiaries' needs (Charlton & Meth, 2017) and the interplay between social justice and environmental sustainability considerations.

Different spheres of government have used different logics to justify adopting different approaches towards achieving BNG objectives. The relative roles of the government spheres has contributed towards these differences. In South Africa, the National government (Department of Human Settlements and the National Treasury) is responsible for housing policy, consultation across the three spheres (national, provincial and local), and funding allocation. Provincial Department of Human Settlements is responsible for developing provincial housing policy, strategic planning and coordination within provinces, and managing the housing subsidy list. Provincial government also has the competence to implement housing projects and is primarily responsible for assessing and monitoring municipal housing programmes, as well as administering national subsidies (National Treasury of the Republic of South Africa, 2003). Local government is responsible for ensuring adequate access to housing for those living within municipalities. As such, "they initiate, plan, co-ordinate and facilitate appropriate housing development within their boundaries, either by

promoting developers to undertake projects or by playing the role of developer" (National Treasury of the Republic of South Africa, 2003: 161). Local municipal government is ultimately responsible for all the associated infrastructure and services, and the maintenance thereof, regardless of which government sphere has initiated and developed a housing project.

Housing projects initiated by the different spheres tend to take different forms, in part because of the relative roles and responsibilities each sphere holds. A striking difference has become evident between the Gauteng Provincial Government's mega human settlement strategy, which prioritises number of housing units, and the City of Johannesburg's plans to densify the City along transit corridors, which considers housing developments in combination with broader city infrastructure development (Ballard et al., 2017). Provincial government's mega human settlement strategy aims to address housing needs through large-scale projects, designed to achieve economies of scale and 'catalyse' economic and social development opportunities (Ballard, 2017). This approach requires large tracts of undeveloped land to create new integrated human settlements, which are typically urban expansion projects. Conversely, Johannesburg's urban development plans concentrate development within the existing urban fabric through infill, and by upgrading existing infrastructure networks to cope with higher population density (Ballard, 2017). Albeit through very different approaches, both of these strategies aim to enhance environmental sustainability and social justice.

This research focuses on government-led housing in South Africa because there is contestation around what approach can best deliver social justice and environmental sustainability. This contestation stems from the complexity and wide set of considerations that must be considered within decision-making processes. However, given the scale of government-led housing developments in South Africa, it is critical that they contribute positively towards both social justice and environmental sustainability. It is thus an appropriate focus for interrogating the research objective of examining the boundary space between social justice and environmental sustainability.

3.2 Methodological approach in response to the research questions

The research objective is explored through three research questions, each of which focuses on a different element of the boundary space between social justice and environmental sustainability, including the practical outcomes, policy approaches and theoretical framings. A relevant methodology has been employed for the respective questions, and each is the focus of a separate chapter.

The first research question, which considers the practical outcomes of government housing on social justice and environmental sustainability, is tackled primarily in Chapter Four. A representative survey and resident interviews are used to interrogate the social justice and environmental sustainability implications of the two government-led housing case studies – through the lived experience of residents, as well as the broader context of government-led housing in Gauteng. The statistical data is complemented by open-ended responses and two photo essays, which provide texture to and personalises the quantitative findings. The photo essays that stand on either side of this chapter further deepens the understanding of residents' lived experiences of Lufhereng and Pennyville.

Chapter Four draws on the Gauteng City-Region Observatory's Quality of Life survey, a large, representative survey of Gauteng residents, together with detailed interviews with residents in each case study, Lufhereng and Pennyville. By bringing these datasets together, this chapter develops a multi-scalar and nuanced assessment of government-led housing, which would not be possible with only one of these datasets. This analysis uses empirical data to explore the complex interplay between various characteristics of social justice and environmental sustainability, with the intention of opening up opportunities for debate around their interaction.

In this study, 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 of residents. This framing of social justice is based on the premise that raising the living conditions of residents and enabling access to various services and opportunities for the poor, contribute towards reducing multidimensional poverty and inequality (Mushongera, Zikhali & Ngwenya, 2017). Facilitating access to economic opportunities and social amenities minimises the associated financial, social and time burdens, which tend to be disproportionately borne by poor and marginalised communities. Chapter Four focuses on distributional justice, rather than procedural justice or justice of recognition, because distributional justice intersects most obviously with environmental sustainability considerations. Environmental sustainability in relation to government-led housing can be divided into the environmental impacts of construction and the impact of the post-construction phase. This analysis focuses on the post-construction phase, which is assessed through resident access to water, electricity, sanitation and waste removal, the ease of accessing services and the average length of commutes – which are both proxies for resource consumption, access to and use of public transport, and urban density. Although the primary focus of this assessment is on the daily lives of residents, some reflections are made regarding the

physical structures of the houses and the associated infrastructure, including the embedded resources associated with their construction.

The study shifts focus in answering the second question, and considers the policy processes and technical considerations involved in conceptualising and operationalising government-led housing projects that bring together social justice and environmental sustainability. Chapter Five uses semi-structured interviews with key informants and document analysis to explore the processes through which the Lufhereng and Pennyville projects moved from an idea or vision into a practical reality. Interviewees reflected on how environmental and social outcomes were envisioned, to what extent these visions were realised, and what factors shifted the projects and in what direction, from their vision to reality. This analysis considers how different rationalities underpin the respective understandings of sustainability and justice, and how rationalities and power influenced decision-making processes, both implicitly and explicitly. This portion of the research did not prescribe definitions of social justice or environmental sustainability, but rather aimed to surface how these concepts and associated ideas were conceptualised by different stakeholders and for the different projects. This analysis considered both the construction and post-construction phases, and provides policy-relevant insights into the boundary space between social justice and environmental sustainability.

The third research question, which is the addressed in Chapter Seven, moves the discussion from the empirical findings and considerations, into the theoretical, by examining how the conceptualisation of just sustainability can be developed to support socially just and environmentally sustainable housing delivery in Southern contexts. This chapter draws on insights from the empirical survey and interview data (Chapter Four and Five), and interrogates recent academic literature related to the boundary space between social justice and environmental sustainability. Although the historical framings around this boundary space is relevant, this chapter considers how recent theorisation, and especially from the global South, sharpens the ways in which just sustainability is understood and applied in relation to government-led housing. It further interrogates how the theoretical framings and practical challenges related to bringing social justice and environmental sustainability together are interconnected.

The two photo essays, provide visual data that layers onto the statistical, technical and policy findings in Chapter Four and Five. They enable a more visceral understanding of the lived experiences of residents and knowledge of the place in which these people navigate life, and where

the theoretical framings and policy processes translate into a tangible reality. These photo essays are an important component of the study's mixed method approach.

The range of methods employed in this study have been deliberately selected and designed to interrogate the practical, policy and theoretical aspects of the research objective described in detail below. The four data methods employed in this study include case studies, surveys, visual methods and semi-structured interviews. Both quantitative and qualitative methods are used to examine the various outcomes, processes and framings related to social justice and environmental sustainability. The study examines two government-led housing case studies in Johannesburg, Lufhereng and Pennyville, and places them in the context of the broader set of government-led housing developments in Gauteng. The sections that follow provide background into the methods used and justification into how these have been applied in this study.

3.2.1 Case studies

Case studies are one of the most frequently employed methods in qualitative research (Yazan, 2015) and provide rich opportunities to gain context-relevant knowledge and build expertise that nuances rule-based understanding and strengthens theoretical development (Flyvbjerg, 2006). Case studies can be defined as individual bounded objects that are studied intensively in relation to their environment (Flyvbjerg, 2011). 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. Watson, 2003; Venter, Biermann & van Ryneveld, 2004; Roy, 2009; Duminy, Odendaal & Watson, 2014: 201; Schindler, 2017). 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 can contribute 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.

Although the use of case studies in research design has important methodological considerations, case studies do not have a clearly defined set of methods that must or should be applied. Case studies can rely on a range of different methods, and generally case study research is strengthened by the use of multiple methods in order to triangulate findings (Yazan, 2015). Scholars have highlighted the importance of acknowledging the researcher's positionality in building reliable case study evidence (Yazan, 2015). This study has adopted a multidisciplinary and mixed-method

approach to enable multiple perspectives and findings to be developed from the cases to inform practice, policy and theory.

Research must consider potential case studies carefully to ensure that the data for the particular site(s) provides sufficient evidence for a successful study (Flyvbjerg, 2006). Case study research can entail either a single case study or multiple case studies. A single case study enables deep insights to be gained with opportunities to explore detailed findings. Using multiple case studies can counter potential critiques that a single case is an outlier or that the findings are exceptional in the broader context. However, there is significant evidence that has challenged the 'conventional wisdom' around single case studies being unable to further scientific development and build generalisations (Flyvbjerg, 2006). Selecting multiple cases can enable comparison across the different sites. With good case study research, multiple cases demonstrate that either the findings can be replicated or the contrasting evidence can enrich and nuance conclusions (Yin, 2009). It is important to balance the benefits of conducting multiple case studies with the additional resource and time requirements of having more than one case study. This decision must also consider the data collection methods chosen for the research, as some methods require significantly more resources and time than others (e.g. ethnography). How case studies are selected, in terms of the number and which cases are chosen, requires deliberate consideration as these factors fundamentally influence the type of data that can be generated and the analysis that is possible (see discussion on Sampling in section 3.2.2).

Case study selection

Lufhereng and Pennyville are both considered flagship projects by the CoJ (City of Johannesburg, n.d.). Lufhereng is located on Johannesburg's urban edge and Pennyville is centrally located to the central business district (CBD) (Figure 3.1). These case studies were selected for a number of reasons based on the research objectives. First, they were both designed under national government's updated integrated residential development programme (BNG), which explicitly seeks to build housing developments in well-located areas, and in a way that provides access to services and economic opportunities and by so doing facilitate sustainable and inclusive human settlements. This relates to the first research question, as these housing developments were initiated with the deliberate intention of providing housing that produces socially just and environmentally sustainable outcomes.

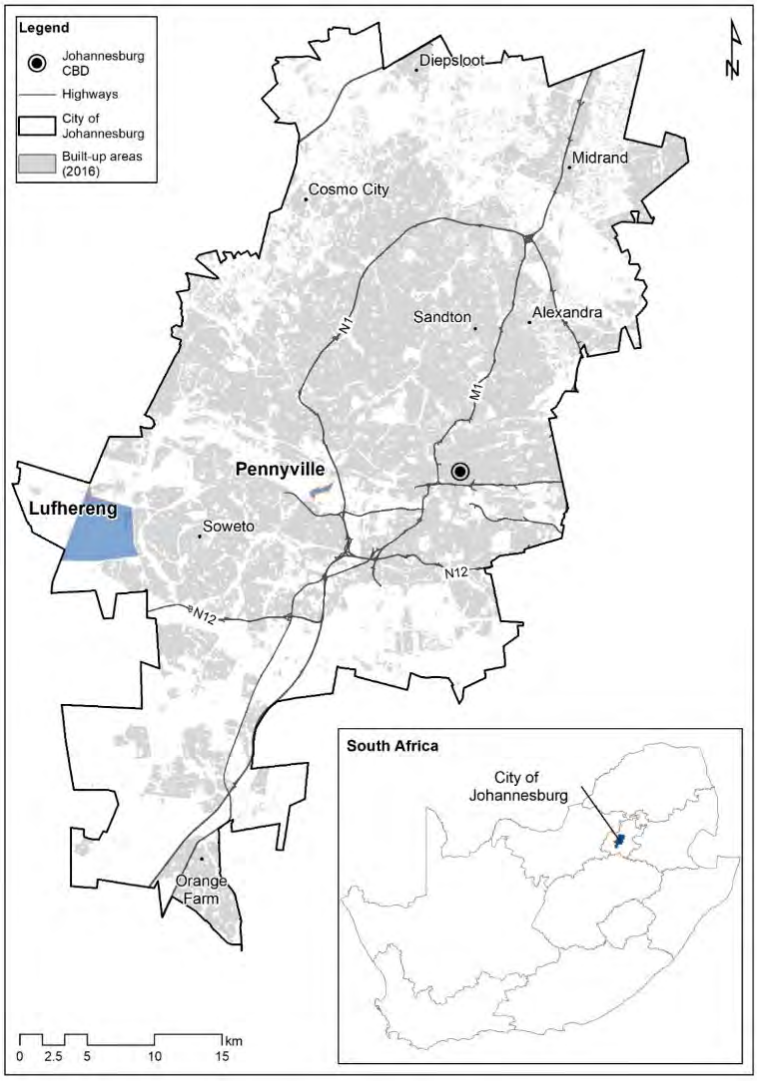

Figure 3.1: The location of Lufhereng and Pennyville (highlighted in blue) within the context of Johannesburg. Map by Christian Hamann. (Data sources: European Space Agency 2017; Gauteng Department of Housing 2014).

Second, both of these cases are either fully completed projects or have completed portions in which people are living. This means that the daily lives of residents can be studied, enabling the justice and sustainability implications of these projects to be assessed. It also means that the decision-making process that influenced the respective planning, design and implementation phases can be interrogated. That these projects are complete ensures that key informants had some distance from the projects and were able to reflect more critically on how the projects progressed and the choices that they made in the process. These factors support addressing the first and second questions that focus on understanding the practical outcomes and policy processes involved in each project.

Third, despite being guided by the same policy framework, these two developments are substantially different from each other and are based on different urban development logics. This

provides a good entry point for developing a robust understanding that is based on multiple perspectives around the ways in which social justice and environmental sustainability are conceptualised and operationalised in relation to government-led housing. Lufhereng is a large development on the urban edge that is considered as one of Gauteng's mega human settlements. It is designed to be internally integrated with respect to different types of residential typologies, economic services and social amenities. This design is meant to enable people to 'live, work and play' within the housing development. In contrast, Pennyville was designed as a strictly residential development, and an infill project located relatively close to the city centre. It has good access to a range of transport options through which residents can easily reach economic opportunities and social amenities (reducing both social and environmental burdens). These contrasting cases provide an opportunity to compare two different approaches to housing developments, namely infill and urban expansion, which reflect different rationalities. The different rationalities enable a multifaceted assessment of the social justice and environmental sustainability outcomes.

Both Lufhereng and Pennyville have been used to assess the success and identify challenges of government's housing policies (Rebel Group, 2016; The Housing Development Agency (HDA), 2017). However, these assessments have been limited in their scope and have not given an indication of the housing developments' implications for social justice and environmental sustainability in combination. The following subsections describe each of these projects and present some of their key features relevant to the boundary space between social justice and environmental sustainability. Each of the settlements is also described in Chapters Four and Five, and effort has been made to provide supplementary details below rather than duplicate descriptions in the subsequent chapters.

Lufhereng

The Lufhereng is a multi-billion rand project located on the western edge of Soweto (Figure 3.1), and is one of the largest government housing projects undertaken under the BNG policy and within the CoJ (Lekgetho, 2013; City of Johannesburg, n.d.). In the early 2000s, the Gauteng Provincial Government approached the CoJ to develop the approximately 2 000 ha site. The site was partially owned by the Province and had been designated as agricultural land. Project planning was initiated in 2004 and Phase 1 of construction began in 2008. Within two years this first phase was completed, and 2 433 houses were handed over to beneficiaries from 2010.

Figure 3.2 shows the full masterplan for the development, which includes approximately 25 000 dwelling units (although there are discrepancies across documents and over time), with a mix of

housing types and tenure options (fully subsidised, partially subsidised, bonded, and rental units) (Charlton, 2017). The first phase, which accounted for about 10% of the total dwelling units, included only fully subsidised units and bonded units (the latter completed many years after the former). Phase 1 has several housing typologies, including semi-detached, row houses (see photographs in Chapter Five), and individual dwellings on their own stand, which are either bonded houses (Figure 3.3) or houses for military veterans (Figure 3.4). In addition to these, the subsequent phases will also include flats and multi-story walk-ups.

Lufhereng was designed to significantly reduce Soweto's housing backlog, providing houses for people on the 1996/97 housing database, those living in backyard dwellings, residents of the Protea South informal settlement, and residents and labourers from the Doornkop and Zuurbult farms on which Lufhereng is located (Nkosi, 2010; South African Government, 2010). As an integrated development, it was designed to include all necessary services within the development including schools, a transport node and associated public transport routes, as well as industrial, agricultural and retail centres (Figure 3.2). In Phase 1, there is a primary school (Figure 3.5) and temporary high school (Figure 3.6), but most other services are still to be developed. The marginalising impact of this delayed service provision is one of the key social justice concerns in the area, as poor access to services and jobs undermines the benefits of improved living conditions.

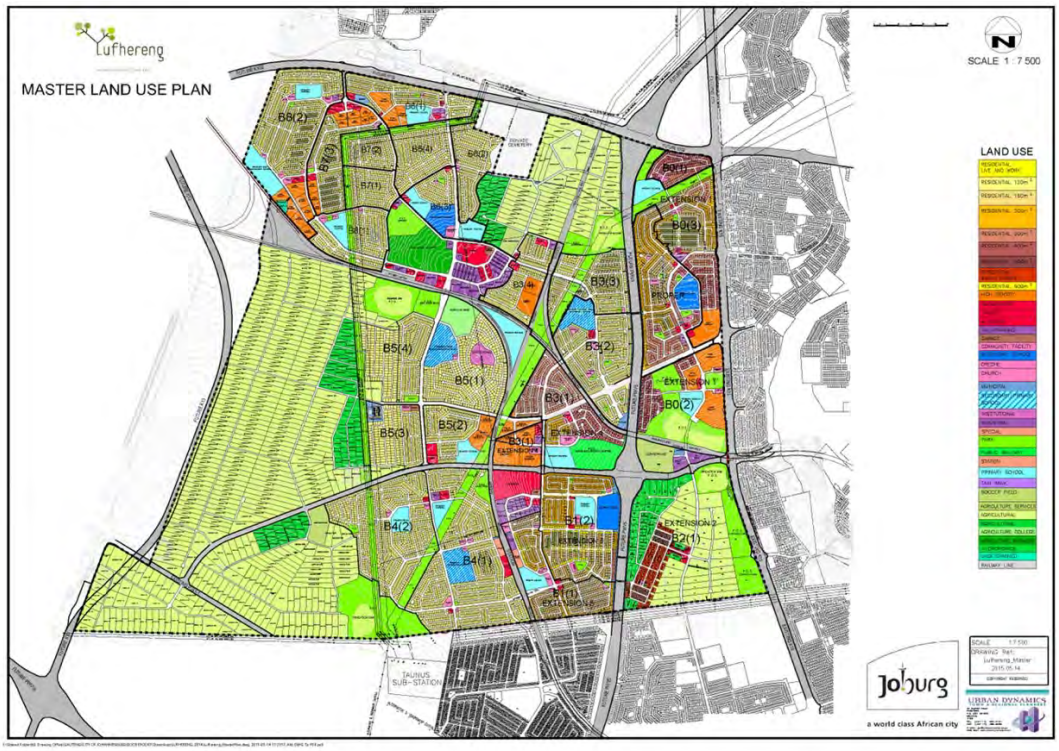

Figure 3.2: The Master land-use plan for the Lufhereng development (dated 2015). Phase 1 of the project is denoted by B0, and is located on the north eastern edge of the development. Source: Urban Dynamics.

Figure 3.3: Bonded houses on their own stand in Lufhereng Phase 1. Photograph: Clive Hassall, 2021.

Figure 3.4: Standalone military veteran's house in Lufhereng Phase 1. Photograph: Christina Culwick Fatti, 2019.

Figure 3.5: Formal primary school on the northern edge of Lufhereng Phase 1. Photograph: Clive Hassall, 2021.

Figure 3.6: Temporary high school in Lufhereng Phase 1, with bonded houses (foreground) and fully subsidised semi-detached houses (background) Photograph: Clive Hassall, 2021.

Pennyville

Pennyville is built on what was originally the Paardekraal farm, which was initially zoned for mining and subsequently industrial use. In 2005, the land was re-zoned for residential use, which paved the way for the housing development (Vosloo, 2008). Pennyville is located on the north eastern edge of Soweto, and is situated between a number of mine dumps and two arterial roads (Figure 3.7). It has close access to various types of public transport, including trainlines (Figure 3.8) and station, a bus rapid transit (BRT) station (Figure 3.9) and a major minibus taxis route connecting Soweto to the Johannesburg CBD.

Pennyville falls within the CoJ's strategic transit-oriented development plans and was one of the first housing projects deliberately designed in response to the updated BNG policy (Department of Human Settlements, 2004). The development includes both fully subsidised units (include two-story walk-ups, semi-detached houses and the occasional freestanding house), and rental units within multi-story flats (see photographs in Chapter Five). Pennyville's mix of housing types and tenure options is a key innovation in terms of socially integrated settlement. It has been used frequently as a case study for inclusive housing developments in South Africa.

Figure 3.7: Pennyville housing development and its surrounding context, including mine dumps and arterial roads. Photograph: Clive Hassall, 2021.

Figure 3.8: Metrorail trains immediately alongside houses in Pennyville. Photograph: Christina Culwick Fatti, 2019.

Figure 3.9: Aerial image of portions of Pennyville, including the BRT station on New Canada Road, Pennyville park and crèche. Photograph: Clive Hassall, 2021.

Pennyville was completed in four phases with construction beginning in 2006, with the first units completed at the end of 2007 and the final units in 2011 (Palmer Development Group (PDG), 2011). Although Pennyville is relatively well located within the city with good access to a range of transport options, the area has very few amenities or services besides the municipal park (Figure 3.10). Because the Pennyville site was so small, the CoJ decided to upgrade existing facilities in the surrounding areas, rather than building new social services (e.g. clinics) in Pennyville itself. Although this approach makes sense from an infrastructure and services planning perspective, the result is that people in Pennyville, who are typically very poor, must pay for transport or walk long distances to access key services.

Figure 3.10: Aerial image of the Pennyville park. Photograph: Clive Hassall, 2021.

3.2.2 Gathering resident insights and perspectives through surveys

One of the key elements of this study is understanding the outcomes of government-led housing. Gaining the insights and perspectives from residents of government-led housing settlements is critical for understanding the ways in which their lives have been affected by living in these areas, and uncovering the social justice and environmental sustainability impacts. Given that surveys are an established methodology for collecting both qualitative and quantitative data, they were chosen as an appropriate method for this study to tackle the first research question. This question

considers the impact and outcomes of government-led housing, in terms of both objective variables (e.g. access to piped water) and subjective assessments (e.g. opinions about whether life is better in the settlement than where they were before). Objective assessments are generally measured using quantitative data, which can provide generalisable conclusions, while subjective assessments are best obtained through qualitative data, but can't be generalised.

This study drew on two different surveys, the Gauteng City-Region Observatory (GCRO) Quality of Life (QoL) survey and a survey of residents from the Lufhereng and Pennyville housing developments. The details of these surveys are provided in Chapter Four (section 4.3), and this section provides additional information and justification for how they support addressing the first research question in a robust way. Effort has been made not to duplicate content across these chapters. The QoL 5 (2017/18) survey, was conducted by a fieldwork agency with contracted fieldworkers, whereas the resident survey was conducted by myself and a fieldwork assistant in each settlement. The QoL survey is conducted every two years and is designed to provide insight into a wide range of measures related to life and the quality of life of Gauteng residents. The survey adopts a broad definition of quality of life, including objective and subjective measures such as demographics, access to services and infrastructure, socio-economic factors, together with opinions and perceptions of residents. The aim of the survey was to provide an alternative assessment of development beyond Gross Domestic Product (GDP) measures.

As a researcher at the GCRO, I have been involved in four iterations of the QoL survey, including leading the QoL 4 (2015/16) survey from initiation to conclusion, involving questionnaire design, sampling methodology and fieldwork plan, procuring and managing fieldwork contractors, quality assurance, data analysis, report writing, and presenting findings at a range of government and academic fora. Besides my personal experience and familiarity with the QoL survey, it is an appropriate survey for this research because it is a very large survey that is designed to provide representative data about the Gauteng population, with a focus on demographic, socio-economic, and psycho-social factors. Furthermore, a substantial number of Gauteng residents living in government-led housing developments were included in the survey. This meant that the analysis could consider outcomes of government-led housing across the whole province – not just within my specific case studies. As a GCRO staff member, I was able to include a number of questions in the QoL 5 (2017/18) survey to assist with answering the first research question in this research. Furthermore, I was able to draw on the expertise and experience from other GCRO staff in

designing the Lufhereng and Pennyville survey, and employ identical sampling methodologies as the QoL survey.[7]

Surveys typically involve a set of questions asked to a respondent, whose answers are recorded for later analysis. Surveys can be conducted in a range of ways including, but not limited to, telephonic, internet and face-to-face (Ornstein, 2014a). The quality of survey data depends on a range of elements including the sample design, the survey questions, interview quality and data collection techniques (Fowler & Cosenza, 2013). Each of these is discussed below, including justifications for why particular methodological decisions were made in this research.

Because this research was interested in assessing the overall outcomes of the two cases related to social justice and environmental sustainability, it was important to use a representative sample. Most surveys, except censuses, include a subset of the population of a study, because including the whole population can be impractical, overly resource intensive, and in some cases, less accurate than a subset of the population (Henry, 2009). Sampling is the process by which individual units are chosen from the population to be included in the study.

Sampling design includes a number of steps including identifying how many individuals or units to include, how these units are selected, the process of generalising from the sample to the whole population, and the likely error and bias of the survey responses from the sample compared to the whole population (Roy, Acharya & Roy, 2016). The size of the sample has a direct impact on the quality of the data and various factors related to fieldwork and analysis. Larger samples reduce the standard error (i.e. improve the accuracy of the sample and potential for it to be representative of the population) and improve the ability to study subgroups within the overall sample. However, larger sample sizes increase the costs and resources required for fieldwork, and amplify the potential for non-sampling errors (Roy, Acharya & Roy, 2016). Identifying the best sample size requires weighing up the benefits and costs of larger samples.

When random processes are used to select the sample (probability sampling), the data can be representative of the population, whereas non-probability or purposive sampling employs subjective selection of sample units. Non-probability sampling allows human judgement to influence which units are included in the sample (Henry, 2009). To minimise bias within the

[7] One of my colleagues, Christian Hamann, who drew the sample for the QoL 5 (2017/18) survey replicated this method, using Geographical Information Systems (GIS) techniques, for the Lufhereng and Pennyville survey.

sample, probability sampling requires that every unit in the population has an equal opportunity of being selected as part of the sample (Fowler, 2013). Data derived from probability sampling can provide statistical insights about the population as a whole. Non-probability sampling is used when the study does not require statistically representative data, but rather specific information about individuals or groups within the population. However, data from non-probability sampling cannot be extrapolated to the whole study population as is possible with probability sampling, non-probability sampling tends to have lower time and resource requirement (Henry, 2009). All sampling, whether probability or non-probability, must be deliberately considered and designed to ensure research validity (Ornstein, 2014b).

Methods for selecting the sample differ for non-probability and probability sampling. Some of the most popular methods for non-probability sampling include convenience, snowball, quota, critical cases, contrasting cases and typical cases (Henry, 2009; Roy, Acharya & Roy, 2016). Convenience sampling, as the name suggests, relies on individuals who can be contacted conveniently by the interviewee. Convenience sampling minimises resource and time requirements of fieldwork. Convenience could relate to numerous factors such as location, language, familiarity with potential interviewees etc. Snowballing entails conducting interviews with a first set of interviewees (e.g. through convenience sampling) and then requesting from those interviewees referrals for potential other interviewees. In quota sampling, the total number of planned interviews is divided and allocated across a set of variables, such as race, sex, income or another easily identifiable characteristic. Generally, quota sampling attempts to obtain the same proportions in the sample as in the whole population (Henry, 2009). The various methods for selecting cases differ from each other based on the intentions of the research. Critical cases are those that are of strategic importance for the particular research aim or question, and are particularly important for generalising from the case study (Flyvbjerg, 2006). Contrasting cases refer to cases that are deliberately different from each other, which enables comparison and contrasting across respective findings. Typical cases are chosen when the study is interested in the average of a population, rather than exceptions or outliers.

Probability sampling can be done in numerous ways including through applying simple random, systematic, stratified, clustered and multi-stage sampling methods (Roy, Acharya & Roy, 2016). Simple random sampling is possible when a comprehensive list of the population (known as the sampling frame) is available and a simple randomised sample can be generated from this list. Systematic sampling also requires a comprehensive list of the population, and is done by selecting a random starting point and then selecting subsequent individuals at a defined interval from that

starting point (Roy, Acharya & Roy, 2016). In both simple random and systematic samples, all units or individuals in the population have an equal opportunity of being selected (Roy, Acharya & Roy, 2016). Both of the surveys in this research used probability sampling to identify respondents because of the need to generalise findings and make conclusions about the respective housing developments, or Gauteng as a whole.

Both of the QoL and resident surveys collected a representative sample of adults (18+) in the respective population The resident survey allows the analysis to make observations about the two case studies and the QoL 5 survey enables generalisations to be made about government-led housing in overall terms, even though not every household in Lufhereng or Pennyville, or every person in Gauteng was interviewed. Although the data from the two case studies can provide generalisations about the residents within these two sites, the data cannot be extrapolated out to all government housing projects because these case studies, Lufhereng and Pennyville, were selected as contrasting cases (non-probability sampling) and there are too few cases (2) to provide any meaningful statistics. Using the QoL survey in combination with the Lufhereng and Pennyville survey allows government-led housing in Gauteng to be considered in general terms, and the Lufhereng and Pennyville interviews provide a rich understanding of the experiences of selected residents within government-led housing.

One key challenge was the process of selecting individual respondents as a full list of the population was not available to select from. In this research, given that the most recent census (2011) was too outdated to give an accurate population listing and census data is not available at the household level. In cases, such as this, a full population list is not available, various techniques can be used to ensure a random sample is drawn by giving all individuals in the population a chance of being selected. These techniques include stratification and clustering. Stratified sampling divides the population into subgroups or strata and then selects a random sample from within each stratum (Roy, Acharya & Roy, 2016). A stratum is a group of individuals or units that are similar to each other. This type of sampling can be applied multiple times through a series of steps where a selection is made randomly from each subgroup, all the way down to an individual participant (Ornstein, 2014b). For example, if a survey aims to interview individuals, but a complete list of individuals in the population is not available, only the number of dwelling units, the sampling process could start by selecting a dwelling, then a household within the selected dwelling, and finally an individual within the selected household. Each of these steps involves a random selection process, and thus facilitates a representative sample.

For clustering sampling, the population is divided into subgroups. In contrast to stratified sampling, clusters are natural groupings of individuals that are not necessarily similar to each other. Cluster sampling includes a random selection of subgroups, and then in cases where the number of individuals within a subgroup is relatively small, all individuals within that subgroup are included in the sample. In situations where the sample within each cluster is too large to include in the sample, a multi-stage sampling process is used. This multi-stage process for selecting individuals from within each cluster combines stratified and cluster sampling methods (Roy, Acharya & Roy, 2016).

For the QoL 5 (2017/18) survey, the full population was not available and so a multi-stage stratification process was used. The survey used a dataset with all dwellings units in Gauteng, which was available from GeoTerraImage (GTI). This building-based land-use dataset, which was generated using updated satellite imagery of Gauteng, provided the most updated list of buildings in the province, including new developments and informal settlements. From this dataset, a set of dwelling units was randomly selected across the province. Respondents were then selected through a multi-stage stratification process at each of the selected dwelling units. First a household within the selected dwelling unit was chosen randomly, and then a respondent within that household was randomly selected. For the Lufhereng and Pennyville surveys, the same method was used as for the QoL 5 (2017/18) survey to identify a set of dwelling units. However, in this case the head of household was selected (which was defined as a person who has knowledge or responsibility over finances in the household). Although this method means that not all individuals in each settlement had an equal opportunity of being selected, it was important for the Lufhereng and Pennyville surveys to obtain as accurate data on household costs and expenditure as possible.

When it is not possible for all individuals or units to have an equal opportunity of being selected in the sample, bias is introduced into the dataset. The different sampling methods result in varying degrees of bias. In general, the more rigorous and unbiased a sample is, the more time and resource intensive it will be (Roy, Acharya & Roy, 2016). The process of designing a survey must weigh up the respective pros and cons, and find an acceptable balance between fieldwork complexity, resource availability and sample bias. Bias specifically relates to errors derived from sampling design, whereas non-sampling errors occur during data collection and analysis (Roy, Acharya & Roy, 2016). Although sample bias cannot be completely eliminated, the more deliberate the survey design process is, the easier it is to identify sources of bias, which can then be noted in the study's methodology and limitations, and potentially controlled for.

One example of an unavoidable source of non-sampling error derives from respondent willingness to participate in the research. Because research ethics require voluntary participation, a portion of the individuals in the selected sample will choose not to participate. This has especially important consequences for probability sampling. To counter the potential impact of this on sample representativity, the sampling procedure must make provision for at least some of the selected respondents not participating. This can be done through substitution. Substitution involves drawing an additional set of sample points that can be used to substitute units where survey responses are not possible. A process for substituting additional sample points or individuals must be included in the initial sample design. The QoL 5 (2017/18) survey and the Lufhereng and Pennyville surveys adopted the same substitution procedure, where a set of substitution dwelling points was selected at the same time as the primary sample was drawn (from GTI's building-based land-use dataset). In field, when an interview could not be done at one of the primary sample points, a substitute from the alternative sample frame was used.

Non-sampling errors (in contrast to bias from sample design) can arise during fieldwork and data processing where the responses collected are not accurately recorded, coded or transferred into the dataset. Using computer-aided personal interview (CAPI) technology in data collection can significantly reduce errors arising from data collection and processing (Roy, Acharya & Roy, 2016). The use of CAPI technology can ensure that all the required questions are completed before fieldworkers can finalise the survey. CAPI can also be used to programme logic skips, where respondents skip over questions that are not relevant to them, based on a response to a previous question. Although skip logics can be applied to all questionnaires regardless of how they are administered, CAPI technology can ensure these skips are implemented more accurately through automated programming, than when skips are followed manually. In addition to these features, CAPI minimises non-sampling errors, reduces the burden of coding survey responses and can improve the accuracy of the dataset.

For the reasons above, the QoL survey has used CAPI to support fieldwork since the QoL 2 (2011) survey, and with each iteration there have been improvements in the available technology. Modern devices such as smart phones and tablets that are used for CAPI fieldwork are also able to capture GPS coordinates. This feature is important for both quality assurance (e.g. to ensure that surveys are conducted at the location that they were designed to) and data analysis (e.g. to conduct various GIS analyses such as trip distance). The Lufhereng and Pennyville surveys also adopted CAPI technology, using a tablet and open-source survey software.

Although CAPI has transformed survey fieldwork over the past decade or two, ensuring the quality of the questionnaire design is of utmost importance, as it influences the ability to conduct fieldwork effectively and to produce meaningful data. Survey questionnaires follow a fixed format in which all respondents are asked the same set of predefined questions. Survey questions can include objective and/or subjective questions. Objective questions collect factual information ,for example a respondent's weight or what they ate for breakfast, whereas subjective questions probe the perspectives and opinions of respondents, such as political views, satisfaction with services or enjoyment in daily activities (Fowler, 2013). Survey questions, and especially those that aim to gather factual information, should be easily understood and answerable by all respondents (Fowler & Cosenza, 2013). Both QoL and the Lufhereng and Pennyville surveys used simple English with minimal use of jargon. Where relevant, survey questions were drawn from other, already tried and tested questionnaires (e.g. StatsSA Census). The Lufhereng and Pennyville surveys included questions from the 2011 StatsSA Census, the GCRO's QoL surveys, a survey conducted by the Urban Modelling and Metabolism Assessment (uMAMA) research group at Stellenbosch University and a number of questions developed specifically for this research.

Survey questions are either open- or closed-ended, where open-ended questions allow respondents to answer questions in their own words, whereas closed-ended questions have a predefined set of response options. Although open-ended questions can provide more accurate descriptions of respondent perspectives and experiences, the responses can also be quite vague. Furthermore, open-ended questions are significantly more difficult to code and analyse than closed-ended questions. Including many open-ended questions can result in higher drop-off rates and non-responses, and result in higher overall survey costs (Baburajan, de Abreu e Silva & Pereira, 2022).

Closed-ended questions can take numerous forms where respondents must choose one or more predefined response option, or select a numerical value (which could be within a pre-defined range). Some of the most commonly used question types include dichotomous, multiple choice, multi-mention, rating scale and ranking questions, all of which are categorical responses. Dichotomous questions have two opposite response options (e.g. 'yes' and 'no'). Multiple choice questions include a list of different options that are mutually exclusive and exhaustive (i.e. include all potential responses) and are not ordered (Fowler & Cosenza, 2013). Multi-mention questions are similar to multiple choice, but allow respondents to select more than one option. For example, respondents could be asked to select all of the modes of transport that they used in their most recent trip (multi-mention). A follow up question could probe which mode they used for the first leg of this trip (multiple choice). Rating scales require respondents to identify where along a

continuum they or something else should be placed. These scales could be adjectives or numbers (e.g. rate your satisfaction on a scale of 1 to 10, where 1 is completely unsatisfied and 10 is completely satisfied). Likert scales are a particular type of rating scale that uses adjectives related to a single dimension, and tend to have either five, seven or nine point scales. Some of the commonly used Likert scale questions relate to satisfaction, agreement, likelihood, frequency, quality and importance (see Table 3.1 for examples). Ranking questions require respondents to place a set of options in order in terms of some dimension (Fowler & Cosenza, 2013).

Table 3.1: Examples of Likert scale question responses, including 5- and 7-point scales (after Bhandari, 2020)

Satisfaction 1. Very dissatisfied 2. Somewhat dissatisfied 3. Neither dissatisfied nor satisfied 4. Somewhat satisfied 5. Very satisfied	**Agreement** 1. Strongly disagree 2. Disagree 3. Somewhat disagree 4. Neither disagree nor agree 5. Somewhat agree 6. Agree 7. Strongly agree
Likelihood 1. Very unlikely 2. Unlikely 3. Neutral 4. Likely 5. Very likely	**Frequency** 1. Never 2. Rarely 3. Sometimes 4. Often 5. Always
Quality 1. Very poor 2. Poor 3. Below average 4. Average 5. Above average 6. Good 7. Excellent	**Difficulty** 1. Very hard 2. Hard 3. Neither hard nor easy 4. Easy 5. Very easy

In both surveys, effort has been taken to balance the need to cater to all potential responses, while ensuring simplicity of the questions. The majority of questions in the QoL, and Lufhereng and Pennyville surveys included either a pre-defined list of possible options, or a 5-point Likert scale (see Appendix 1: Lufhereng and Pennyville resident questionnaire and Appendix 2: GCRO QoL 5 (2017-18) survey questions). Because the Lufhereng and Pennyville survey was relatively small (60 respondents), it included a number of open ended questions that enabled respondents to communicate their experiences and thoughts in a way that would not be captured fully through closed-ended questions. This is an important way in which this research gained a nuanced understanding of the lived experiences of residents.

The order and logic of questions within a questionnaire can influence the responses. Baburajan et al. (2022) flag how open-ended questions that come before closed-ended questions can influence the responses to the closed-ended questions. In the Lufhereng and Pennyville surveys, the open ended responses typically were used to elaborate people's responses to a previous closed-ended question, and were placed after a potentially relevant closed-ended question.

Questions with embedded assumptions are those where the response options might not be applicable for all respondents (Fowler & Cosenza, 2013). For example, a question that probes satisfaction with the parks in an area assumes (incorrectly) that there are parks in all areas. To improve such a question, either an opening question should be added which asks whether there are parks in the area, or the response options should include an option that indicates that there are no parks in the area. The survey was carefully designed so as not to include leading questions or those with embedded assumptions. The pilot interviews were helpful in addressing any oversights in this regard.

In cases where respondents cannot answer accurately or honestly due to incorrect assumptions or an incomplete set of response options, they can feel frustrated and be less likely to complete the questionnaire or they might become less concerned about the accuracy of their responses. Avoiding respondent frustration by including additional questions and skip logics outweighs the additional cost and complexity for questionnaire design and data analysis (Stopher, 2012). The QoL survey applies a series of sophisticated skips throughout the survey to minimise interviewee frustration while obtaining as detailed responses as possible. This also means that although the QoL 5 (2017/18) survey comprises a total of 248 questions, no single respondent answered this many questions.

There is a tendency for respondents to distort their responses to present themselves in more socially desirable ways (Fowler & Cosenza, 2013). Placing sensitive questions towards the end of the survey, once a level of familiarity and trust has developed between the interviewer and interviewee, can increase the willingness of respondents to answer accurately. Enabling self-administration of sensitive questions can also improve response accuracy (Fowler & Cosenza, 2013). Both the QoL, and Lufhereng and Pennyville surveys placed sensitive questions (e.g. those related to monthly income, sources of income, age, etc.) at the end of the survey. The QoL survey has, in recent years, included a voluntary self-complete section of the survey, which asks respondents questions related to a range of other topics such as gender-based violence and sexual preference. After considering the potential ethical risks in the Lufhereng and Pennyville survey, I

decided that this was not necessary, the interviews were not considered harmful in any way to the respondents, and the questions covered topics concerning their living conditions and daily lives. Discussing these things with a stranger might have been considered intrusive by some respondents. In response to this potential, care was taken to discuss principles of voluntary participation, withdrawal and anonymity before interviews began. There was one instance in Lufhereng where the respondent chose to end their participation during the interview. The information gathered up to the point where the interview was discontinued was deleted and not used in the analysis. Anonymity has been maintained for all resident participants, and where direct quotes, responses or photographs have been included in the thesis, pseudonyms have been used.

Survey data collection can be done in numerous ways including face-to-face, telephonic, mail and via the internet, and it can either be done by an interviewer/fieldworker or self-administered (Fowler, 2013). The method of data collection plays a critical role in the ability to achieve the sample as per the study design, and selecting a data collection method must be done in tandem with the sampling methodology. For example, online interviews are unavoidably biased to those individuals who have access to the internet, and thus cannot be generalisable to the whole population – these surveys will be self-administered and will rely on non-probability sampling methods. The method of survey administration significantly impacts data quality and accuracy. For example, telephonic interviews that include closed-ended questions with a long list of response options can be difficult for respondents to answer as it is difficult to recall all potential options. To counter this risk, response options should be limited in number and complexity. A well-designed and thought-through survey is also more likely to be completed by respondents. Respondents are more likely to provide accurate responses if they believe their responses are confidential and that accurate answers are important. For questions with numerous response categories, self-administration can improve response accuracy and reduce the time taken (Fowler, 2013). However, fieldworkers are valuable in ensuring that the questions are interpreted correctly and that the survey is completed as designed.

The number of questions in the survey and how long it takes to administer also influence the accuracy of responses and interviewee frustration, which are influenced by the fatigue of both the respondent and fieldworker. Other factors that contribute towards longer interviews include questions that are difficult to understand or read out, and questions that need further explanation. Significant time is spent in the planning phases of the QoL survey to balance the need to ask a wide range of questions (many of which must be included in each iteration to enable longitudinal analyses), while also trying to keep the survey as short as possible. Nonetheless, the QoL survey is

generally considered a very long survey and for the QoL 5 (2017/18) iteration it took between 20 minutes and over 1 hour 30 minutes to complete. The Lufhereng and Pennyville surveys were not as broad in scope as the QoL survey and took between 14 and 41 minutes to complete.

Interview pilots are an important way to test how the survey instrument performs in the field, how comprehensible the questionnaire is for respondents, the ease of completing the survey, how long it takes to administer and the ability to analyse the data as anticipated. Pilots provide an opportunity to adjust and refine the questionnaire and fieldwork plan to address any issues identified. I conducted pilot interviews in Lufhereng on 17 and 18 November 2018, and in Pennyville on 28 November 2018, with five pilot interviews conducted in each settlement. In advance of these pilots, I drafted a questionnaire and programmed it into a digital platform to use in the field. The pilot questionnaire comprised of 78 content questions and 10 questions related to the location, respondent demographics and ethical permissions.

After the pilot interviews, the questionnaire was refined. A few additional questions were added, some questions that either did not work or were not going to be helpful for analysis were removed, and others were edited to improve wording or to adjust the response options provided. The final questionnaire included a total of 83 questions, of which 11 were open-ended questions, and 9 related to interview consent, ethics, and interviewee demographics. The survey included a range of questions focusing on household services, resource use, employment and reflections on residents' current living conditions compared to where they lived before moving into the respective development. The QoL survey comprises over 200 closed-ended questions that span a wide range of topics including demographics, basic services, employment, transport, satisfaction and personal opinions. Of the larger set of questions, only a portion of questions were used in this study, including questions related to household resource consumption, waste production and individual travel data.

Based on the pilots, I realised the importance of having a fieldwork instrument that can function even when there is no cell phone signal, which the platform that I had initially selected (Google Forms), was not able to do. Instead, I used an open-source software package called KoBo Toolbox. KoBo Toolbox, which is a robust survey tool that has been designed for conducting surveys in the global South, and especially in areas where mobile signal is poor. It is both simple to programme the questionnaire and easy to use in the field. One of the additional benefits for this research is that KoBo Toolbox can export the dataset directly into IBM SPSS format, which saves a significant amount of time for data preparation. The GCRO uses IBM SPSS as the statistical software package

to store and analyse QoL survey datasets, and so I am familiar with this software and had always planned to use it for data cleaning and analysis of the Lufhereng and Pennyville survey data.

The pilot interviews were also important in that I had not devised a method for selecting the dwelling unit when the interview point was located in a set of flats or two-story walk up. In response to this omission, I created the following protocol: On approaching an interview point within a set of flats or multiple unit structure

1. Allocate a number to each dwelling unit starting from the top down, and going from left to right for each level.
2. Using a random number generator (on the tablet or fieldwork device), select a number within the relevant range.
3. Conduct the interview at the corresponding unit from the first step.

Interviews were conducted face-to-face in both settlements, with fieldwork in Pennyville taking place in March 2019 over ten days with an average of three interviews conducted each day. Fieldwork in Lufhereng was conducted in April 2019 over nine days, with an average of slightly more than three interviews per day. As mentioned above, interviews were captured on a tablet using CAPI technology. In each of the study areas, a resident of the area worked as my research assistant and helped with navigating the respective settlements, translating the interviews and gaining the trust of potential respondents. These research assistants were particularly helpful in making the first contact with potential respondents and explaining the aim of the interviews. During fieldwork as we walked through each settlement, the research assistants also gave their insights into the settlements, providing an insider's understanding of the respective areas. In most cases, I was able to conduct the interviews in English, with only occasional need for translation. Where translation was required, my fieldwork assistants acted as translators for me. I paid my research assistants per interview completed, which meant that they were incentivised to help me secure and complete interviews.

Conducting surveys requires for numerous ethical risks to be navigated in doing interviews, and in storing, analysing and sharing data. Both the QoL surveys and the Lufhereng and Pennyville survey obtained ethical clearance from a university ethics committee.[8] The QoL survey's data collection

[8] The GCRO has obtained ethical clearance from the University of the Witwatersrand Human Research Ethics Committee (Non-Medical), and I obtained ethical clearance (for the whole study, including the survey from the University of Cape Town's Faculty of Science Research Ethics Committee (Appendix 3: Ethics

and storage follow careful ethical processes to protect respondent identities and ensure interview confidentiality. The QoL datasets are fully anonymised, with any personal information and locational data removed before being used for research purposes, thus protecting the respondent identities and ensuring interview confidentiality. For this research, two special variables were created: the first identified residents of government-led housing developments via their specific location and the other calculated travel distance from the respondent's home to their destination. These variables were created by the GCRO's QoL team and I as the researcher did not use the dataset with specific respondent location, but rather the deidentified dataset. Any data that might be shared in connection with this thesis will include the additional 'government housing' and commuting distance variables but no detailed locations.

Lufhereng and Pennyville survey interviews were conducted at, and sometimes inside people's homes. All resident participants were provided with project information and consent forms, which were signed by the interviewer and interviewee, and each kept a copy for their records. GPS coordinates and personal details were collected together with the survey responses, but these details have remained confidential, and have been stored securely on a password-protected computer and secure Google Drive folder. Data has been backed up on a secure server at the University of the Witwatersrand, via a password protected network pathway. This protocol has been applied to all data collected for this research. Any data that needs to be shared on any public repository will be completely anonymised.

Analysing the survey data

Both the QoL 5 (2017/18) survey and resident survey datasets provide insight into the lived experience of Gauteng residents, and offer an unparalleled opportunity to assess residents of government-led housing developments in the province. Open-ended questions from resident survey were analysed as text and allowed resident narratives to emerge and complement statistical data.

Each interview in the QoL survey is georeferenced, thus it was possible for this research to extract all of the QoL respondents who live in government-led housing developments. This group of respondents was then compared against respondents living in informal settlements and those

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clearance certificate), and the relevant ethical procedures were followed during fieldwork, data analysis and write up (the various forms are included in Appendix 4: Participant information sheet and Appendix 5: Participant consent forms).

living in the rest of Gauteng. A 2014 spatial dataset of government housing developments, which was obtained from the Gauteng Department of Human Settlements, was used to extract those QoL respondents located within government-led housing projects. Defining this group of government-led housing residents allowed most of the QoL survey questions to be analysed in relation to this group. A number of other variables needed to be created for this study. Commuting distance, which is used as a proxy for access / proximity to economic opportunities, was derived using the straight-line distance between the interview location (i.e. the respondent's residence, where the interview took place) and where the respondent works (measured from the centroid of the subplace identified by the respondent). This variable was generated by QoL survey team members, and I did not work with the exact location of the survey respondents.

3.2.3 Visual and photographic methods

This research has used visual methods in combination with statistical data as an innovative way to build in subjective experiences of government-led housing and include multiple ways of knowing into the research. Visual methods can be valuable in conveying ideas, give a sense of different contexts and be a tool to present an argument or convey findings that might not be possible using only text (Heng, 2020). These methods allow the reader the potential to draw their own conclusions based on what they see and thus they are not solely dependent on the researcher's interpretations. Where the reader can come to the same conclusions as the researcher through the visual material, it strengthens the trust in the research conclusions more generally and can inspire an engaged readership. Visual perceptions are critical components of how spaces are experienced (Hunt, 2014), thus visual methods have the potential to surface the lived experiences and daily lives of research participants in ways that are not possible through traditional text-based methods (Fast, 2017). Visual methods are relatively new within social science research and there is a wide range of ways of including them within research. The visual essay (often taking the form of a 'photo essay') is one of the most common methods, which typically arranges images (e.g. photographs) together with text, in a deliberate way to convey a story, concept or argument (Heng, 2020). Importantly, the images do not function merely as illustrations of the data or argument but are necessary components of communicating the argument. While some scholars do not consider text necessary within visual essays, and rather that the images should be curated masterfully enough to lead the reader through the story or argument on their own, text can ensure that the reader grasps the nuances and particularities of the visual materials (Heng, 2020). Visual essays can be arranged in many ways including chronologically, or using narrative and thematic approaches (Heng, 2020). Hunt (2014) argues that taking photographs as a component of data collection can enable

researchers to focus differently on the research subject, and thus consider new ways of interpreting and analysing the complexities of urban contexts and experiences.

I have been deliberate about gathering photographs in this research of the two housing developments, Lufhereng and Pennyville. These photographs bolster the objective data from the surveys, interviews and document analysis, and provide subjective ways of seeing and understanding the developments and their residents. Photographs were taken while I went around Lufhereng and Pennyville during initial scouting visits, when conducting pilot interviews and while gathering survey responses. I took many photographs of the public realm and the people within it while walking through the developments. Where I got consent, I took photographs of interviewees and their houses. Walking around the developments with the deliberate intention of taking photographs helped me to be more observant of Lufhereng and Pennyville, features of the physical environment as well as what people were doing. Being the only white person in either area and taking photographs with a big camera (not just a phone) made me a point of interest for residents. They would often ask me what I was doing in the area, and some requested that I take photographs of them, and I sent these photographs to them via WhatsApp. Taking photographs helped in some cases for me to build rapport with residents, where they were interested to see the photographs on the camera. Some respondents took the course of the interview to warm to the idea of having their photographs taken, while others were suspicious of me, what information I wanted and how I was going to use it and the photographs that I took. I was sensitive to these concerns, telling them about this research and what the photographs would be used for, and I refrained from taking photographs and I put my camera away when I felt it was making people uncomfortable.

Although according to privacy laws, photographs taken in the public realm do not require consent of individuals, I have endeavoured to use only photographs where the face of individuals is not visible unless informal permission to be photographed was obtained. Questions regarding consent for photographs and interview recording were included in the interview consent forms. Some respondents gave permission for photographs to be taken of themselves and/or their home. They were also asked whether these photographs could be used in any research reports, publications and online posts. Only photographs where permission was obtained for both being taken and published have been included in this thesis and the respective journal articles. Names have not been used in connection with any photograph, regardless of consent received by respondents.

The photographs taken in Lufhereng and Pennyville have been used in two ways within the thesis. First is the traditional method of including photographs within chapters and in the journal articles

(Chapters 4 and 0), and they help to illustrate various points within the analysis and discussion. Second, photographs from the field have been curated into two photo essays, which are situated between the journal article chapters. These photo essays have been used to help build the narratives and to strengthen the arguments made within the broader thesis in response to the research objective and research questions. The photographs have been arranged thematically. The first photo essay explores access to housing and services, which is one of the key themes in this thesis. The second photo essay focuses on the residents of Lufhereng and Pennyville, and captures some of their stories, how they navigate the areas within which they live, make friends and find work opportunities. These photo essay aim to ground the synthesised statistical analyses with the tangible reality of the housing developments, and bring the people and their lived experiences to the fore. This allows for a deeper understanding of the lived reality of government-led housing developments to be examined and communicated. Each photograph in these essays has been carefully selected and content has been written that links with the key arguments in the various other chapters in the thesis.

3.2.4 Semi-structured interviews

Semi-structured interviews tend to be conducted with one respondent at a time and take on a conversational form, with some key discussion prompts or questions to guide the conversation (Adams, 2015). Semi-structured interviews enable the researcher to be responsive to the discussion and to probe insights from the interviewee in an agile way, while making sure to touch on the relevant areas of interest for the study. The interview guide that helps to structure the interview can include both closed- and open-ended questions, and these questions tend to be followed up with questions of clarity and additional detail (Adams, 2015). Open-ended questions can help to reveal the interviewee's perspectives and how they perceive the world and situations around them (Yin, 2009). Although researchers often consider the aim of interviews to be to extract the information required to answer the research questions as directly as possible, interviews are first and foremost social interactions (Holstein & Gubrium, 1995). Researchers must be sensitive to interviewees, and avoid questions that might invoke defensiveness, irritation or frustration in the interviewee, because these undermine trust and cooperation that is necessary for a successful interview. Because of the intensive nature of semi-structured interviews, limiting interviews to one hour in length can help to minimise fatigue and optimise engagement of both the researcher and interviewee (Adams, 2015).

The aim of interviewing is to facilitate a conversation that "maximiz[es] the flow of valid, reliable information while minimising distortions of what the respondent knows" (Holstein & Gubrium, 1995: 3). However, interview data is a product of an interaction between two individuals at a particular point in time and cannot be considered completely factual or neutral of social and other biases. Rose (1997) posits that the knowledge produced is fundamentally tied to the person(s) producing that knowledge. Because interviews are strongly influenced by the interviewee, the questions that they ask, and in turn their values, perspectives and opinions, it is critical for the researcher to be reflexive and self-aware of how they might bias the conversation (Whiting, 2008). Oldfield and Patel (2016) emphasise the importance of the researcher considering themselves as co-producers of knowledge rather than an expert. This "humble" approach can facilitate deeper engagement with a range of knowledge and perspectives (Jasanoff, 2018: 14)

Semi-structured interviews were conducted with key informants including local government officials, project managers and other stakeholders who were involved in the decision-making processes of the Lufhereng and Pennyville housing projects. Key people involved in the respective projects were identified for interviews through existing government contacts, and examining online information and project documents. Thereafter, a snowballing technique was used to identify additional interviewees who were involved in or have insight into relevant decision-making processes. A total of 15 people were interviewed between May and October 2019, and the data saturation principle was used to guide how many interviews were conducted (Fusch & Ness, 2015).

Each interview was guided by a standard discussion frame that included questions about the interviewee's role in the relevant project, how the project was envisioned, how they understand social justice and environmental sustainability in relation to the project, and whether they were aware of instances where the project plan or vision shifted from the original intention. Interviews took the form of a discussion and ranged in duration from just under one hour to over two hours (see Appendix 6: Key informant interviews conducted).

Interviews are often transcribed to facilitate data analysis. Depending on the research and objectives, transcription could include the just the content of the discussion, or also include utterances or verbal fillers (e.g. 'um', 'uhh', 'like') and pauses (Roulston, 2014). The choices around what is included and excluded from transcriptions has important implications on the analysis that can be undertaken using the interview data. Interviews for this research were recorded, with

permission, and transcribed in accordance with required ethical guidelines.[9] The various verbal fillers, pauses and elements of the discussions (e.g. laughter) were included in the transcriptions.

Ethical concerns regarding interviews with key informants (government officials, housing project developers and consultants) were limited as the questions were not personal in nature. All interviews were arranged in advance with interviewees. Each participant was provided with a project information sheet and a consent form, which was signed by the interviewer and interviewee, and each kept a copy for their records. Principles of voluntary participation, withdrawal and anonymity were discussed and agreed before interviews. Names of key informants have not been used in the thesis, rather interview references have been applied. Given that many of the consultants and developers who were interviewed no long work on the respective projects, they were able to reflect critically on the various projects without any potential risk to them personally or professionally. Interviews with government official interrogated the actions, justifications and decisions that are in the public interest and thus are not sensitive in nature. The recent regulations around protection of personal information in South Africa have an important impact on snowballing techniques and in particular on obtaining names and contact details of potential respondents. Care was taken to obtain consent from individuals before their contact details could be shared for research purposes.

Relevant project documents, visions and plans were sourced during key informant interviews and through online keyword searches. Interview transcripts and project materials were coded and analysed using NVIVO Qualitative Data Analysis Software to identify both pre-identified and emerging themes, as well as connections across different data sources. For example, 'decision-making, knowledge and power' was a theme identified at the start of the research and tied directly to research questions two and three. As research progressed with the literature review and analysing key informant interviews, the specific theme around how local and provincial government interact and shape decision-making processes emerged through reading literature and analysing key informant interviews. The analysis of key informant interviews paid particular attention to the explicit structures and decision-making processes in each project, as well as the underlying power dynamics and politics at play.

[9] Ethics approval was obtained by the University of Cape Town's Research Ethics Committee before fieldwork commenced. Approval code: FSREC 65 – 2018. See Appendix 3, 4 and 5 for the relevant approval documents, information sheets and consent forms.

3.3 Conclusion

This chapter has presented the methodological approach of this research, carefully demonstrating how appropriate methods and data have been drawn upon to consider the practical, policy and theoretical elements of the research objective. By drawing on numerous data sources and methods, this research explores the research questions from multiple perspectives, including insights from residents, practitioners and decision-makers. The research has also considered multiple scales, including the city, project, household and individual. The complex set of evidence drawn on in this research provides opportunities for robust engagement with the research questions through the case studies, and allows nuanced insights and conclusions to be drawn.

Although the field of Geography is "inherently interdisciplinary" (Baerwald, 2010: 496) the inclusion of a range of methods and data within one study remains relatively uncommon. This research has adopted a multidisciplinary approach, drawing on statistical, visual, interview and case study methods, which have been deliberately designed to ensure complementarity. Because each method focused on a different element of the research and the boundary space between social justice and environmental sustainability, in combination, the various methods and data were able to reveal both blind spots and insights that would not be possible through a single disciplinary approach (Baerwald, 2010; Culwick & Patel, 2017). The juxtaposition of statistical and visual methods is especially notable in this regard. Not only are the photo essays in this thesis innovative in and of themselves, but their application alongside statistical survey (quantitative) data is especially uncommon. The photo essays surface the lived experience of residents within government-led housing developments and in this way humanise the analysis, whereas quantitative methods deliberately do not focus on the individual experience so that they can make generalisations about the city scale, or about government-led housing in general.

Numerous studies have been conducted about government-led housing, and even the particular cases have been the focus of other research and assessments. However, this research is novel in that it uses government-led housing as a lens through which to understand the boundary space between social justice and environmental sustainability. Case studies have been deliberately selected to enable the logics, processes and outcomes of two opposing urban development approaches to be compared and contrasted in relation to social justice and environmental sustainability. This research is innovative in the way that it juxtaposes Lufhereng, which was designed as an integrated mega-human settlement on the urban edge, and Pennyville, which is a small transit-oriented, infill project.

A key focus area of this research is to bring methods and approaches to knowledge production into the centre of the debates around just sustainability. This research asserts that knowledge approaches and incorporating multiple perspectives and methods through an interdisciplinary approach is necessary to build a robust and complex understanding of the boundary space between social justice and environmental sustainability. This chapter has demonstrated how the conceptual framework and research objectives are fundamentally tied to the methodology, where the ability to draw practical, policy and theoretical conclusions depends on the methods and data collected. Using the methods described in this chapter, the following three chapters present the empirical data and findings of the research and consider in turn the practical, policy and theoretical aspects of the boundary space between social justice and environmental sustainability.

Homes: bridging the boundary between people and the city

Government-led housing projects progress through a range of technical, political, financial and construction processes before being handed over to recipients. The metrics that are used to assess their success relate to the number of houses that are built, what services have been provided and what amenities are now available to 'X' number of recipients. It is easy in these administrative processes to forget that every house is home to a person, a family, and their lives. This photo essay provides a layering onto the technocratic and political focus that dominates assessments. It shows how people have taken pride in personalising their homes, growing their gardens, improving the finishes and building extensions. It also shows how the services that they now have access to are integrated into their daily lived experiences. This photo essay provides a tangible understanding of what housing and services mean for residents. Each photograph in this essay is captioned to direct the reader to particular elements within the photograph and to associated arguments within the broader thesis.

Photograph 1
Orlando Pirates veranda

Houses in Lufhereng were designed deliberately with a street-facing veranda where residents sit and talk to their neighbours – perhaps about the recent football match, and as people walk by.

See section 5.3.1

Although the majority of houses in Lufhereng are painted beige and red, some houses were painted "expensive" colours to help residents find their way around the settlement, and prevent residents getting lost among houses with near identical designs and colours. This picture shows one of these such houses – the yellow house, with blue windows.

See section 6.1

Photograph 2
The house with yellow walls

Photograph 3
Backyard row

Many residents have built additional dwellings, outhouses (brick structure pictured) and adding rooms to accommodate tenants or additional family members, despite limited space available in Pennyville.

See section 4.5 and 7.3

People place great pride in their houses and where possible they invest resources towards enhancing their gardens and the aesthetic appeal of their houses both for their own enjoyment, but also with the intention of using free housing to move up the housing ladder.

See section 3.1

Photograph 4
Garden of pride

Photograph 5
Streets and wires

Formal access to the municipal electricity grid is an important element of government-led housing developments, and improving access to basic services.

See section 4.4

Photograph 6
Solar geyser on a cloudy day

The installation of solar water heaters provides residents with hot water, while not adding additional electricity costs, and draws on renewable energy. This minimises the environmental impact of improved service provision. However, on overcast days as this one pictured in Pennyville, residents would likely shower cold.

See section 6.1

Photograph 7
Chained and waiting for 'garbage' day

Refuse removal has improved for many government-led housing recipients. In Pennyville only a third of residents had access to weekly refuse removal before moving to the area, and now everyone benefits from this service. In this way, municipalities can minimise the negative environmental consequences of inadequate waste disposal.

See section 2.1

4 Building just and sustainable cities through government housing developments

Preface

This chapter is a verbatim reproduction of a paper published in *Environment and Urbanization* in 2020 (https://doi.org/10.1177/0956247820902661). It responds to the first research question and explores the practical implications of Lufhereng and Pennyville on social justice and environmental sustainability. This paper uses empirical data to assess the social justice and environmental sustainability outcomes of government-led housing in Gauteng. The analysis draws on GCRO's Quality of Life V (2017/18) survey and interviews with residents of Lufhereng and Pennyville housing developments. The survey data provide an aggregated picture of government housing developments in Gauteng Province, and the resident interviews allow for more detailed insights into the lives of people in these developments. The data and interviews provide insights into various factors including access to services, accessibility, and income and employment of residents living in government housing developments. An important contribution of this paper is in demonstrating the complex interaction between social justice and environmental sustainability. The data reveal that residents in government-led housing have tangibly improved access to basic services and amenities. However, compared with residents in informal settlements and the rest of Gauteng, the government-led housing developments tend to be poorly located with regard to economic opportunities, and residents are forced to explore other income-generation opportunities or incur high transport costs. This study found that government housing developments in Gauteng have contributed in some ways to enhancing both social justice and environmental sustainability. However, there are also instances where outcomes have been negative for one or both of these goals. This complexity, where social justice and environmental sustainability outcomes differ depending on the measure or assessment, challenges assumptions that social justice is either aligned or oppositional to environmental sustainability. In reality, both can be true simultaneously. This poses significant pressure on decision-makers as they work to further just sustainability. These findings highlight how problematic it can be try to rationalise and simplify the relationship between social justice and environmental sustainability. This paper argues for nuance in assessing government housing projects, and the importance of considering carefully the multiple and contrasting outcomes of urban development for social justice and environmental sustainability. This paper provides a valuable contribution to scholarship by building an understanding of the multifaceted outcomes of government-led housing developments and how these provide a complex

understanding of the practical boundary space between social justice and environmental sustainability.

The two photo essays that bookend this journal article chapter provide a visual layering to the assessments and statistics in this chapter. The two photo essays mirror the two main components of this paper. The first photo essay, *Homes: Bridging the boundary between people and the city,* gives a visual sense of the houses and the basic services within Lufhereng and Pennyville, and they complement the assessment of access to shelter and services through government-led housing.

These assessments are followed in this chapter by qualitative data from the two case studies that bring nuance to the quantitative assessments. Similarly, the second photo essay, *People, faces and lives: humanising the statistics,* gives a visceral sense of the resident reflections, providing a strong reminder that behind the statistics and quotes are real people.

Numerous sections in this chapter are directly referenced in the two photo essays. Photograph 5 in the first photo essay connects with the assessment of access to electricity in section 4.4 of this chapter. The discussions around growing vegetables and finding opportunities to supplement resident incomes in section 4.4.3 are reflected in Photograph 8 and Photograph 13 respectively. One of the key discussion points in this paper is around resident investments in their properties (Section 4.4) and in particular the importance of auto-constructed backyard dwellings as adding value to their properties and creating income generation opportunities (Section 4.5). Photograph 3, Photograph 4 and Photograph 10 are images that depict what these investments look like and the people who have made these investments. Finally, given the difficulty in finding employment, and especially in remote government-led housing developments, many residents have started small businesses. The qualitative and quantitative data reflecting on this in the chapter (Sections 4.4.3 and 4.5) are reflected in Photograph 13 and Photograph 14.

Abstract

While government housing can raise living standards for the urban poor, it has environmental impacts and contributes to urban resource consumption. In Gauteng Province, South Africa, government housing aims to improve quality of life, reduce poverty and inequality, and transform unsustainable urban forms. This paper draws on survey and interview data to explore the social justice and environmental sustainability outcomes of Gauteng's government housing programmes. The data reveal improved access to basic services and amenities. However, the developments tend to be poorly located with regard to economic opportunities, and residents are forced to explore other income generation opportunities. This paper highlights the complex interplay between justice and sustainability, where the outcomes are aligned in some instances and conflictual in others. It points to the need to move beyond linear, reductionist relationships between justice and sustainability to further the conceptual understanding of their interlinkages.

Keywords

accessibility; environmental sustainability; Gauteng; government housing; just sustainability; social justice

4.1 Introduction

Urbanisation and population growth are two of the most significant global trends. Both are concentrated in the global South, particularly in Africa and Asia (UNFPA - United Nations Population Fund, 2007; Pieterse & Parnell, 2014; UN-Habitat, 2016). This population increase is associated with an increased demand for housing and basic services. Southern cities face the challenge of planning and implementing urban development in a way that accommodates the expanding urban populace and meets its basic service needs, but also minimises such negative effects as environmental degradation, high resource consumption, pollution, and social and economic exclusion. In Gauteng Province, South Africa, the challenge of meeting the growing need for housing and services is compounded by existing housing backlogs, poor access to basic services (water, sanitation and electricity), high unemployment and inequality.

Recent global commitments emphasise the concurrent need to achieve a just and sustainable growth trajectory (UN-Habitat, 2016). Social justice and environmental sustainability have been widely acknowledged as both ethical and practical, evidenced through the global adoption of the 2030 Agenda for Sustainable Development (UN-Habitat, 2016). Despite commitments to a form of development that is both just and sustainable, such pledges are yet to translate to urban

development that truly achieves these imperatives. As a consequence, poverty, unemployment, climate change and environmental degradation remain intractable global issues that are concentrated in cities in the South.

Government housing developments can play an important role in raising living standards for the poorest groups in society, and particularly for people living in informal housing (Shapurjee & Charlton, 2013; Turok & Borel-Saladin, 2016). Informal or auto-constructed housing is the fastest-growing form of accommodation in many cities in the global South. Particularly in informal settlements, this housing tends to be associated with poor living conditions, inadequate access to shelter and basic services, and unhealthy environmental conditions. Government housing provides an important means of addressing these social and environmental issues. However, these developments do not necessarily align social justice and sustainability imperatives. Not only do government housing developments directly affect the ability of the urban poor to access adequate services and opportunities, they also have broader environmental impacts and implications for resource consumption. Without careful planning, government efforts to address the housing crisis exacerbate existing inequality, unsustainable resource consumption and environmental degradation (Turok, 2016a).

South Africa's government housing programmes, while successful in providing nearly 3 million houses and benefitting around 10 million people (Turok, 2016a), have faced significant critique in the post-apartheid era (Biermann, 2005; Charlton, 2017) both for their inability to truly address poverty and inequality, and for exacerbating unsustainable urban growth trajectories (Goebel, 2007; Crane & Swilling, 2008). This paper draws on survey and interview data to gain insight into the lives of people living in government housing developments in Gauteng, South Africa, and to explore the interplay between social justice and environmental sustainability outcomes of these developments.

The paper specifically engages with a range of factors to determine the success of government housing programmes in achieving justice imperatives. These factors include housing, living conditions, access to basic services and income generation opportunities of people living in different areas in Gauteng. This analysis also explores the implications of these housing developments on sustainability and the interaction between just and sustainable outcomes. The results provide evidence that government housing developments in Gauteng have contributed to material improvements in residents' quality of life, despite not addressing all aspects of poverty alleviation or environmental sustainability. The case further identifies ways some residents have

made alterations to their houses and pursued economic opportunities – using government housing to enhance their poverty alleviation efforts. The paper also focuses on a number of elements related to sustainability, including resource consumption, density and location, with its impact on access to services and commuting distance. This paper avoids simplistic conclusions, and uses this case to provide nuance on the successes and failures of government housing in Gauteng and to explore the complex interplay between social justice and environmental sustainability.

Section 4.1.1 provides an introduction to government housing in Gauteng, South Africa. This is followed by an account of the relevant literature in Section 0, a description of methodology in Section 4.3, an assessment of Gauteng government housing in Section 4.4, and a discussion of findings in Section 4.5.

4.1.1 Government housing developments in Gauteng

Urbanisation patterns in Gauteng mirror many global patterns. It is South Africa's smallest province, but its population growth is the fastest in the country (Statistics South Africa (StatsSA), 2017). This compounds the region's housing backlog, levels of informality and challenges in ensuring access to basic services. In addition, the legacy of apartheid racial segregation continues to influence spatial inequality, poverty and unemployment (Haferburg, 2013; van Wyk, 2015).

During apartheid, South African cities were deliberately designed to create spatial separation between racial groups and functions (separating business and residential areas). This resulted not only in structural inequality with disproportionately worse access for Black people to resources and opportunities, but also in cities with segregated residential and commercial areas. This type of development has resulted in sprawling suburbs, long commutes that depend on motor vehicle travel, inequality and unsustainable resource consumption.

The post-apartheid government placed significant emphasis on building fully subsidised low-cost houses for poor South Africans, through the 1994 Reconstruction and Development Programme (RDP) (Visser, 2004). Government housing programmes are targeted at people who currently lack access to adequate housing and meet a number of requirements, including monthly household income below a certain threshold. The dual aims of these programmes are to provide improved living conditions and the necessary support to allow these citizens to rise out of poverty (Venter & Cross, 2014). In South Africa, the provision of low-income houses is seen as an opportunity for people to get onto the housing ladder (Newton, 2013), with the key intention of changing the ownership profile of property (Rubin, 2014).

Government housing developments in the early post-apartheid years, tending to be low-density and located on the urban edge, have been criticised for exacerbating spatial segregation, inequality, exclusion and urban sprawl, and entrenching inefficient land-use patterns with high resource consumption trajectories (Haferburg, 2013; Mubiwa & Annegarn, 2013). Haferburg posits that the government's housing policy has created "vast RDP archipelagos that sit in a kind of peri-urban limbo like loosely-associated satellites" (Haferburg, 2013: 263).

In light of critiques of RDP, the government released the 2004 Comprehensive Plan for Housing Delivery: Breaking New Ground (BNG), to address and realign low-income housing policy (Rebel Group, 2016). The BNG policy reframed the housing delivery approach as one that systematically addressed wider-ranging impacts of apartheid – focusing on "sustainable human settlements". (The government interprets this in a number of ways, including support for sustainable livelihoods, ensuring affordable housing in sufficient quantities, and concern for environmental sustainability regarding density and proximity to services (DPME, 2014).) This focus shifted towards housing as an enabler for improving quality of life, reducing inequality, and using residential development as a tool in spatial restructuring (Parnell & Crankshaw, 2013). An important acknowledgement was the need for integrated housing developments in well-located areas, where needs beyond just housing could be met – specifically focused on urban areas (DPME, 2014). In line with these principles, the Gauteng government envisioned public housing programmes as an important instrument for building inclusivity, by providing basic services and enabling access to economic opportunities (Charlton, 2010).

Although the BNG policy attempts to maximise the benefits of compact urban form, Jenks (2000) flags a possible negative consequence of increasing density and land-use efficiency of government housing developments, in that reduced plot sizes in more compact areas or units in multi-storey buildings can limit or prevent low-income groups from generating income through rental and home businesses. A significant proportion of the growth in informal housing in South Africa, and Gauteng in particular, has been in the form of self-build backyard dwellings (Figure 4.1). Backyard dwellings provide additional housing opportunities with better access to basic services and infrastructure than informal settlements, as well as opportunities for owners to generate income through rental (Turok & Borel-Saladin, 2016; Scheba & Turok, 2020).

Although the government espouses a planning approach to urban spatial form that emphasises integration, efficiency, sustainability and quality of life for all, scholars note that publicly funded housing projects continue to be poorly situated for a number of reasons. A significant driver of

housing projects on the urban edge of Gauteng is the urgent need for housing, and the perception that land on the periphery is cheaper and less contested than land in the urban core (Charlton, 2014). Hunter and Posel (2012), however, critique housing programmes that emphasise access to basic services over proximity to job opportunities, noting that many informal dwellers choose to live in substandard conditions to allow easier access to work.

Figure 4.1: Government housing with informal backyard dwellings, Zandspruit, Johannesburg. Photograph by Christina Culwick Fatti, 2019.

Figure 4.2 shows the locations of government housing programmes in Gauteng (blue) relative to the region's urban footprint (grey). Information on this set of housing programmes (2014) was obtained from the Gauteng Department of Human Settlements, and includes planned and completed projects and those under construction[10]. While the map shows that some of these developments are located within the existing built-up areas in relatively close proximity to economic centres (e.g. Johannesburg and Pretoria central business districts [CBDs], Sandton, Germiston), the vast majority and the largest government housing developments are located on the urban edge. It is likely that some of the older housing developments are better located now than when they were first

[10] The dataset includes a few housing developments that have been abandoned subsequent to the dataset being finalised in 2014.

constructed, as urban and economic development has subsequently taken place in the surrounding areas.

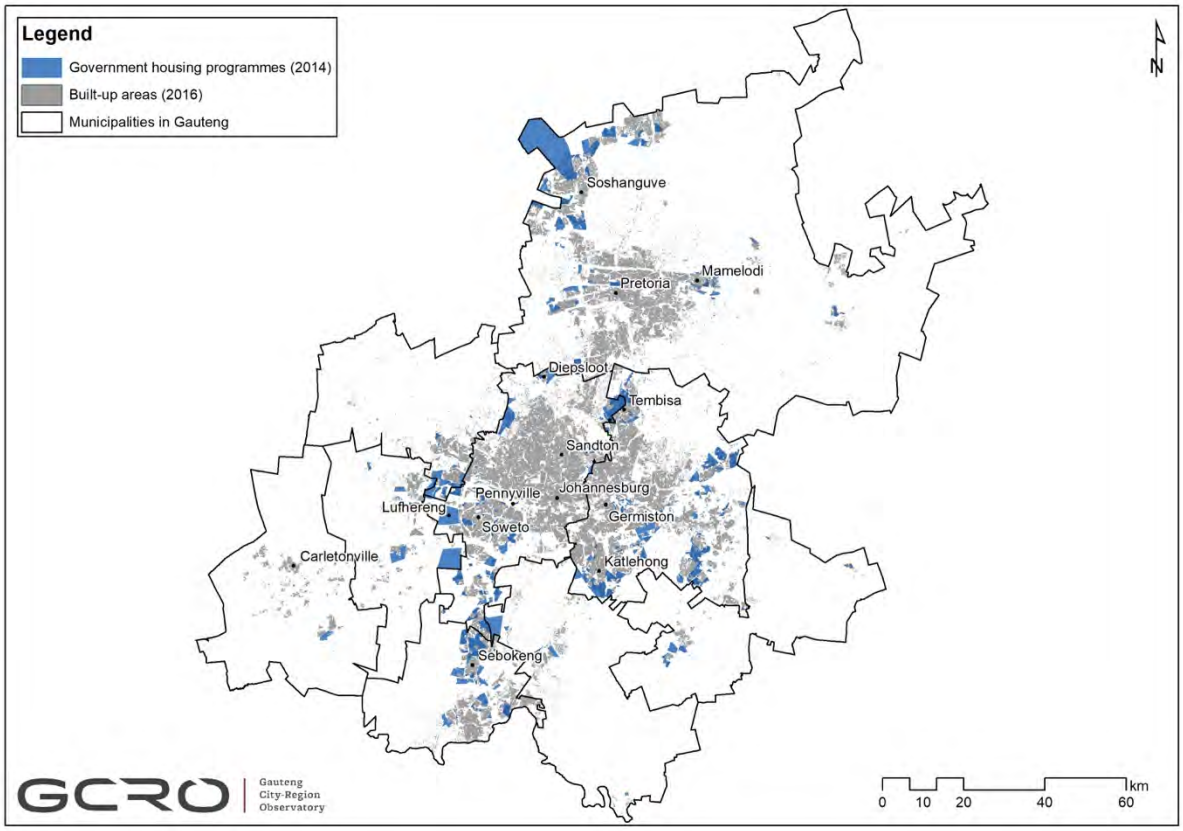

Figure 4.2: Planned and built government housing programmes in Gauteng (2014). Data source: Gauteng Department of Human Settlements (2014). Map by Christian Hamann (2018).

This paper provides an overall assessment of government housing projects in Gauteng, and draws detailed insights from two housing projects in Johannesburg: Lufhereng and Pennyville. Both were greenfield sites, designed as part of the national government's integrated residential development programme. This programme explicitly seeks to build housing developments in "well-located" areas in a way that provides access to services and economic opportunities. Pennyville, constructed between 2006 and 2011, is a medium-density housing development, located between Soweto and the Johannesburg CBD within the mining belt. It is well located with regard to a range of public transport options, including train, bus rapid transit (BRT) and minibus taxis. The first set of recipients received houses in 2007/2008. Lufhereng is a large development on the western edge of Soweto. Although the broader project is still under construction, Phase 1 was completed and the first set of recipients received their houses in 2010. Because Lufhereng is on Johannesburg's urban development edge, all necessary infrastructure and services (including transport and retail) have

been included in the design of the broader development, but most have not yet been developed. The final settlement design includes extending the existing train line and bus routes to service the settlement. However, these extensions are still pending and there is a concern that the train line might not materialise due to the dire state of the Passenger Railway Agency of South Africa (PRASA).

4.2 Background: Conceptualising Just Sustainability in the Context of Government Housing

This paper engages with the practices, interconnections and disjunctures around justice and sustainability through the case of government housing. This section provides background on the concepts with which this paper engages. It first explores in Section 4.2.1what is meant by social justice and environmental sustainability (from here on referred to as "justice" and "sustainability"), and how their interaction can be conceptualised as "just sustainability". Then Section 4.2.2 goes on to consider these features with reference to government housing.

4.2.1 Interactions between social justice and environmental sustainability

Despite wide acknowledgement of the interconnectedness of social and ecological systems, and in particular the imperatives of enhancing sustainability and justice, Leach et al. (2018) highlight the paucity of systematic research into the ways these imperatives are interlinked.

In this paper, justice is defined to incorporate the principles of equity and fairness, which focus on ensuring wellbeing for everyone rather than treating everyone the same way (equality) (Leach et al., 2018). Expanding on Campbell's (1996) definition with respect to sustainable development, social justice refers to 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. This definition must include efforts to reduce or redress existing inequities in distribution. Although this definition (and this paper) focuses primarily on distributive justice, both recognitional and procedural justice are necessary components of justice (Leach et al., 2018).[11] Sustainability is underpinned by the need to conserve the natural environment, minimise the use of resources and

[11] Distributive justice refers to the ways resources, costs and benefits are distributed across society. Procedural justice refers to processes of decision-making and conflict resolution that are fair and equitable and that allow all affected people to influence the process. Recognitional justice refers to the acknowledgement of identity and values, and explicitly reacts against discrimination based on cultural or political bases.

limit waste production. Climate change has encouraged a particular emphasis on the need to minimise greenhouse gas emissions and build developments that are resilient in the face of climate disasters. Sustainability approaches draw on principles of maximum efficiency, where the needs of society are met through the least possible impact on resource and land consumption.

Since the emergence of the 'sustainable development' agenda in the 1980s, the literature on the areas of commonality among environmental, social and economic systems has grown. Much of this literature embodies an assumption that justice and sustainability are mutually attainable if they are considered and planned for carefully enough. Despite emphasis on the nexus of these imperatives, there has been great difficulty in translating this theoretical alignment into reality (Visser, 2004; Patel, 2006a; Vogel et al., 2016b). In practice, justice and sustainability have a complex relationship – they can stand in opposition to each other or have non-linear interactions (Marcuse, 1998; Patel, 2006a; Leach et al., 2018). There are numerous examples of progress towards one of these imperatives undermining the achievement of the other (Marcuse, 1998; Patel, 2006a; Culwick, 2015). Just sustainability explicitly refers to interconnected space between justice and sustainability (Agyeman & Evans, 2003).

While much scholarship acknowledges that social, environmental and economic systems are interconnected, there is a spectrum in terms of how their interaction is conceptualised (Leach et al., 2018). At one end of the spectrum, these different systems are considered independently, while at the other, the achievement of either justice or sustainability is posited to depend on the achievement of the other. Scholars on the latter side argue either that justice is a precondition for a sustainable society, or that attention to environmental issues, which are primarily borne by the poor, is necessary for attaining social justice (Agyeman, Bullard & Evans, 2002; McDonald, 2002; Agyeman, 2005; Swilling & Annecke, 2012; Heynen, 2013). This paper balances these two ends of the spectrum. It emphasises that addressing the current environmental crisis and achieving sustainability cannot be done without attention to the imperatives of justice, while acknowledging that these two objectives are not always mutually beneficial (Leach et al., 2018).

This paper contributes to the literature on just sustainability through an exploration of empirical evidence on government housing, how it can further both sustainability and justice, and where particular actions might further justice but not sustainability and vice versa.

4.2.2 Just and sustainable government housing

Government housing projects play an important role in enhancing the quality of life for poor urban dwellers (Chiu, 2000; Shapurjee & Charlton, 2013; Turok, 2016a) (a key justice imperative), but they also have broader implications on spatial form, resource use, and access to opportunities and services (Turok, 2016a). Many studies have explored different elements of government housing projects related to either sustainability or justice, such as the cost implications of housing developments based on their location (Biermann, 2005; Biermann & van Ryneveld, 2007), the inclusivity of the house allocation process (Rubin, 2014), and the impact of housing developments' location and type of settlement on just spatial form (Haferburg, 2013). Other studies have deliberately engaged with both environmental and social implications of government (and low-income) housing developments (Goebel, 2007). However, most of these studies do not analyse the interaction between justice and sustainability outcomes.

However, Aquino and Gainza (2014) contend that simplified location-based assessments are insufficient to measure the overall impact of development. They argue for a deeper engagement with issues related to quality of life, access to economic opportunities and urban amenities across different groups in society.

Chiu (2000) engages with the interplay between the justice and sustainability imperatives of housing developments, and the fact that access to accommodation and basic services has unavoidable environmental impacts, including land transformation, ongoing use of resources and energy, and waste production. However, as Goebel (2007) highlights, the increased resource consumption of poor households as they gain access to basic services is very small compared to the resource consumption of elite households.

A typical objective of land use and transformation planning for sustainable urban development is a reduction in the amount of land required per household (IRP, 2018). Turok (2016a) highlights that housing has the largest impact on urban land transformation. If it is developed in a way that entrenches "sprawling" and "haphazard" urban growth, it can be difficult to service with infrastructure, public transport and other public services (e.g. schools and hospitals), thus increasing the financial and environmental costs of development. Many scholars emphasise that compact urban development has significant environmental and social benefits because it means shorter travel distances, better accessibility to services, amenities and opportunities, and more compact public infrastructure networks (IRP, 2018). Despite these potential benefits, compact development alone is insufficient to ensure just and sustainable outcomes (Biermann, 2005; IRP,

2018), and can instead contribute negatively to both justice and sustainability, leading to land transformation, exacerbated heat island effects, encroachment on urban green spaces, and exclusion through land and housing price escalation (Mueller, Hilde & Torrado, 2018).

Both the literature and government policies emphasise that for government housing developments to raise quality of life, they need to ensure access to social services and economic opportunities (Turok & Borel-Saladin, 2016). Turok and Borel-Saladin (2016) identify a range of features that influence the impact of housing, including the structure of the house and property, ease of access, core services, location and the local environment. Understanding the influence of this set of features contributes to a broader understanding of the overall outcomes of housing on both social and environmental systems.

Although numerous studies explore the different outcomes of government housing, there is a paucity of research that explores the interaction and trade-offs between justice and sustainability. This paper draws on a large dataset together with more detailed case study evidence to arrive at a more nuanced assessment of government housing developments. While it explores a range of aspects related to government housing programmes and their social, environmental and economic implications, this paper does not attempt to provide a comprehensive report on government housing programmes. Rather, it focuses on the interactions between different justice and sustainability outcomes.

4.3 Methods

This paper draws on empirical evidence on government housing in Gauteng: both the results from the Gauteng City-Region Observatory's Quality of Life V (2017/18) (QoL) survey and interviews with residents of the Lufhereng and Pennyville government housing developments. The QoL survey data provide an aggregated picture of government housing developments in Gauteng Province, and the Lufhereng and Pennyville interviews allow for more detailed insights into the lives of residents of these developments. Table 4.1 provides a summary of the two datasets, including the number of interviews conducted in each.

Respondents to the QoL survey included a total of 24,887 adults, selected to be a representative sample of the Gauteng population. This sample included respondents who live within areas defined by the Gauteng provincial government as public housing projects, and also those outside these

areas in Gauteng – some in informal settlements, and some in formal residential areas.[12] The sample frame was based on a building-based land-use layer generated by GeoTerraImage (GTI) using updated satellite imagery for Gauteng. This provides the best available understanding of buildings in the province, particularly new developments and informal settlements. The survey respondents were selected using a multiple-stage randomisation process, which randomised the selection of the dwelling unit, household and respondent for each interview. The survey included 248 closed-ended questions on a range of topics including demographics, household services and needs, transport, employment, neighbourhood, personal opinions and satisfaction, which are all important components of or proxies for sustainability and justice (Shapurjee & Charlton, 2013; Suzuki, Cervero & Iuchi, 2013; Aquino & Gainza, 2014).

Table 4.1: Breakdown of Quality of Life V (2017/18) respondents within government housing developments, informal settlements and the rest of Gauteng, plus the interviews with residents in Lufhereng and Pennyville.

Data source		Number of respondents	Percentage of total[13]
Quality of Life V (2017/18) survey	Government housing	6 612	27%
	Informal settlements	1 669	7%
	Rest of Gauteng	16 608	67%
	TOTAL	24 887	100%
Government housing interviews	Lufhereng	30	50%
	Pennyville	30	50%
	TOTAL	60	100%

Interviews were conducted with 30 residents each in Lufhereng and Pennyville. Interviews were not restricted to recipients of government housing, and included people who are renting from the government or a private landlord. To ensure statistical representativity[14], interview respondents

[12] The individual developments in the spatial dataset are not aligned accurately with the edges of settlements. To ensure that all relevant QoL 5 (2017/18) respondents were included in the analysis, respondents located within 250 metres of the boundary of each housing development polygon were also included in the analysis. The respondents in the "government housing" group are not necessarily recipients of government-subsidised housing, but live within the areas defined as government housing developments, and might for example be renting from the government or a private landlord or living rent free.

[13] Percentages do not sum to 100 due to individual rounding.

[14] For a sample of 30 respondents, the 95 per cent confidence interval for a binary yes/no question is 18 per cent. To significantly improve this, substantially more interviews would have been required (e.g. 100 interviews provide a confidence interval of 10 per cent). The QoL survey provides very high precision to balance the lower precision of the case study interviews. The GCRO Quality of Life V (2017/18) survey data can be accessed from the GCRO – info@gcro.ac.za.

were selected using the same sampling methodology (based on updated multi-stage randomisation) as the QoL survey. However, the person who was interviewed in each household was either the head of the household or another household member who had an understanding of the household's income and monthly costs. The interview included a set of closed- and open-ended questions focusing on household services, resource use, employment and reflections on current living conditions compared to where people lived before moving into the government housing developments.

Both datasets were analysed using IBM SPSS software.

4.4 Assessing Government Housing in Gauteng

The analysis of government housing projects in this section begins with a general overview of demographics and access to basic and other services (e.g. healthcare and schools). The analysis then delves into an overall assessment of access to goods, services and work opportunities. The analysis concludes with an exploration of residents' strategies for enhancing the quality of life through improving their dwelling and creating opportunities for income generation. This is followed for each topic by an examination of how it plays out for people who live in Lufhereng and Pennyville.

Table 4.2 provides some general results from the QoL survey, comparing respondents who live within the three different housing typologies in Gauteng: government housing, informal settlements and the rest of Gauteng. In overall terms, these results reveal that people living in government housing are substantially better off than those who live in informal settlements, but they are worse off than residents in the rest of the province. The group categorised as the "Rest of Gauteng" primarily includes people living in middle-income and affluent areas. Table 4.2 shows that people living in government housing are more educated than people in informal settlements. This is likely because informal settlements have a higher proportion of migrants (local and international) than government housing, and the QoL survey highlights that people born in the province have higher education levels.

4.4.1 Access to services

Access to basic services is a critical component of government housing programmes, and Table 4.2 demonstrates the success of government housing in enhancing access to basic services such as water, sanitation and electricity. Although access to formal accommodation and adequate basic services among respondents within government housing developments is worse than in the "rest of

Gauteng", it is substantially better than among those who live in informal settlements. The vast majority of people who live within government housing developments (92 per cent) have access to adequate water (piped into their dwelling or yard), compared to fewer than half of people in informal settlements (40 per cent). These results are mirrored for electricity and adequate sanitation.

Table 4.2: Comparison of a range of variables across respondents living in government housing developments, informal settlements and the rest of Gauteng. Data source: Gauteng City-Region Observatory's Quality of Life V (2017/18) survey.

	Government housing	Informal settlement	Rest of Gauteng
Number of household members	3.5	2.9	3.2
Average monthly household income[15]	R5 232	R2 691	R12 025
Employed	32%	34%	43%
Education – Matric[16] *or more*	50%	37%	67%
Born in Gauteng	51%	27%	61%
Household member gets government grant	56%	45%	36%
Average number income sources	1.9	1.7	1.8
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%
Satisfied with standard of living	50%	36%	64%
There are public schools in area[17]	89%	55%	91%
There are public health facilities in area	87%	59%	91%
Public transport within 20 min walk	91%	87%	81%
Households that grow food to eat / sell	19%	23%	13%

The interviews in Lufhereng and Pennyville allowed for an analysis of the change in access to basic services between the places where respondents lived before and the government housing developments where they now live. All interviewees in Lufhereng and Pennyville now live in formal accommodation and have adequate access to basic services (formal electricity connection, flush

[15] US$ 1 = approx. R 14.
[16] Matriculating is equivalent to completing high school.
[17] Access to public schools and healthcare facilities is drawn from questions regarding satisfaction with public schools and healthcare facilities. Responses included a range from "very dissatisfied" to "very satisfied" and an option for "there are none".

toilet and water piped into their dwelling). Some 63 per cent of residents reported that they had lived in either an informal or a traditional dwelling before moving into the government housing development. Half of those interviewed said that previously they had accessed water from beyond their yard (e.g. from a street tap, water tank or river). Only 30 per cent had access to a flush toilet where they lived before coming to Lufhereng or Pennyville; 32 per cent relied on a chemical toilet, 20 per cent on a pit latrine and 15 per cent on a bucket toilet. More than half of people interviewed (55 per cent) said that previously they had no access to electricity. However, further probing revealed that many of these people likely had *izinyoka-nyoka* access (illegal electricity connections).

4.4.2 Accessibility

In addition to basic services, people must be able to access goods, services and opportunities such as shops, healthcare facilities, schools, parks and public transport. An accessibility index was derived from the QoL survey to give an overall sense of access to a range of services. The index combines 13 variables into a single accessibility score, which is scaled out of 10:

1. Living within a 15-minute walk of somewhere to buy groceries
2. Living within a 15-minute walk of financial services/banks
3. Living within a 15-minute walk of an internet café
4. Living within a 15-minute walk of business services (printing, photocopying, etc.)
5. Living within a 15-minute walk of a post office
6. Living within a 15-minute walk of a park or green space
7. Living within a 15-minute walk of a library
8. The most frequent trip takes 30 minutes or less
9. The closest public transport access point is within a 20-minute walk
10. If there are children in the household, it takes them under 30 minutes to get to school
11. The personal monthly transport cost is R 250 (US$18) or less
12. There are no public schools in their area
13. There are no government health services in their area

The combined accessibility index score (out of 10) was grouped into categories: “very low” (index score <2), “low” (index score 2–3.9), “moderate” (index score 4–5.9), “high” (index score 6–8), and “very high” (index score >8). Figure 4.3 shows that accessibility is lowest among people in informal settlements, followed by those living within government housing, and is highest among people in

the rest of Gauteng. People within government housing developments are as likely to have low or very low accessibility (35 per cent)[18] as high or very high accessibility (38 per cent).

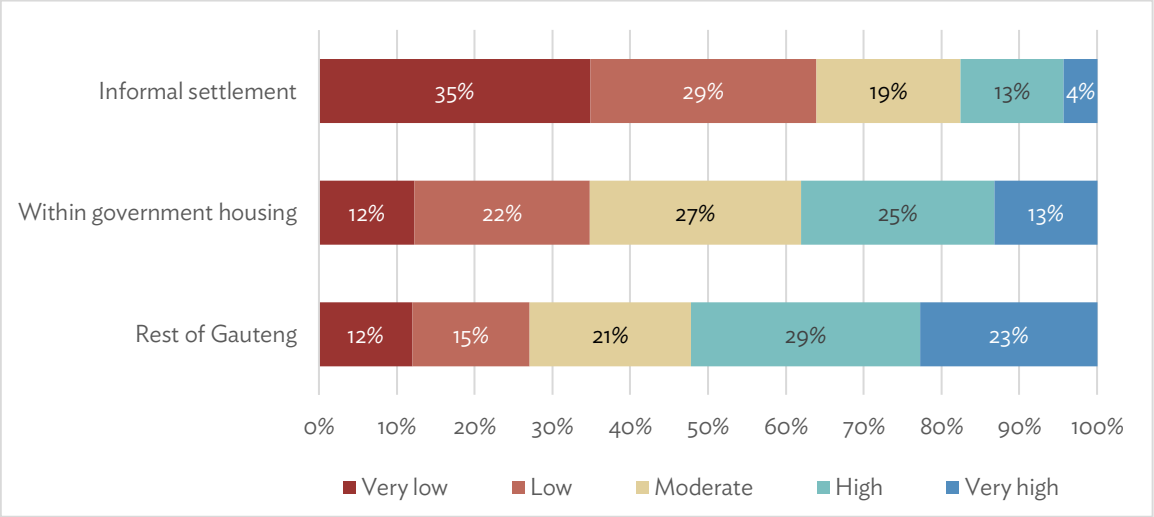

Figure 4.3: Accessibility index categories for people within government. Data source: Gauteng City-Region Observatory's Quality of Life V (2017/18) survey.

Accessibility index scores differ widely between different government housing developments across the province.[19] Settlements such as Alexandra and Cosmo City (Johannesburg) have high average accessibility, whereas settlements such as Hammanskraal West (Tshwane) and Alliance Extension 9 (Ekurhuleni) have very low access to goods and services. Although the QoL results highlight that overall access is better in government housing developments than informal settlements, the Lufhereng and Pennyville interviews reveal that access has not necessarily improved for individuals after moving from an informal settlement to subsidised housing. Located immediately adjacent to an industrial area and a major retail outlet, the Zamimpilo informal settlement is arguably better located with regard to work opportunities and services than Pennyville. Likewise, Lufhereng respondents lamented that services and opportunities are harder to access than from where they lived before, particularly for those from Protea South, which was close to a train station, retail outlets and work opportunities in Lenasia.

Despite low accessibility scores in some government housing developments, the QoL survey results show that people within government housing developments on the whole have the best access to

[18] The discrepancy between this percentage and those in Figure 4.3 is due to rounding.
[19] This analysis excludes any housing programme in the QoL 5 (2017/18) dataset where there are fewer than 15 respondents. Lufhereng is included in this subset due to insufficient respondents.

public transport. Some 91 per cent of government housing respondents live within a 20-minute walk of public transport, compared to 87 per cent of informal settlement residents and 81 per cent of the rest of Gauteng (Table 4.2). The contrast between Lufhereng and Pennyville in this regard, although not great, is indicative of the differences within this category. Interviews indicated that 100 per cent of people in Pennyville lived within a 10-minute walk of public transport, but only 83 per cent of those in Lufhereng did. Importantly, different areas have access to different types of public transport, including trains and buses subsidised by the government, and privately run minibus taxis. Pennyville is located within immediate proximity to a train station and a bus rapid transit station, and straddles a main taxi route between Soweto and the Johannesburg CBD. From Pennyville, the cost to travel to the CBD is R 7.50 (US$ 0.52) by train, R 11.80 (US$ 0.83) by BRT and R 12 (US$ 0.84) by taxi. A number of Pennyville interviewees highlighted that they rely on the weekly train ticket (R 46 [US$ 3.22] per week) as a cheap option for looking for jobs.

Lufhereng is currently only serviced by minibus taxis. Transport was highlighted as a significant concern for many Lufhereng residents. A taxi ride to the CBD from Lufhereng costs R 16 (US$ 1.12), and R 18 (US$ 1.26) for the other direction. The closest train station to Lufhereng is Naledi, where a taxi to the station costs R 9 (US$ 0.63) and the train ticket into town is R10 (US$ 0.70). Sandile[20], a Lufhereng resident, flagged that it is hard to find work from Lufhereng because there is no train station close by. Despite the distance, some Lufhereng residents like Enzokuhle will walk 45 minutes to the train station to benefit from the cheaper fare. For poor households, the cost of transport, and particularly privately run public transport, is prohibitively high. Despite being more expensive than other modes of public transport, minibus taxis (privately run public transport) are the dominant mode of transport among people living within government housing developments in Gauteng.

Notwithstanding their generally better access to public transport, government housing developments tend on the whole to be poorly located with regard to work opportunities. Figure 4.4 compares the average distance (straight-line) travelled from home to work or to look for work, among the three groups. People living within government housing developments travel on average 23 per cent further than people in informal settlements and the rest of Gauteng. While averages can hide the range of individual experiences, the spread of data confirms that commutes from government housing developments tend to be longer than in either of the other categories.

[20] All names have been changed to protect the identities of interviewees.

Commutes from informal settlements have the smallest range (86 kilometres), compared to 97 kilometres for government housing and 124 kilometres for the rest of Gauteng. Despite a few very long commutes, the majority of respondents in the rest of Gauteng commute under 10 kilometres (median), whereas the majority of commuters from government housing developments travel over 14 kilometres. These results confirm previous analyses highlighting that government housing programmes are situated far from traditional economic centres (Wray et al., 2015). The QoL survey shows that people in government housing are the least likely of all respondents to arrive at work within 30 minutes of leaving home. They are also the most likely to take over an hour to get to work. The distance and time taken to reach economic opportunities is likely to contribute to the lower employment rate among people living within government housing compared to those living in informal settlements and the rest of Gauteng (Table 4.2). Despite the vast differences between Pennyville and Lufhereng, the interviews revealed no significant difference between commuting time from these settlements. There was also no significant difference in employment between the settlements. This could reflect the broader economic environment where jobs are hard to find or potentially the small sample size in these areas. A number of interviewees in Lufhereng lamented that it was harder to find jobs now than where they lived before.

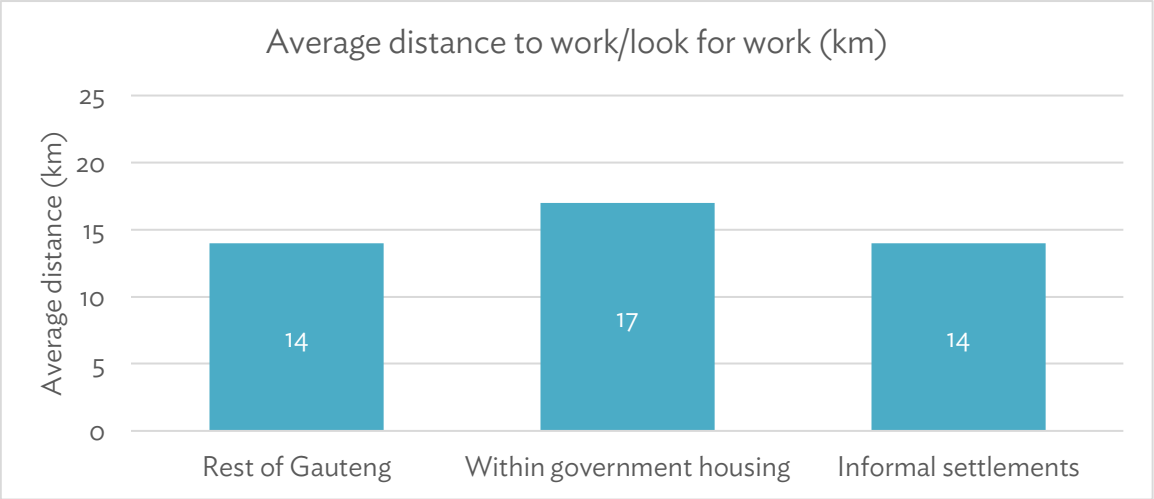

Figure 4.4: Comparing the average straight-line distance to work or to look for work for people living within government housing, informal settlements and the rest of Gauteng. Data source: Gauteng City-Region Observatory's Quality of Life V (2017/18) survey.

4.4.3 Income and employment

Despite similar employment levels in government housing (32 per cent) and informal settlements (34 per cent), monthly income is higher in government housing. This could be influenced by the higher education levels among government housing residents and their higher likelihood of

benefitting from government grants and rental as sources of income (Table 4.2). The majority of people in Gauteng draw on a range of income sources, possibly because no individual source of income is sufficient for their needs. Government housing provides an opportunity for recipients to supplement their income through rental. Figure 4.5 demonstrates that a greater proportion of households in government housing rely on rent as a source of income compared to people living in informal settlements and the rest of Gauteng. Much of this rental income is from self-built backyard dwellings (sometimes using "informal" construction methods). The QoL survey reveals that 16 per cent of people within government housing developments live in informal backyard dwellings. Rental income from backyard dwellings provides a real opportunity for people in government housing to improve their economic circumstances. However, this typically requires that owners invest in their properties.

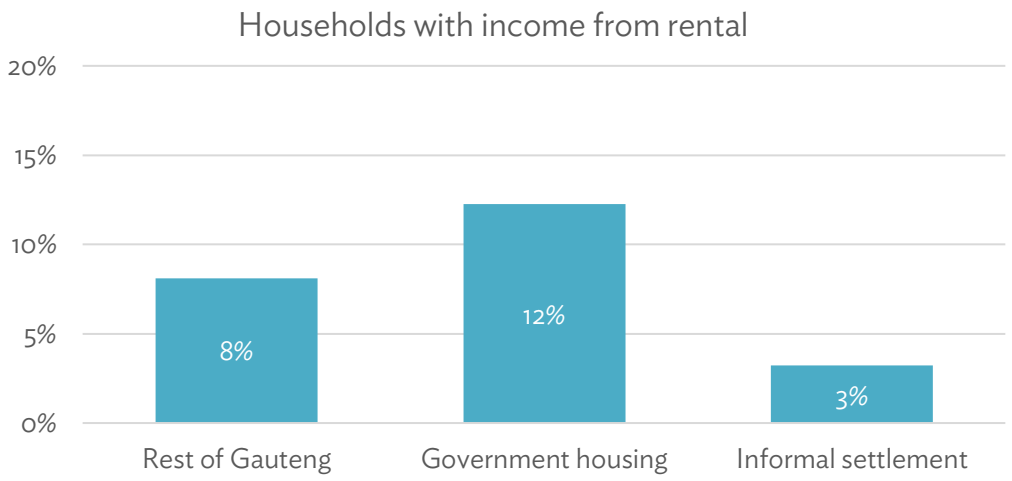

Figure 4.5: The proportion of households where rental income is a source. Data source: Gauteng City-Region Observatory's Quality of Life V (2017/18) survey.

The Lufhereng and Pennyville interviews revealed that the vast majority of people have made improvements to their houses or properties (79 per cent). Some 21 per cent of these people have added ceilings to their homes, and 47 per cent have built additional rooms onto their properties. These additional rooms are used for a range of reasons, including to house family members, to run businesses and to rent out. Rent is a source of income for 22 per cent of Lufhereng and 44 per cent of Pennyville homeowners who have built additional rooms.

The cost of food and the additional burden of accessing retail outlets increases the need for people to use a range of food strategies, including growing vegetables and fruit. Some 19 per cent of people living in government housing grow food to eat and/or sell (Table 4.2). This is significantly higher

than in the rest of Gauteng, but lower than in informal settlements. Less dense housing developments are more likely to facilitate informal agriculture. Lufhereng, an area specifically designed as a potential urban agriculture hub, has significantly higher prevalence of food growing than Pennyville. Some 43 per cent of interview respondents in Lufhereng grow food, compared to only 10 per cent in Pennyville, likely because of the greater amount of space available in Lufhereng.

The following section uses these empirical findings to explore the extent to which justice and sustainability outcomes are produced through government housing developments.

4.5 Building just and sustainable cities through government housing

The data reveal that government housing developments have substantially improved living standards for residents in Gauteng. The majority of residents in Lufhereng and Pennyville previously had inadequate access to accommodation and basic services, whereas every person interviewed now has adequate access to basic services and formal accommodation. This reveals a tangible improvement in quality of life because of the government's investment in housing developments. Many people like Elsie (in Lufhereng) explain that because of their improved living conditions they "can't complain" about other issues they might be facing. Although issues of accessibility remain, government housing developments have addressed some basic justice imperatives.

However, these housing developments have negative implications for the environment because of land-use transformation, embedded resource requirements of infrastructure and housing, and the likely higher daily use of resources (e.g. water and electricity) because of improved access to basic services. However, compared to elite groups, resource consumption remains low. For example, QoL data show that the majority (76 per cent) of households in the rest of Gauteng, with an income of R 25,600 (US$ 1,790) per month or more, spend over R 500 (US$ 35) per month on electricity, whereas only 15 per cent of people in government housing spend this much.

Despite the literature critiquing government housing developments for being poorly located (Landman, 2010; Haferburg, 2013), this analysis shows that, although some government housing developments do indeed have low access to goods and services, in overall terms, accessibility is higher than in informal settlements. This indicates positive outcomes for both sustainability and justice. The greater the overall accessibility, the shorter the distances people must travel to get the things that they need. This reduces the environmental impacts as well as the time and financial costs of travel.

It is likely that older housing developments have higher access to goods and services because these have had time to establish in new areas. Lufhereng is an example of a government housing settlement that was built in an area without existing services or opportunities. The housing development is being built in phases, and the first phase was built long before any of the social or economic services that are planned for the overall settlement. The next phases are currently under construction, and it is likely that it will still be a number of years before the associated services are completed. Many Lufhereng residents, like Solly, lament that *"it's hard to get things from Lufhereng"*. Lethabo emphasised that *"you have to travel if you want something"*. Government housing developments that have poor accessibility place a significant burden on residents. This not only has negative justice implications, it also increases the environmental footprint of people living in these areas due to longer commutes that are reliant on motorised transport.

This locational disadvantage is at the centre of many justice and sustainability concerns with government housing developments. Long commutes and trips to look for work by people living in government housing developments contribute to high financial and time costs that undermine people's ability to move out of poverty. These long commutes also reflect carbon-intensive and environmentally unsustainable travel patterns. Although this mirrors the general transport system in Gauteng, where people live far from where they work, the results suggest that this pattern is slightly worse for people living within government housing developments. While it is important to draw a distinction between proximity to work opportunities and securing work, anecdotes from interviews confirmed the challenge of finding jobs from government housing developments. Dorothy highlighted that *"you waste that small amount of money you have looking for money"*. This also affect's people's ability to find work. Samuel reflected that *"[i]f you came to Pennyville not working you are still not working"*. The interviews highlighted that many residents limit the number of trips in search for jobs because of the cost of transport, while others will walk long distances to the train to benefit from subsidised fares.

Interviews with residents in Pennyville, who have much better access to trains than Lufhereng residents, flagged the importance of the weekly and monthly train tickets in enabling people without jobs to go out and look for work. Government-provided public transport such as trains and buses are important for the poorest groups in society, as they provide a means for the government to subsidise travel. However, few of the government housing developments in Gauteng are close to existing train or bus stations.

The data highlight that access to public transport is highest among people who live in government housing developments. Although it is likely that areas within the "rest of Gauteng" also have high access to public transport, many of the middle-class and affluent areas are poorly served by public transport. Comparatively high access to public transport can be primarily attributed to the prevalence of private taxis. The private minibus taxi industry has been highly successful in ensuring access to public transport for the majority of people in Gauteng in the absence of effective government-led public transport. Unlike government-provided public transport, which can take many years to respond to travel needs in new areas, the private taxi industry is flexible and responsive to new market opportunities. This analysis suggests that the private taxi industry has proved invaluable in ensuring that people in government housing developments can access goods, services and opportunities that are not located within or close to these developments.

However, taxis are more expensive than trains and buses, and there are limited options for saving money through buying weekly or monthly tickets. As Dorothy from Lufhereng reflected, *"we pay the money we don't have"* because they have no other option than to use taxis. This reflects a complex interplay between improving and undermining justice and sustainability. Taxis increase access to goods, services and opportunities through public transport and enabling people to rely on public transport rather than private vehicles – both positives for justice and sustainability. However, their cost places a burden on household resources, undermining the justice imperatives of reducing poverty and inequality. And taxis that facilitate long-distance daily commuting contribute to entrenching the existing unsustainable transport system in the province. Taxis are also less resource efficient and produce more emissions per potential rider than buses and trains.

The analysis revealed that many recipients of government housing subsidies have built additional rooms and backyard dwellings to either supplement their income through rental, or provide additional accommodation for their household. More than half of people who live in informal backyard dwellings in Gauteng reside in government housing settlements. Turok and Borel-Saladin (2016: 388) argue that self-built backyard structures

> *provide more flexible accommodation to rent; greater proximity to economic opportunities than dormitory townships; better access to essential services and more safety than informal settlements; a regular source of income to poor homeowners acting as landlords; higher residential densities, and a more compact urban form enabling more cost-effective public transport and community infrastructure.*

These benefits enhance the justice imperatives of providing additional accommodation, with better access to basic services, and providing opportunities for income generation. From a sustainability perspective, higher densities can minimise the impact of development on land and resource consumption. The results in Table 4.2 highlight that government housing developments do indeed have higher average household sizes than other groups in the province.

Despite the possible benefits for justice and sustainability of backyard dwellings, there are a number of potential issues that need to be taken into account in this particular situation. While backyard structures may provide greater proximity for more people to economic opportunities in some situations, as Turok and Borel-Saladin (2016) suggest, this is not the case within these poorly located government housing developments. Furthermore, self-build developments can pose potential risks. Lufhereng, for example, is built in a dolomitic area and thus great care needs to be taken in extending water networks and adding weight to areas with high risks of developing sinkholes. Government support and deliberate planning could help maximise the benefits of rental and individual investment, while minimising the negative consequences of self-built developments such as overloaded infrastructure, increased fire and health risks, environmental impacts, poor aesthetic quality, and the potential for aggravated social tensions and tenuous access to basic services for tenants (Lemanski, 2009).

A further concern regarding increasing densities is the reduction of potential land for agriculture. Small-scale farming provides low income communities with locally grown food, which is positive from an environmental sustainability perspective. It also improves access to food at a lower cost and with the potential to generate income through selling – both positives for social justice. The data suggest that although residents of government housing are more likely than the rest of Gauteng to grow food, this differs between settlements and is influenced by where space is available (e.g. Lufhereng and not Pennyville).

4.6 Conclusions

Global urban growth trends place significant pressure on cities to accommodate the increasing urban populace and ensure sufficient access to basic services and economic opportunities. This challenge is further compounded by the need to reduce unemployment and inequality, while minimising resource use and the negative environmental consequences of development.

This paper used survey and interview data from Gauteng, South Africa to assess some of the justice and sustainability implications of government housing developments. The analysis reveals that

government investment in housing developments has improved justice imperatives through the improvement of access to adequate accommodation and basic services. Although these housing developments tend to have slightly lower access to economic opportunities than the rest of Gauteng, the private taxi industry has enhanced access to goods and services for residents in these areas. Taxis play a critical role in bridging the distance between government housing developments and work opportunities, but this comes at a cost that can be prohibitive for many poor households. Despite sometimes living in poorly located settlements, residents in government housing developments have been able to improve their earning potential, through building and renting out backyard rooms. This has had the additional benefit of increasing the density of government housing developments, which improves the efficiency of infrastructure investment. This study has demonstrated that government housing developments have contributed to enhancing justice and sustainability for residents. However, there are also instances where outcomes have been negative for one or both of these imperatives.

For government housing developments to help achieve both justice and sustainability imperatives, it is necessary to consider the broader implications of housing – not merely housing as access to adequate accommodation and basic services, but the associated access to goods, services, work opportunities and income generation options. The importance of affordable public transport in facilitating access to amenities, services and economic opportunities has been demonstrated. The outcomes of government housing developments would be significantly improved in Gauteng if government-led public transport were developed in parallel with the housing developments, to support residents in accessing job opportunities affordably. Furthermore, government assistance and incentives for economic opportunities in and around government housing programmes could support both environmental sustainability and social justice imperatives, particularly for settlements with low accessibility scores and long average commutes.

This paper highlights the complex interplay between justice and sustainability imperatives. In some instances, justice and sustainability outcomes are aligned (e.g. improved access to goods and services), whereas in other instances the outcomes are conflictual (e.g. improving access to basic services has resource-use implications). This empirical evidence highlights the theoretical stance put forward by Leach et al. (2018), that linear, reductionist relationships between justice and sustainability are not adequate in furthering a conceptual understanding of the interlinkages between these imperatives. Rather, different elements of justice and sustainability interact in complex ways.

A point of emphasis in the paper is the importance of decision-making that takes multiple criteria into account and engages with trade-offs between different decisions and the associated outcomes of government housing. This requires assessing both the direct impacts of these developments and the ongoing implications. Addressing the current multifaceted crisis of meeting the basic needs of a growing urban population and reducing poverty and inequality, while protecting environmental resources, requires thinking differently about this set of challenges. Creating an enabling environment for multiple systems to coexist can provide an important way for a range of actors across government, society and the private sector to help build cities that are both more socially just and environmentally sustainable.

PEOPLE, FACES AND LIVES: HUMANISING THE STATISTICS

Lufhereng and Pennyville, are housing projects that feature in various government reports and documents. Although the aim of these projects is to improve people's lives and to have an impact on their quality of life, it is often easy to forget the human element. This photo essay grounds the technical assessments, quantitative analyses and abstracted reflections of project managers with the people who live in these areas every day. It shows how their lives are woven into the bricks, wires, pipes and tar – the steps they take, the friends they make and the daily work they do. People who live here are not merely recipients, these places are now theirs, with their hopes, dreams, disappointments and frustrations. Each photograph in this essay is captioned to direct the reader to particular elements within the photograph and to associated arguments within the broader thesis.

Photograph 8
Walking through the mielies

On the western edge of Lufhereng is a farming area where many of the residents grow mielies, peanuts and other crops. They share techniques and give advice to each other.

See section 4.4.3

> Lufhereng Phase 1 has a quiet, gentle and welcoming feel. People walk through the area, not merely to get somewhere but to be with people. They know their neighbours and greet each other.

See section 5.3.1

Photograph 9
Ambling with a companion

Sitting outside Bongikosi's kitchen door, which opens out onto one of Pennyville's main internal streets. Bongikosi lived in Zamimpilo informal settlement before moving to Pennyville in 2008, and is now very proud of his home. He has made numerous improvements to his house including adding a bathroom with an electric geyser, finishing the interior with plaster and a ceiling, and installing built-in kitchen cupboards. For him, life is much better here than before, with "*many changes and progress. New things and beginnings*".

See section 4.4

Photograph 10
Mandla and Bongikosi

Photograph 11
Bicycles and friends

Cycling is not a common mode of transport in Pennyville, but children and teens are often seen riding and playing with their bikes in the streets, which are generally safe for pedestrians and cyclists.

See section 5.3.1

Photograph 12
Let's talk outside, the children are sleeping

Thabisa moved to Lufhereng in 2012 from an informal dwelling in Protea South. She waited for 15 years to get her house, after applying in 1997 (see section 0). She feels that "*Here [in Lufhereng] it is better*". She does not live in a shack anymore and she and her children are "*now safe*". She runs a day-care centre from her house for children in the area.

See section 5.2

Photograph 13
Walking in search of customers

Pennyville has only a few spaza shops in the area, so residents have identified opportunities to source and sell household items and other wares to supplement their income.

See section 4.4.3

Mlungisi lives in Lufhereng. He has a matric, but he hadn't been able to find a job since moving to Lufhereng. In 2018, he started a small business with a friend, washing cars and making chips on the side. They are sure that things will get better now that their business is starting to gain momentum.

See section 4.5

Photograph 14
Waiting for the hungry regulars

Photograph 15
Banter after practice

The Pennyville park has a concrete football pitch that has clearly been well used. This group of young men relax and joke about after a friendly football game. They love it, but they take their matches seriously.

See section 5.2.1

5 In pursuit of just sustainability: Knowledge, power and conflicting rationalities in government housing projects

Preface

This chapter is a verbatim reproduction of a paper published in *Local Environment: The International Journal of Justice and Sustainability* in 2023 (https://doi.org/10.1080/13549839.2022.2136636). It engages with the second research question, which focuses on policy processes, and uses key informant interviews to interrogate how social justice and environmental sustainability have been conceptualised and operationalised in Lufhereng and Pennyville. This chapter examines how different logics and motivations influence the social justice and environmental sustainability outcomes of these two government-led housing projects. It interrogates the decision-making and policy processes related to these projects, and the role that conflicting rationalities play in undermining efforts to build both socially just and environmentally sustainable housing.

Photographs have been incorporated in this paper to illustrate and justify some of the evidence presented. In addition to this visual evidence, various sections in this chapter are referenced in the two photo essay. In section 5.3.1, the chapter describes how various design elements were adopted that further social justice and environmental sustainability. In particular, the photo essay provides a tangible understanding of these elements and how they translate into enriching the lives of residents. The street-facing verandas (photo 1) and the pedestrian centred design (photo 9) of Lufhereng, and the walkable streets in Pennyville (photo 11) were all carefully designed and implemented. These photo essays further elucidate how planning decisions, such as including a football pitch into the Pennyville Park (section 5.2.1) can spark friendships and positive activities for young men (photo 15). While challenges in implementing plans and promises by government (section 5.2) have real consequences for people and can trap residents in a lengthy period of waiting (photo 12).

The concept of conflicting rationalities, which Watson's (2003) used to explore how disjunctures play out within state and community engagements, is adopted and applied within a new context. This chapter explores how conflicts play out within three realms: conceptual, institutional and implementation. This application extends the theory and contemporary understanding of urban planning in the face of tensions and trade-offs. The chapter reveals how institutional dynamics, politics and conflicting rationalities diverted both Lufhereng and Pennyville from their envisioned outcomes. However, the results show how disconnections between theory and practice are not

necessarily driven by conflicts between social justice and environmental sustainability, but rather more subtle factors. In this way, the idea of conflicting rationalities, which focuses on overt conflicts was limited in its ability to help interpret the study findings. Thus, this paper introduced a new concept: obscured rationalities, that builds on Watson's 'conflicting rationalities' but refers to more hidden conflicts that nonetheless influence processes and outcomes. The chapter argues that by placing too much attention on the overt conflicts between social justice and environmental sustainability attention can be diverted away from the more subtle practical, and sometimes mundane, processes that cumulatively undermine progress towards social justice and environmental sustainability.

Abstract

Social justice and environmental sustainability are often joint policy objectives, however, achieving the dual goal of just sustainability has proved difficult in both theory and practice. Scholars argue that a key challenge is balancing trade-offs between sustainability and justice objectives. This is evident within government-led housing, where there is little consensus regarding how to balance the housing needs within the context of existing unsustainable and unjust urban forms, resource constraints and high inequality. This paper explores this conundrum by examining how different logics and motivations influence justice and sustainability outcomes of two government housing projects in Johannesburg, South Africa – Pennyville and Lufhereng. We apply the concept of conflicting rationalities [Watson, Vanessa. 2003. "Conflicting Rationalities: Implications for Planning Theory and Ethics." *Planning Theory & Practice 4* (4): 395–407] within a new context, thereby extending the theory and understanding of planning in the face of tensions and trade-offs. Three themes are used to surface different rationalities that influence just sustainability: (1) the assumption that justice and sustainability can be achieved simultaneously within government-led housing, (2) how power, influence and coordination within government contribute to disjunctures between justice and sustainability, and (3) assumptions around infill versus urban expansion for achieving just sustainability. The paper reveals how institutional dynamics, politics and conflicting rationalities diverted each project from their envisioned outcomes. The results show that disconnects between theory and practice are not necessarily driven by conflicts between justice and sustainability, but rather obscured rationalities. Focusing on conflicts between justice and sustainability can deviate attention away from the practical, and sometimes mundane, processes that cumulatively undermine progress towards justice and sustainability.

Keywords

just sustainability; social justice; environmental sustainability; government-led housing; conflicting rationalities; Johannesburg

5.1 Introduction

Increasingly, agreements and plans at the global, national and local levels emphasise the simultaneous need to improve living conditions for the poor as well as to respond decisively to the growing climate and environmental crises – in essence, the need to achieve just sustainability. Just sustainability refers to the striving towards a fair or equitable distribution of resources, and the benefits and costs of development – including efforts to reduce or redress existing inequalities –

while taking into account the natural resource implications and limits (Agyeman, Bullard & Evans, 2002; Campbell, 2013; Culwick & Patel, 2020).

The idea of just sustainability pushes against assertions that "equity can only be achieved at the cost of the environment" (Gupta et al., 2020: 505), or that the urgency of environmental crises necessitates any action even if it is unjust. This growing attention to just sustainability has in many cases assumed that these goals can be brought together synergistically through careful attention and planning (Westman & Castán Broto, 2021). Recent global agreements emphasise that it is necessary to promote development that is concurrently socially just and environmentally sustainable (United Nations (UN), 2015; UN-Habitat, 2016; Ziervogel et al., 2022).

The 2030 Agenda for Sustainable Development (United Nations (UN), 2015) highlights the dual importance of environmental sustainability and social justice within numerous goals (e.g. Goal 6 [Water and sanitation], Goal 7 [Energy], Goal 9 [Resilient infrastructure], Goal 11 [Sustainable cities and human settlements]) and in some cases within individual indicators. The assumption that underpins the Sustainable Development Goals (SDGs) is that attention to the identified indicators will foster both social justice and environmental sustainability. However, this paper argues that many factors, some seemingly unrelated to the immediate goal of just sustainability, can undermine achieving this dual goal.

Evidence has shown that "a policy commitment to sustainable development does not automatically result in the achievement of social and environmental justice" (Patel, 2006a: 692). Scholars caution that although instances exist where alignment can be found between social justice and environmental sustainability, there are other cases where fundamental conflicts exist and trade-offs are required between these equally critical goals (Campbell, 2013; Pasgaard & Dawson, 2019; Culwick & Patel, 2020). These conflicts and trade-offs are influenced by different rationalities. De Satgé and Watson (2018: 26) describe a rationality "as a view, a 'way of seeing', a position or perspective, an argument, a way of making sense of the world and a set of values, or perhaps a worldview, of actors in a particular setting". There are occasions where different rationalities can result in conflicts (Watson, 2003). This paper investigates the extent to which this plays out in government-led housing, and the role of conflicting rationalities in undermining efforts to build both just and sustainable housing.

In principle, conflicting rationalities is defined by different perspectives on an issue that cannot be reconciled through debate or resolved through 'correcting' underlying logics towards a universal understanding (Watson, 2003). Rather, conflicts are borne from different worldviews, cultures or

perspectives rather than an unwillingness to see from the other's point of view. Watson's initial work on conflicting rationalities focused primarily on how disjunctures play out within state and community engagements, recognising that contextual differences are important in shaping ethics and perspectives (Watson, 2003). This paper extends Watson's usage of conflicting rationalities and explores how conflicts play out within three realms: conceptual, institutional and implementation.

This paper engages with the conceptual challenge of bringing social justice and environmental sustainability together within government-led housing, and presents how contrasting approaches are argued to be able to reconcile differences. Tensions manifest institutionally, with conflicting rationalities playing out between and within government spheres and departments, and among key politicians and officials involved in government-led housing projects. The third form of conflicting rationalities in this paper relates to the practical implementation of government-led housing and how different approaches influence justice and sustainability outcomes.

Governments play a necessary role in helping to raise the living conditions for the poor (Caldeira, 2017; Mitlin & Bartlett, 2020; Mete & Xue, 2021) and government-led housing is one way to achieve this. South Africa's government-led housing programme aims to improve access to shelter and basic services. Despite committing to redressing inequality and unsustainability through improving access to services and opportunities, there is no consensus regarding how to balance the immediate need for housing, within the context of an unsustainable and unjust urban form, resource constraints and high inequality. The assumption that it is possible to achieve universally beneficial outcomes across a range of measures undermines where real conflicts exist, and trade-off decisions need to be made (Watson, 2003). For example, an emphasis on providing as many housing opportunities as possible, might not align with ensuring access to economic opportunities or achieving resource efficiency. Although these rationalities are different, each is valid.

South Africa's government-led housing programme has been critiqued for entrenching urban sprawl, spatial inequality, marginalisation and unsustainable urban form (Financial and Fiscal Commission (FFC), 2011; Mubiwa & Annegarn, 2013); although there are examples of developments that do not follow this trend (Charlton, 2014). The South African government released a housing plan in 2004 entitled 'Comprehensive Plan for Housing Delivery: Breaking New Ground' (BNG) in response to these critiques and to help facilitate housing developments that are internally integrated 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" (Department of Human Settlements, 2004: 17).

Physical urban form plays an important role in meeting the BNG objectives, because it fundamentally influences environmental sustainability and social justice (Hughes & Hoffmann, 2020). There are persistent debates around the location and form of government-led housing, in particular weighing up the relative costs and benefits of urban expansion and infill development, and considering the associated impact on accessing amenities and employment opportunities. Many cities, including the City of Johannesburg Metropolitan Municipality (CoJ) in South Africa, have prioritised infill development to maximise infrastructure investment and facilitate efficient and sustainable public transport systems. Infill developments are argued to have lower environmental consequences and to more easily enable access to services and opportunities. In contrast, urban expansion developments are argued as being able to address the need for housing more quickly than infill developments and potentially at a lower cost to the government (Angel et al., 2011), especially where past forms of urban development have not been able to keep pace with the growing housing demand (Biermann & van Ryneveld, 2007; Cirolia, 2014). Provincial government in Gauteng (the province in which Johannesburg is located) has prioritised large-scale housing developments to maximise the number of housing opportunities for the poor, and to facilitate developments that are mixed-use and cater to a range of income groups (Ballard, 2017; Ballard et al., 2017).

The objective of this paper is to understand the implications of government-led housing on social justice and environmental sustainability (hereafter 'justice' and 'sustainability'), and how rationalities and decision-making influence these outcomes. Specifically, this paper interrogates how justice and sustainability have been conceptualised and operationalised in two government-led housing developments in Johannesburg: Lufhereng and Pennyville.

The contrast between infill and urban expansion approaches in Johannesburg is a manifestation of different rationalities held by provincial and local government, with Lufhereng and Pennyville each representing a different rationality. These case studies are thus useful in comparing different logics underpinning government-led housing. They are both greenfield sites but are in very different parts of the city. Lufhereng is a large urban expansion project designed as an integrated settlement, whereas Pennyville is a well-located, infill residential development. These two developments were both designed as part of the national government's updated housing programme, which explicitly seeks to build housing in well-located areas and in a way that provides access to services and

economic opportunities – thus achieving sustainable human settlements (Department of Human Settlements, 2004). However, this research raises questions around how well-located is defined and with what objective in mind, arguing that these are underpinned by different, and sometimes conflicting rationalities. Disjunctures emerge between different government spheres and departments, and among key stakeholders, which are driven by divergent priorities such as maximising the speed and number of housing delivery versus ensuring integration and access to a range of services and amenities.

This paper first reviews how the intersection between justice and sustainability has been conceptualised and engaged in the literature, and how these ideas relate to government-led housing. Specific focus is placed on access to services and opportunities in addition to improvements to accommodation and basic service access. The review further considers the role that decision-making and conflicting rationalities play in influencing outcomes. The paper then lays out the materials and methods used in the study, including background and justification for why Lufhereng and Pennyville are useful for exploring these themes. The paper draws on semi-structured key informant interviews and relevant project documents to interrogate three themes in which conflicting rationalities play out: (1) the assumption that justice and sustainability can be achieved simultaneously within government housing developments, (2) how power, influence and coordination among government departments contribute to disjunctures between justice and sustainability, and (3) the comparative ability of infill versus urban expansion to achieve just sustainability. The case studies reveal how the respective projects unfolded, and despite laudable visions and significant effort, the potential justice and sustainability outcomes were undermined.

The paper argues that the disconnect between theory, or conceptualisation, and implementation is not, as the literature proposes, necessarily driven by obvious conflicting rationalities between justice and sustainability, but rather obscured or hidden rationalities that are revealed during implementation when political motives, practical considerations and misalignments between departments confront project plans. While the conceptual challenges of aligning justice and sustainability are engaged with in depth elsewhere (Culwick Fatti, 2022), this paper argues that focusing on the perceived (or even real) conflicts between justice and sustainability can deviate attention away from the conflicting rationalities evident in practical, and sometimes mundane, processes that cumulatively undermine progress towards justice and sustainability within government-led housing.

5.1.1 *Just sustainability*

There is growing evidence that human impacts have significantly affected environmental systems and that the associated consequences for society are becoming increasingly apparent (Steffen et al., 2015; Allen et al., 2018; IPCC, 2021). Global environmental crises such as climate change, biodiversity loss and land use change have been identified as having biophysical thresholds that if breached could cause catastrophic and non-linear change, potentially threatening human survival (Steffen et al., 2015). To prevent catastrophic outcomes, it is necessary for society to improve resource efficiency, shift towards low-carbon development, minimise harmful waste and protect critical ecosystems (Allen et al., 2018). However, reducing environmental impacts cannot be at the expense of society and its needs. Just sustainability is underpinned by the idea that staying within planetary boundaries and addressing poverty and inequality are interrelated (Roy et al., 2018; Pasgaard & Dawson, 2019; Rockström et al., 2021), and that unless environmental and social issues are addressed together, they will both persist (Agyeman, Bullard & Evans, 2002). Scholars argue that addressing structural inequality will concurrently address the primary drivers of environmental issues such as climate change because their drivers are the same (Westman & Castán Broto, 2021).

Raworth's (2012) doughnut model proposes that there is a common space between sustainability and justice, where the minimum needs of society are met without breaching planetary boundaries. This 'sweet spot' is considered the realm of just sustainability. Scholars caution that assumptions around common needs and minimum standards of well-being ignore differentiated interpretations of what is just (Pasgaard & Dawson, 2019), and emphasise the importance of incorporating different interpretations of justice (distributional, procedural and recognitional justice) into just sustainability models and assessments (Leach et al., 2018; Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020; Menton et al., 2020). Leach et al. (2018) propose that the realm of just sustainability is a dynamic zone that is bound by some objective thresholds together with subjective elements that are open to interpretation and context.

Despite propositions that justice and sustainability can be achieved together (Rockström et al., 2009; Raworth, 2017; Westman & Castán Broto, 2021), this is not a given and there are examples where tensions can arise between and within justice and sustainability. Scholars caution that an unjust sustainability transition is a strong possibility (Marcuse, 1998; Swilling, 2019), and similarly that in addressing poverty and inequality, planetary boundaries could be overshot (Leach et al., 2018; Ciplet & Harrison, 2020). The struggle to achieve just sustainability in reality, despite plans

and commitments, highlights a complex relationship between its component parts (Patel, 2006a; Vogel et al., 2016b; Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020; Culwick & Patel, 2020).

There is a need to refine how just sustainability is conceptualised, by incorporating where conflicts exist between and within justice and sustainability (Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020; Culwick & Patel, 2020; Lu et al., 2021; Rockström et al., 2021). Scholars argue that oversimplifying the interactions between justice and sustainability is not only unhelpful for analysis but also project planning and implementation (Simon et al., 2016; Leach et al., 2018). Making progress towards just sustainability requires examining the practices around its implementation (Westman & Castán Broto, 2021), and a better understanding of how and where conflicts arise can support a more complex conceptualisation of just sustainability (Hughes & Hoffmann, 2020).

5.1.2 Just and sustainable government-led housing

Government-led housing is an example of where multiple factors combine to influence a complex set of environmental, social and economic outcomes. In addition to improving the quality of shelter and access to basic services (Adegun, 2019; Culwick & Patel, 2020), government-led housing, particularly at the scale undertaken in South Africa, fundamentally impacts infrastructure networks and land-use change, which can, in turn, create path dependencies, and have long term impacts on resource consumption (IRP, 2018; Mahendra & Seto, 2019; Pineo, 2022). To understand the full impact of these programmes, housing provision must be considered within the broader context of ensuring access to social services and economic opportunities (Turok, 2016a; Mete & Xue, 2021). Affordability and sustainability of housing for recipients depends on the financial and time costs of transport to access services and opportunities (Chan & Adabre, 2019).

Enabling access to services is not straightforward, in part due to different types of access - distinguishable between access by proximity and by mobility (Mete & Xue, 2021). Proximity enables access through dense, well-located and mixed-use areas, whereas mobility-enabled access requires affordable and convenient transport options (typically through good public transport networks). Proximity-based access would be considered the better environmental option (Mete & Xue, 2021) and is likely to incur lower transport-related costs, which is a positive social justice outcome. Because access to economic opportunities, and to amenities and services are not necessarily the same for a particular settlement (Culwick Fatti, 2021), different interpretations and focuses of access can result in choices being made between either economic opportunities or services.

Access to services and opportunities is influenced by the location and form of housing (Rode & da Cruz, 2018; Culwick & Patel, 2020), which in turn shape social, environmental and economic outcomes. Waters (2016) emphasises that the form of development is important in terms of its ability to facilitate easy access to services, quality of life and connection. Two of the approaches to development that are often contrasted in terms of their ability to build just and sustainable cities are infill development and urban expansion.

Infill developments are located within the existing urban fabric on either brownfield or greenfield sites, and they tend to increase density of the existing urban form. This type of development is often considered environmentally sustainable as it can enhance infrastructure efficiency and the viability of public transport while limiting sprawl and land-use change (IRP, 2018). Urban expansion projects tend to be greenfield developments on the urban edge, and are argued as being able to facilitate spacious living conditions, greater opportunities for green spaces and natural light in houses (Neuman, 2005). Urban expansion projects are perceived by many practitioners as having lower financial and regulatory burdens compared to infill development. These developments can also facilitate more housing opportunities because land tends to be cheaper and more available on the urban edge. However, government-led housing on the urban edge tends to be critiqued for marginalising recipients and undermining poverty alleviation efforts (Goebel, 2007; Crane & Swilling, 2008; Adegun, 2018; Mahendra & Seto, 2019; Turok, Visagie & Scheba, 2021).

In terms of enabling access to economic and job opportunities, although better located, dense developments can increase chances of finding jobs, location does not guarantee better earning potential, and people in these developments without income tend to be worse off because of higher living costs (Biermann & van Ryneveld, 2007). Furthermore, being well-located with respect to job opportunities does not necessarily coincide with good access to services (Culwick Fatti, 2021). This raises questions around the definitions of well-located housing developments, and which areas are prioritised for government-led housing development and infrastructure investment (Pieterse, 2019). Recipients of government-led housing are oftentimes people living informally, which is in part why these programmes over-emphasise the physical structure of the house and basic services over access to social amenities and economic services (Adegun, 2019; Mitlin & Bartlett, 2020).

On the surface, government-led housing decisions can seem to be choices between enhancing justice by maximising the number of housing opportunities (through urban expansion) and pursuing sustainability through infill development. In reality, the choices and consequences are seldom that neatly divided. For example, reducing average commuting time and distance by

ensuring housing is well located reduces carbon emissions and transport costs (positive for both justice and sustainability). However, not all actions with positive justice benefits also have positive sustainability consequences or vice versa. For example, infill development can compromise green space availability and exacerbate issues such as flooding and urban heat island effects (Aquino & Gainza, 2014). By contrast, the sustainability benefits of infill development (e.g. improved access to public transport and infrastructure efficiencies) can come at the cost of affordable housing and inclusionary spaces (Aquino & Gainza, 2014). There is limited research that considers both justice and sustainability in terms of government-led housing, particularly in South Africa (Adegun, 2018).

5.1.3 Decision-making and conflicting rationalities

The inability to achieve both just and sustainable outcomes is not necessarily reflective of a lack of will, nor lack of explicit strategies to achieve these goals, but rather a result of the complex factors and trade-offs that must be considered within decision-making. Although in some cases decisions are motivated by politics or self-interest, even laudable intentions can result in negative outcomes due to unintended consequences (Patel, 2014).

A key challenge appears to be translating city-level visions into project-level outcomes. Urban development visions and policies are by necessity normative and designed to be universally beneficial. Nastar et al. (2019) argue that broad-scale plans and indicator-based assessments can miss the major challenges that prevent real progress towards justice and sustainability. Although government planning is often assumed to be based on evidence and rational decision-making this assumption obscures the influence of institutional worldviews and power in decision-making. Rather, "planning...is an interesting mixture of the political and the non-political" (Murdoch, 2000: 504). Importantly, organisations are made up of individuals, and thus individual worldviews, in addition to institutional worldviews influence decision-making. May and Perry (2017: 28) argue that in some cases "city officials practise anticipatory decision-making: that is, fear of having no voice or influence unless conforming to dominant priorities". A range of factors including power, politics and different philosophical positions influence decision-making processes (Patel, 2006b), and different rationalities can pull decision-making in opposing directions. Achieving just sustainability requires not only intervention across a range of sectors and stakeholders, but also confronts where interests and responsibilities are not necessarily shared (Mummery & Mummery, 2019).

Interrogating decision-making processes and the role of rationalities can reveal trade-offs between justice and sustainability. Campbell (2013) proposes the idea of 'conflicting urgencies' to highlight

the tensions planners face between addressing either justice or sustainability considerations before the other and where it is not reasonable to address one goal first. However, he argues that forcing a balance between the two can obscure structural conflicts between these objectives (Campbell, 2013).

This paper considers how different rationalities underpin the respective understandings of sustainability and justice, and how rationalities and power influence decision-making processes, both implicitly and explicitly. The literature suggests that different understandings held by various stakeholders not only make it difficult to draw connections between justice and sustainability in practice but that conflicting rationalities between justice and sustainability are borne out of these differences. However, this empirical study reveals that what prevents real progress towards justice and sustainability, derives from seemingly unrelated processes and decisions, resulting in disconnections rather than overt decision-making in favour of either justice or sustainability.

5.2 Materials and methods

This research draws primarily on semi-structured interviews that were conducted with local government officials, project managers and other stakeholders who were involved in the decision-making processes of the Lufhereng and Pennyville housing projects. Key people involved in the projects were identified for interviews based on existing government contacts, and examining online project documents and information. Thereafter, a snowballing technique was used to identify additional interviewees who were involved in or have insight into relevant decision-making processes. A total of 15 people were interviewed between May and October 2019. Interviews were recorded, with permission, and transcribed in accordance with required ethical guidelines.[21] Relevant project documents, visions and plans were sourced during key informant interviews and through online keyword searches. Interview transcripts and project materials were coded and analysed using NVIVO Qualitative Data Analysis Software to identify key themes and connections across different data sources.

5.2.1 Case studies

Johannesburg is situated in the Gauteng province, where residential dwelling growth is a key driver of spatial change. Between 2001 and 2016, the province saw a 60% increase in residential buildings

[21] Ethics approval was obtained by the University of Cape Town's Research Ethics Committee. Approval code: FSREC 65 - 2018

(from 2 million to 3.5 million) (Hamann, 2018). Government-led housing contributes significantly to this growth and is thus a driver of associated environmental impacts such as land-use change. However, government-led housing is an important means through which poor citizens obtain adequate shelter and access to basic services in the city.

Johannesburg is not only the most populous city, it is among the fastest-growing of South Africa's municipalities (Statistics South Africa (StatsSA), 2016). The city characterises the inequality and sustainability issues prevalent in many cities in the global South and has high unemployment levels (Todes, Weakley & Harrison, 2018). The city has a sprawling urban form with multiple higher density nodes. Housing tends to be located far from economic opportunities, and long road-based commutes characterise the city's mobility patterns. A significant portion of people in Johannesburg live informally – either in informal settlements or auto-constructed dwellings in the backyard of formal houses (Turok & Borel-Saladin, 2016; Hamann, 2018). The South African government has placed concerted effort into raising the poor's living conditions through the government-led housing programme in which qualifying citizens (Myeni & Okem, 2019) can benefit from fully- or partially-subsidised houses or rental units. However, the ways in which government-led housing projects are conceptualised varies across different spheres of government. There are especially significant conflicts between housing plans proposed by Gauteng Provincial Government and the CoJ (Charlton, 2014), which are evidenced in the two case studies in this paper.

Lufhereng and Pennyville are two of Johannesburg's many government-led housing developments and they were selected as case studies for this research for numerous reasons. First, they both fall under the national government's updated housing policy which aims to build sustainable and inclusive human settlements. Second, despite being guided by the same policy framework, they are substantially different from each other in both form and location. Lufhereng is a large development on the urban edge, designed to be integrated with respect to different types of residential typologies, economic services and social amenities. Pennyville is an infill development that is centrally located within Johannesburg but consists primarily of residential land-use (Figure 5.1). These contrasting elements provide opportunities to compare two different approaches to housing developments, namely infill and urban expansion, which reflect different rationalities. Third, these projects are both either completely finalised or have completed portions, and each has people living within them. This enables the justice and sustainability implications to be analysed as well as the decision-making process that influenced the respective planning, design and implementation phases. The following sections present an overview of each project.

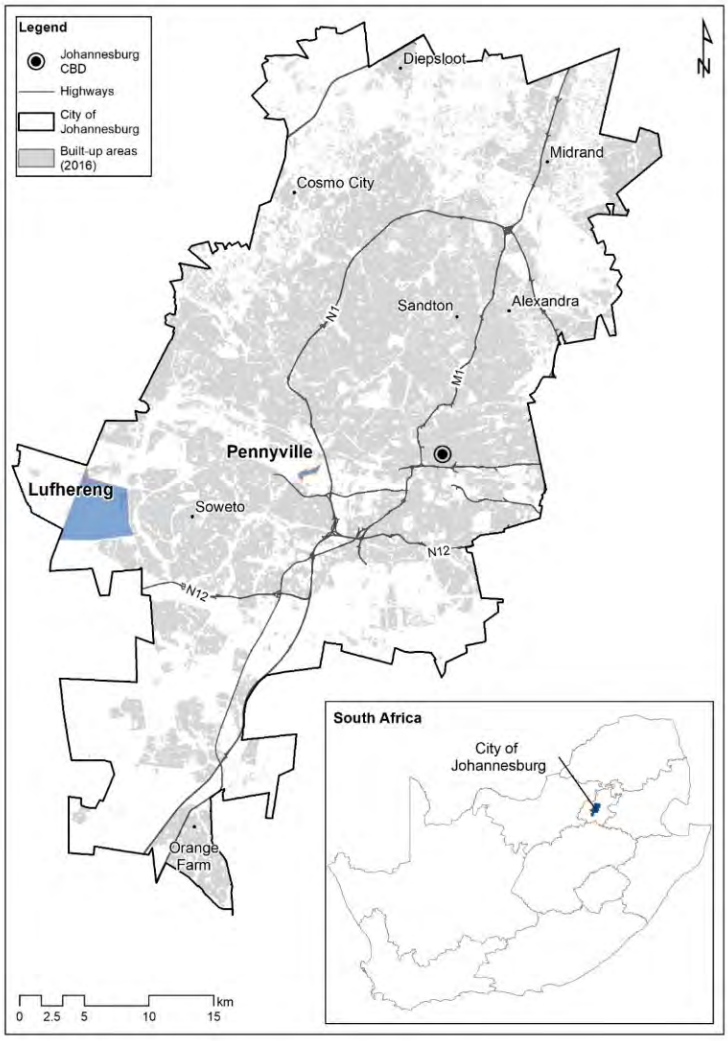

Figure 5.1: The location of Lufhereng and Pennyville (highlighted in blue) within the context of Johannesburg. Map by Christian Hamann. (Data sources: European Space Agency 2017; Gauteng Department of Housing 2014).

Lufhereng

Lufhereng is located on the western edge of Soweto, near the municipal boundary between CoJ and the West Rand District Municipality. In the early 2000s, the CoJ was approached by Gauteng Provincial Government to develop the approximately 2 000 ha site (the Doornkop farm), which was partially owned by the Province and had previously been designated as agricultural land. The CoJ's urban development boundary was extended to accommodate the project. Project planning was initiated in 2004 and Phase 1 of construction began in 2008. The fully subsidised houses within the first phase were completed from 2010 and 2 433 houses were handed over to beneficiaries (Figure 5.2). Lufhereng was designed to provide subsidised houses to a range of beneficiaries including people living in Protea South informal settlement, informal backyard dwellings in Soweto, residents of the original Doornkop farm, military veterans and people who had been on the housing

waiting list since the 1990s (Charlton, 2017). Bonded houses within the settlement would be open to the market.

Figure 5.2: Phase 1 of the Lufhereng housing development (outlined in blue)

The whole project is designed to include around 25 000 dwelling units (although there are discrepancies across documents and over time), with a mix of housing types and tenure options (fully subsidised, partially subsidised, bonded, and rental units) (Charlton, 2017). The first phase, which accounted for approximately 10% of the total number of dwelling units, included only fully subsidised units and bonded units. The completed portion includes semi-detached and row houses (some of which are double story) (Figure 5.3), with the bonded houses comprising individual dwellings on their own stand. The remaining phases will also include flats and multi-story walk-ups.

There are limited services and amenities in and around Lufhereng, and thus it was designed with a full suite of new services and infrastructure, including schools, a transport node and associated routes, as well as industrial, agricultural and retail centres. Most of these services are still to be completed, including bus and train services, shops, petrol stations, and the planned industrial and agricultural centres where job opportunities are anticipated. This delay has led to current residents being marginalised in terms of social amenities and economic opportunities, often having to travel long distances to access services (Culwick & Patel, 2020). For residents who moved from areas

with good access to transport infrastructure and economic opportunities, the comparatively poor access has been felt acutely. Delays in delivering services and opportunities have prompted scholars to question the viability of Lufhereng as a site for integrated housing (Charlton, 2017; Meth et al., 2022).

Figure 5.3: Housing types in Lufhereng: row houses with some double-storey houses (top); semi-detached houses (bottom). Photographs by Christina Culwick Fatti, 2019.

In addition to the land transformation impacts, the Lufhereng development contended against a range of environmental concerns, including dolomitic land, aquifers, a wetland and several special grassland areas. The presence of dolomite[22] was a significant constraint on where, what type and how development could take place. In addition to the necessary geotechnical studies, the infrastructure required to mitigate and protect against sinkholes had additional resource, cost and time implications.

Pennyville

Pennyville is located within Johannesburg's mining belt, between Soweto and Johannesburg's central business district. Pennyville was constructed on a site that was initially zoned for mining and then industrial use. In 2005, the land was re-zoned for residential use, paving the way for the development (Vosloo, 2008). Pennyville is considered a strategic development within the previous 'buffer' between the wealthier white northern suburbs and Soweto (Charlton, 2013), and along a transport corridor connecting spatially divided areas in the City.

The land for the development came from a land-swap agreement between the CoJ and Pennyville Zamimpilo Relocation Pty (Ltd) (PZR), a subsidiary of CalgroM3, in which PZR received land in Riverlea ext. 3 from CoJ in exchange for the Pennyville site (Vosloo, 2008). Pennyville is situated between a number of mine dumps and two arterial roads (Figure 5.4) and was designed to eradicate Zamimpilo informal settlement, which is approximately 2 km from Pennyville, adjacent to a major industrial area. The Pennyville is well located with regards to a range of public transport options, including train, bus and minibus taxis. The development falls within the CoJ's strategic transit-oriented development corridors because it is situated along a bus rapid transit route, with immediate proximity to a station. Pennyville was one of the first projects deliberately designed in response to the updated BNG policy and has been used as a frequent case study for inclusive housing developments in South Africa.

The development is approximately 100 ha comprising 2 751 housing units, which include 1 552 fully subsidised units, 395 subsidised rental units and 804 market-based rental units (Palmer Development Group (PDG), 2011). Pennyville is a medium density development with two-storey walk-ups, semi-detached houses, and multi-story flats (Figure 5.5). Construction began in 2006,

[22] Dolomite is a sedimentary rock made up of carbonate minerals that dissolves on contact with acidic water to create underground cavities and caves (Cairncross, 2004). Dolomitic areas are prone to sinkhole development and pose significant risks for buildings and infrastructure collapse.

and the four project phases were completed between 2007 and 2011 (Palmer Development Group (PDG), 2011). The settlement has a crèche, which was donated by the developer as a corporate social responsibility initiative and a developed municipal park (Rebel Group, 2016). Although Pennyville is considered 'strategically located' (Interview 31 July 2019) access is primarily mobility-based and besides the municipal park, the development does not have any amenities or services.

Figure 5.4: Pennyville housing development (outlined in blue).

5.3 Results

The study's results are presented under three themes in which each of the case studies is discussed. The first interrogates the assumption that justice and sustainability can be achieved simultaneously within government housing developments. The second explores the extent to which power, influence and coordination among government departments contribute to disjunctures between justice and sustainability. The third probes assumptions around infill and urban expansion developments, with a particular focus on access to services and opportunities. In each of these themes, different logics and rationalities are surfaced – between city and project scale considerations, between different government spheres and departments, and among key politicians and officials in the project management teams.

Figure 5.5: Housing types in Pennyville: flats (top), two-storey walk-ups (middle), semi-detached houses (bottom). Photographs by Christina Culwick Fatti, 2019.

5.3.1 *Building government-led housing that is just and sustainable*

South Africa's housing programme has been strongly tied to the vision of a society free from apartheid's oppression, with the promise of housing being used extensively to garner political support (Ballard, 2017). After being the ruling majority across all spheres of government for the first two decades of democracy, the African National Congress (ANC) began to lose support, and particularly in urban areas. Party politics has been especially contested in Johannesburg, where in 2016 the ANC lost control of the city to an unlikely alliance of the Democratic Alliance (DA) and the Economic Freedom Fighters (EFF). In Gauteng, government-led housing has become a key site of contestation, particularly between Gauteng Provincial Government and CoJ.

CoJ's spatial development frameworks prioritise infill development to densify the existing urban form within key nodes and along transport corridors, and using these corridors to connect spatially disparate areas (Abrahams & Everatt, 2019; Harrison & Rubin, 2020). In contrast, Gauteng Provincial Government has focused on mega-human settlements on the urban edge with the hope that these large developments could quickly reduce the housing backlog while catalysing economic growth on the urban periphery (Ballard, 2017; Harrison & Rubin, 2020).

Despite not aligning with CoJ's strategic plans, Lufhereng was prioritised and facilitated through the City's processes (Gauteng Department of Human Settlements, 2020). Interviewees reflected that "The reality is, politically, housing takes the front row" (Interview, 6 June 2019), and "[p]oliticians are under pressure to give houses at whatever cost." (Interview, 26 August 2019). As a large project that had the potential to address a significant portion of the housing backlog in Soweto (Urban Dynamics, n/d), Lufhereng held greater political appeal than numerous small projects, and its prioritisation reflects the interests of those in power, rather than beneficiaries who ultimately bear the consequences and externalised costs of the development (e.g. high transport costs).

It was hoped that through effective collaboration between the Province and City, Lufhereng could deliver social, environmental, economic and political objectives. To compensate for its non-ideal location, Lufhereng is planned as an integrated development that links into public transport networks and aims to facilitate walkability. At the development scale, these plans enable concurrent achievement of both justice and sustainability objectives (Bigen, 2017) – "we've all started here from the objective, yes, to benefit people and to benefit the planet" (Interview 23 July 2019). Achieving these objectives requires the successful implementation of the project design, which is proving very difficult. This is in part due to the range of considerations that need to come together in addition to housing and basic infrastructure, such as connecting into local and regional

transport systems, providing social services, and stimulating economic development. Each of these poses different challenges to the project. For example, the planned extension of the train network has been threatened by the collapse of the Passenger Rail Agency of South Africa (PRASA) (Democratic Alliance, 2020), while the proposed bus routes are yet to materialise more than 10 years after the first houses were completed. There are also uncertainties around whether the envisioned economic opportunities will materialise (see discussion below). Without the successful implementation of Lufhereng economic, social and transport plans, the housing project risks exacerbating injustice and unsustainability at both the project and city scales.

The Lufhereng development has also tried to intervene at the scale of the dwelling unit to achieve social and environmental objectives. Innovations included verandas and room orientation to facilitate social engagement in the public realm and infrastructure efficiencies. One proposal attempted to increase the housing density and economise on road and infrastructure lengths by using a 'mushroom' layout, with two houses in the front and two in the back, all leading off a communal driveway (Figure 5.6). However, despite the infrastructure efficiencies, Joburg Water had concerns that blockages could not be linked and charged to a particular stand. This design would thus require additional manholes to mitigate this risk. However, this proposal was not supported, and traditional layouts were used, which doubled the length and cost of infrastructure (piping, roads etc.) (Interview, 4 June 2019). The overriding motivator was around identifying blockages and ability to charge for services rather than investing in sustainable infrastructure, and demonstrate priority towards simplifying operational processes.

One of the innovations to integrate residential and economic land-uses in Lufhereng included building double story units along the main pedestrian routes (Interview, 4 June 2019). These units would have businesses on the ground floor and living space upstairs. Other stand designs included setting the house back from the road to allow cars to be parked outside and zoned for trading. This intervention would have fostered both sustainability and justice imperatives through bringing together residential and economic spaces. However, during construction residential units were built on these stands instead. These plans that could have supported local economic development, sustainability and good public spaces, did not come to fruition because the construction of Phase 1 was fast-tracked without proper consultation with the project team (Interview, 20 June 2019).

Pennyville was among the first South African developments to achieve integration within a government-led development between different housing typologies, income groups and tenure types (Rebel Group, 2016). However, Pennyville "was a housing priority first and foremost, and we

really didn't think of it as a sustainable human settlement at that particular point in time" (Interview 31 July 2019). As a result, the area lacks other amenities and residents must travel to access all services including schools and job opportunities. This has social, financial and environmental consequences. Residents complain that transport costs are sometimes unaffordable (Culwick & Patel, 2020).

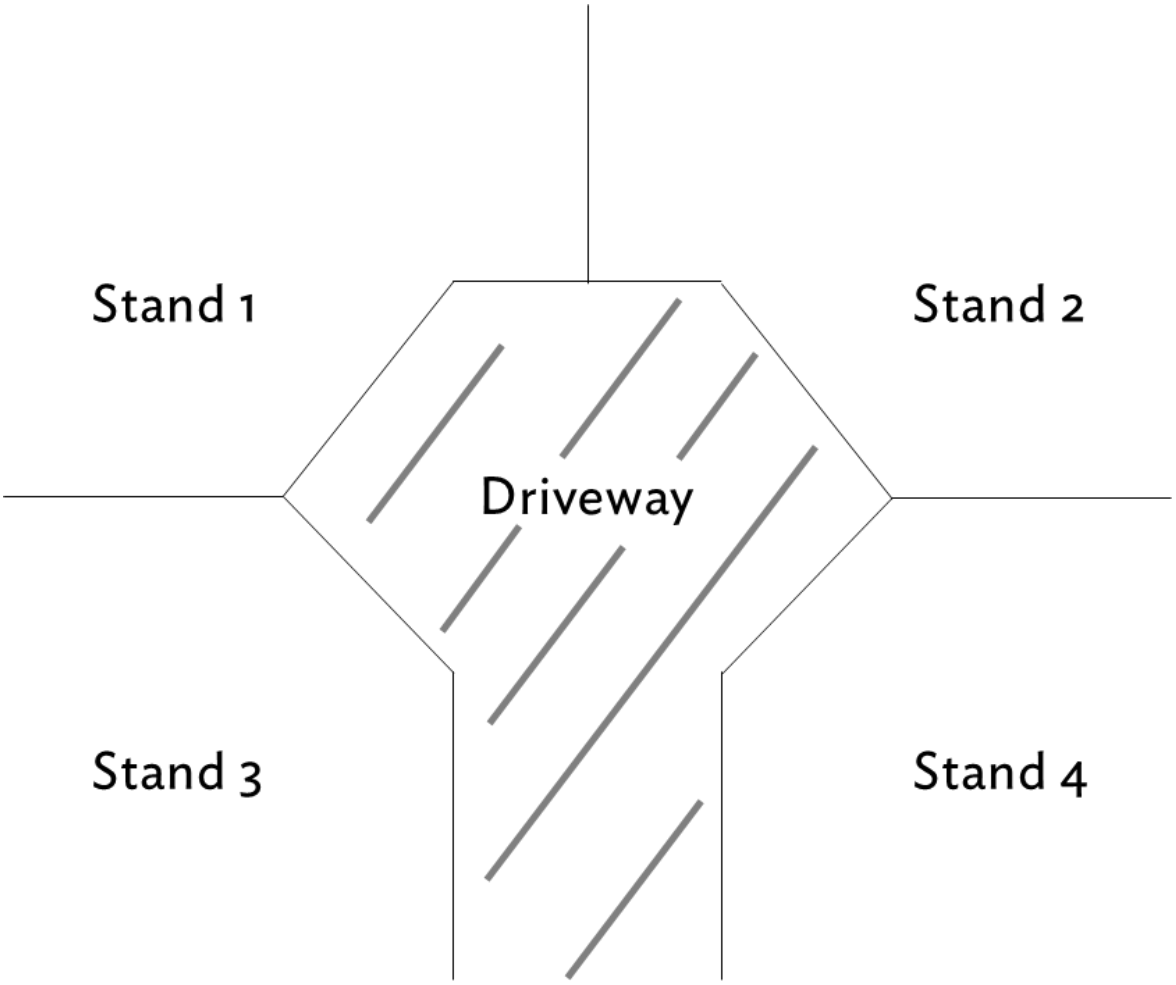

Figure 5.6: Proposed mushroom design in Lufhereng's subsidised housing.

A further concern around Pennyville's location is its proximity to mine dumps, with some of the closest houses less than 100 m from an adjacent mine dump. Although pollution buffer regulations allow housing to be developed within this distance (Department of Environmental Affairs, 2018), recent studies suggest that chronic respiratory symptoms and diseases are more prevalent for people living within 2 km of mine dumps than those living further away (Nkosi, Wichmann & Voyi, 2015). This raises concerns around the suitability of the site in providing accommodation that does not pose health risks to residents.

Although the CoJ has a set of justice and sustainability indicators at the city level, there is limited guidance around how these objectives translate to the project scale (Interview, 9 July 2019). Environmental considerations tend to be limited to Environmental Impact assessments (EIAs) and environmental compliance at the project scale, with little engagement with longer-term sustainability. In alignment with the sustainability commitments in City-led housing projects (City of Johannesburg, 2007), Pennyville included solar geysers, a park, and planting trees and grass (Figure 5.7). However, some of these elements were considered as social rather than environmental benefits, "with the aim of uplifting the community's morale and setting a new benchmark for low-cost housing developments" (Vosloo, 2008: 54). This highlights how good environmental outcomes can result despite the absence of project-level sustainability rationalities, demonstrating that there is sometimes no linear relationship between intentions and outcomes.

Although Pennyville was developed before CoJ adopted their 'complete streets approach'[23], the settlement design limited the number of larger roads, aimed to be pedestrian-friendly and facilitate easy and safe movement within the settlement (Vosloo, 2008). This design assumed that because Pennyville is a low-income area with good public transport access, car parking space was not necessary. In reality, residents do have cars and because no parking was provided, these vehicles tend to be parked on pavements and road verges, thus obstructing pedestrian walkways (Figure 5.8).

5.3.2 Power, influence and coordination among government spheres and departments

All three spheres of government in South Africa are involved in housing delivery, with government-led projects typically being initiated and developed by provincial or municipal housing departments. These projects are funded by the national treasury through two grants that are administered by the provincial government. Municipalities, even in provincially led projects, are responsible for the associated infrastructure (Abrahams & Everatt, 2019). The overlapping responsibilities, particularly between provincial and local governments, have resulted in a contested and competitive relationship, which can be awkward and sometimes conflictual, and where power and influence can determine outcomes.

[23] In the complete streets approach, roads are deliberately designed to accommodate a range of modes and users (e.g. pedestrians, cyclists, public transport, private cars etc.)

Figure 5.7: Established trees lining the streets of Pennyville Extension 1 (top); Pennyville park (bottom). Photographs by Christina Culwick Fatti, 2019.

Figure 5.8: Cars parked alongside houses, limiting pedestrian movement in Pennyville. Photograph by Christina Culwick Fatti, 2019.

Lufhereng, as a flagship housing project, was described as "a joint venture" between all three spheres of government (Gauteng Provincial Government, 2012). The project was proposed by Gauteng Provincial Government, and despite not aligning with the City's spatial development frameworks, CoJ was obligated to make it work, because of political pressure (Charlton, 2017). Although the project was embedded within CoJ structures, it was not protected from political influence from powerful provincial actors. In 2008, the then Member of the Executive Council (MEC) for Housing in Gauteng (a key ANC appointment) exerted pressure on the project to deliver houses and hand them over to beneficiaries as quickly as possible in advance of the upcoming provincial elections. The provincial department circumvented the project management team and appointed a construction company to build Phase 1. An interviewee noted that "we need to deliver and we need to build houses – they were counting numbers" (Interview, 9 October 2019). The influence of a powerful political figure helped to rally together the various infrastructure teams to successfully complete construction. However, this phase was pushed through before the plans had been finalised or buy in had been obtained from banks and private stakeholders that were critical for the successful implementation of the bonded housing, services and amenities within this phase. One interviewee reflected that "in the end the planners, like ourselves, are sometimes constrained

by political will and intent. They might focus somewhere else or they might have different objectives" (Interview, 23 July 2019). The politically motivated urgency to deliver houses and secure ANC votes hampered the achievement of planned integration between housing, amenities and economic opportunities.

Although government-led housing projects are required to be integrated, this can "impact on the particular yields of a particular department and they've got a set mandate" (Interview 31 July 2019). In other words, making a settlement mixed-use can reduce the total number of housing opportunities within the development, thus the housing department is conflicted between delivering more houses versus ensuring an integrated settlement.

The long duration of the Lufhereng project (nearly two decades) has undermined sustained commitment from government departments and stakeholders. Despite initial enthusiasm and support, interviewees suggested that over time people lost interest and 'forgot' their commitments to the associated infrastructure and services (Interviews, 20 June 2019). Because of the complexity in the municipal systems and the number of component parts that are required to come together in an integrated development, the upfront commitments do not always translate into implementation as the "urgency is lost in the system" (Interview, 20 June 2019). This demonstrates not only a lack of coordination between government departments, but also the lack of clarity regarding the sequencing and who takes responsibility for ensuring the implementation of plans.

Conflicting rationalities were also evident in Pennyville. Although it was designed to eradicate the Zamimpilo informal settlement, as the development progressed it became clear that this initial intention was unrealistic for both practical and political reasons. Practically, although the project aimed to accommodate a range of people, there were nonetheless those living in Zamimpilo unable to access any of the available options (e.g. they were not eligible for government subsidies or could not afford market rental). The developer also found that although shacks were demolished immediately as households were moved into Pennyville, the vacant land soon became re-occupied. This reflects the broader demand for houses and because Zamimpilo is well-located with respect to job opportunities, it is likely to remain sought after despite poor living conditions. Politically, different agendas resulted in Pennyville's beneficiary list including people from Noordgesig, Orlando, Diepkloof and Westbury in addition to Zamimpilo (Masondo, 2008). Although the project was owned, initiated and managed by CoJ, the provincial government is responsible for the beneficiary list. The ANC MEC promised residents from other areas housing opportunities in Pennyville, because another provincial-led project could not accommodate everyone in these areas.

Local CoJ ward councillors also applied pressure for people within the Pennyville region to be accommodated, rather than from other regions as promised by the provincial government.

Beyond coordination between the provincial and municipal housing departments, buy-in is required from numerous other departments. Both Lufhereng and Pennyville achieved widespread support in the planning and design phases of the projects. However, in both cases, silos between departments, and individual mandates and plans emerged during implementation. This resulted in deviations from the project designs as well as limited or problematic delivery of amenities and services. One interviewee reflected that "you have one department: 'we're telling you what's necessary to create a sustainable urban environment', but you have a department there saying, 'I get measured on delivering subsidised housing, I don't care about anything else'. Another one is, 'I build schools, I don't care about anything else'" (Interview 23 July 2019). Different values, motivations and political agendas influence the extent to which departments follow through on project plans.

Schools provide good examples of how this played out in each project. In Lufhereng Phase 1, a temporary high school was built without consultation with the project team and was initially not in accordance with the strict building standards required by the underlying dolomitic conditions. The department's urgency to deliver resulted in the school not having proper water or sanitation for a few years.

Pennyville's proposed school is a slightly more complex example. During the construction of Pennyville's stormwater attenuation ponds, three inclined mine shafts were discovered. After inspection, they were considered safe to block off. However, the land that was under-mined was zoned for open space and recreation (Vosloo, 2008), and included part of the school site. Several interviewees maintained that there was sufficient 'stable' land for the school buildings, and the remaining 'undermined' areas could be safely used for sports fields and playgrounds. However, the school is still not built and the area set aside for it remains vacant (Figure 5.9).

That the school has never been built in Pennyville has been attributed to poor coordination between the housing and education departments, and that the plans, priorities and budgets of the Gauteng Education Department did not align with those of the housing project (Interviews, 6 June 2019 and 9 October 2019). However, other CoJ reflections suggest that the entire school site is unsuitable for development of any kind. It is possible that rather than contract and communication problems (Interview, 9 October 2019) the school was never built due to safety concerns.

At the launch of the Pennyville project, the then Mayor of Johannesburg reported that in addition to the school, a clinic would be provided to the area by the Gauteng Department of Health (Masondo, 2008). However, in the end rather than building a new clinic within Pennyville, the Department of Health chose to upgrade the existing facilities in the surrounding areas to cope with the additional population within the broader catchment area. Although this approach makes sense from an infrastructure planning perspective and was potentially the most cost-effective option for the Department, it has resulted in Pennyville residents, who are typically very poor, having to pay for transport or walking long distances to access healthcare.

Figure 5.9: Pennyville's vacant school site. Photograph by Christina Culwick Fatti, 2019.

In response to residual issues in Pennyville, a CoJ official reflected that in some cases, the City must be "aspirationally pragmatic" (Interview, 9 July 2019). Elaborating that although it is possible to create 'perfect' plans and to tick all the boxes in design, in reality, given the constraints of a particular project site, budget etc., sometimes it is necessary to be pragmatic and acknowledge that a project might only make small steps in the direction of desired change (at the city level) rather than achieving comprehensive transformative change. For example, integration among income groups and housing typologies was prioritised in Pennyville over a fully integrated development that included amenities and services. The City chose to be innovative in one respect and set a

precedent for future development, while managing constraints that prevented the project from achieving a more comprehensive set of justice and sustainability objectives.

5.3.3 Enabling access to services and economic opportunities

The different development approaches to Lufhereng and Pennyville, provide opportunities to interrogate how infill and urban expansion projects compare. Lufhereng was designed primarily around enabling access through proximity (although access to long-distance public transport was also envisioned), whereas Pennyville was designed around mobility-enabled access through transit-oriented development. Despite the different approaches adopted in the two developments, one interviewee reflected that "both areas still suffer from the same issues… where you've got your lack of economic opportunities and your social facilities and all that stuff" (Interview 31 July 2019). Lufhereng's inability thus far to achieve integration is in part due to the project's focus being housing, with the project management team located within the housing department. The necessary capacity (human and financial) to ensure that the planned supportive social and economic aspects of the project are implemented, was not explicitly provided for. However, there remains the perception that "it's a young city so it's going to be established over time" (Interview, 4 June 2019). This highlights how the features of a particular location are not considered constant over time, and although Lufhereng might currently be poorly located, it is hoped that this will change in the future, particularly as economic developments establish in the area.

Lufhereng's economic development plan, published in 2011, included a detailed proposal for how the settlement could realistically support economic activity and create jobs. This plan focused specifically on green economy principles and linking in with existing economic activities in the project's general vicinity. The plan was considered robust and provided clear evidence that, with the correct incentives and investment, the area could support industrial, agricultural and retail businesses, and provide a variety of job opportunities at a range of skill levels (Interviews, 30 May 2019 and 26 June 2019). However, despite interest and initial support from numerous departments, and potential investors, there has been limited coordination and commitment among the relevant government and private stakeholders required to ensure that the potential opportunities translate into a viable reality. This highlights a significant risk that the development that was designed to benefit from proximity-enabled access, could instead be dependent on mobility enabled access, which, given the location of the settlement within the city, will have negative social and environmental consequences.

Although the Pennyville development was successful in its primary objective of improving recipients' living conditions and achieving social integration, some key issues remain. One critique is that the area is zoned for only residential use, which has rendered small businesses within the settlement illegal and left residents primarily mobility-based options to access economic opportunities. Furthermore, because the area was considered too small to accommodate additional people or structures, the settlement was not designed to enable residents to build additional rooms or structures to their dwelling, which has become an important livelihood strategy for the urban poor. Despite no provision being made in terms of infrastructure capacity, there has been extensive auto-construction of buildings within the area (Figure 5.10), thus placing pressure on the infrastructure networks.

Figure 5.10: Aerial image of Pennyville showing subsidised dwelling units and auto-constructed backyard dwellings. Photograph by Clive Hassall, 2021.

Both Pennyville and Lufhereng case studies provide opportunities to explore the implications of decision-making and conflicting rationalities on justice and sustainability. Despite conflicting logics, both local and provincial governments' approaches to new development are argued as being able to further both justice and sustainability (Rebel Group, 2016; Bigen, 2017). The results reveal how plans do not always translate into reality, and how institutional dynamics, politics and different rationalities undermined the full potential of just sustainability visions.

Each project shifted due to political influences, which revealed conflicting rationalities at both individual and organisational scales. In Pennyville, this was most evident in the different visions for who the settlement would accommodate. The CoJ's plans to target all residents of the Zamimpilo informal settlement were affected by the different agendas of provincial politicians and local councillors. In Lufhereng, the political pressure to fast-track Phase 1 highlighted tensions between the urgency of delivering housing and ensuring access to a broader set of amenities and services. The worldview held by a powerful ANC politician favouring one form of justice (housing and service provision) over other forms, or even justice and sustainability together, was tied to vested political interests to secure votes in an upcoming election. Political influence also resulted in the provincial government subverting CoJ project management processes and structures, which in turn watered down plans to make the settlement mixed use and mixed income, with negative implications for justice and sustainability.

These examples also highlight how the various and overlapping responsibilities can lead to conflicting rationalities between local and provincial governments (Charlton, 2014; Turok, 2016b). The provincial human settlement department is under significant pressure to address the housing backlog and is incentivised to minimise upfront costs to maximise how many houses can be delivered within the available budget. Thus, they have prioritised urban expansion projects where land is cheaper and more readily available. Whereas municipalities are incentivised to consider the ongoing and long-term implications for infrastructure, maintenance and transport. CoJ has thus prioritised infill development. On the one hand, prioritising addressing the housing backlog is a key justice consideration, however it can come at the cost of access to amenities and economic opportunities, and have high environmental costs. On the other hand, prioritising infrastructure efficiency and densification might be strategic in furthering just sustainability in the longer term, the immediate need for housing remains a key issue.

Charlton (2017) argues that despite claims that there is alignment between different spheres of government, there remain contradictions between spatial plans at the different levels. Lufhereng, for example, extends the urban boundary in a relatively low-density way as per Provincial government's mega-human settlement approach. However, this project is located within Johannesburg and goes against the CoJ's spatial frameworks that prioritise densification within key nodes and along transport corridors. The conflicting rationalities of these spatial development logics, undermine the benefits of either taking root, and in particular the potential to further just sustainability is undermined.

In both Pennyville and Lufhereng, issues arose due to misalignments between different government spheres and departments. In each housing development, weak coordination and follow-through resulted in delayed or no social services and amenities. In Pennyville, this is particularly evident where the school remains unbuilt over 10 years after houses were completed, and the plans for a clinic were replaced by upgrading healthcare facilities in the surrounding areas. The lack of a clinic in Pennyville reveals conflicting rationalities between government and residents. Although the health department has fulfilled its mandate in ensuring healthcare facilities are able to cater to the needs of the community, the ability of Pennyville residents to access these facilities is limited by distance. In Lufhereng, despite local and provincial governments coming together to create the project, the struggle to translate the project's vision into reality is in part a function of the institutional conflicting rationalities between Gauteng and Johannesburg, and between various departments.

Although government plans might incorporate economic development opportunities, the government can only facilitate and incentivise investment from businesses and the private sector. The Lufhereng project's success depends on the active participation of a range of government actors and private commercial investors, which at the time of writing had not yet been secured and the portions of the development that are planned to include economic opportunities remain undeveloped. This is an example of how government plans sometimes attempt to influence factors not necessarily within their formal remit (Murdoch, 2000). Thus, projects progress through implementation with the hope, but no certainty, that the supportive services and economic opportunities will develop over time, which places significant risk to the project's economic sustainability.

The case studies highlight that poor connectivity between housing developments, and economic and social amenities do not necessarily arise due to a lack of planning, but rather as project plans confront powerful political agendas, and where poor follow-through and departmental priorities derail intended outcomes. The lack of coordination and misaligned priorities between housing, social services and economic development play fundamental roles in undermining both sustainability and justice.

Building settlements that are integrated across housing, businesses and social amenities is already highly complex, before adding additional challenges of ensuring relevant departments follow through with commitments to achieve this integration. Thus, facilitating mobility-based access rather than proximity-based access can be easier, lower risk and potentially cheaper to build.

However, housing developments that rely on mobility-based access, such as Pennyville (by design) and Lufhereng (in practice), externalise transport costs onto residents that can contribute to marginalisation and exacerbate negative environmental consequences.

In principle, both Lufhereng and Pennyville were designed to address both social and environmental objectives, despite taking very different forms. The Lufhereng case demonstrates that the potential efficiencies and opportunities associated with large integrated projects can be undermined by slow implementation (Charlton, 2017). Although some scholars and practitioners argue that urban expansion projects have greater potential to address the scale and urgency of the housing demand than infill projects (Angel et al., 2011), the evidence in this study does not support these claims, particularly because of project delays. Delays are caused by many factors such as the need to acquire and consolidate different land parcels; the complexity of integrating a number of land-uses; upgrading bulk infrastructure networks; and in some cases stimulating economic development. This study does not, however, conclude that infill development is necessarily superior for achieving just sustainability. The cases highlight that neither infill nor urban expansion projects are without constraints and associated complexity. Pennyville confronted post-mining related issues and high living costs for residents despite being strategically positioned from the City's perspective.

These cases suggest that in addition to conflicting rationalities between justice and sustainability, what undermines their concurrent achievement is fundamentally influenced by conflicting rationalities between political motivations, priorities, practical considerations, and decisions with unintended consequences. By addressing contradictions between spatial plans at different scales, misalignments between government spheres and departments, and disconnections between housing, social services and economic opportunities, the challenge of furthering just sustainability through government-led housing would be reduced.

5.4 Discussion

Both Pennyville and Lufhereng case studies provide opportunities to explore the implications of decision-making and conflicting rationalities on justice and sustainability. Despite conflicting logics, both local and provincial governments' approaches to new development are argued as being able to further both justice and sustainability (Rebel Group, 2016; Bigen, 2017). The results reveal how plans do not always translate into reality, and how institutional dynamics, politics and different rationalities undermined the full potential of just sustainability visions.

Each project shifted due to political influences, which revealed conflicting rationalities at both individual and organisational scales. In Pennyville, this was most evident in the different visions for who the settlement would accommodate. The CoJ's plans to target all residents of the Zamimpilo informal settlement were affected by the different agendas of provincial politicians and local councillors. In Lufhereng, the political pressure to fast-track Phase 1 highlighted tensions between the urgency of delivering housing and ensuring access to a broader set of amenities and services. The worldview held by a powerful ANC politician favouring one form of justice (housing and service provision) over other forms, or even justice and sustainability together, was tied to vested political interests to secure votes in an upcoming election. Political influence also resulted in the provincial government subverting CoJ project management processes and structures, which in turn watered down plans to make the settlement mixed use and mixed income, with negative implications for justice and sustainability.

These examples also highlight how the various and overlapping responsibilities can lead to conflicting rationalities between local and provincial governments (Charlton, 2014; Turok, 2016b). The provincial human settlement department is under significant pressure to address the housing backlog and is incentivised to minimise upfront costs to maximise how many houses can be delivered within the available budget. Thus, they have prioritised urban expansion projects where land is cheaper and more readily available. Whereas municipalities are incentivised to consider the ongoing and long-term implications for infrastructure, maintenance and transport. CoJ has thus prioritised infill development. On the one hand, prioritising addressing the housing backlog is a key justice consideration, however it can come at the cost of access to amenities and economic opportunities, and have high environmental costs. On the other hand, prioritising infrastructure efficiency and densification might be strategic in furthering just sustainability in the longer term, the immediate need for housing remains a key issue.

Charlton (2017) argues that despite claims that there is alignment between different spheres of government, there remain contradictions between spatial plans at the different levels. Lufhereng, for example, extends the urban boundary in a relatively low-density way as per Provincial government's mega-human settlement approach. However, this project is located within Johannesburg and goes against the CoJ's spatial frameworks that prioritise densification within key nodes and along transport corridors. The conflicting rationalities of these spatial development logics, undermine the benefits of either taking root, and in particular the potential to further just sustainability is undermined.

In both Pennyville and Lufhereng, issues arose due to misalignments between different government spheres and departments. In each housing development, weak coordination and follow-through resulted in delayed or no social services and amenities. In Pennyville, this is particularly evident where the school remains unbuilt over 10 years after houses were completed, and the plans for a clinic were replaced by upgrading healthcare facilities in the surrounding areas. The lack of a clinic in Pennyville reveals conflicting rationalities between government and residents. Although the health department has fulfilled its mandate in ensuring healthcare facilities are able to cater to the needs of the community, the ability of Pennyville residents to access these facilities is limited by distance. In Lufhereng, despite local and provincial governments coming together to create the project, the struggle to translate the project's vision into reality is in part a function of the institutional conflicting rationalities between Gauteng and Johannesburg, and between various departments.

Although government plans might incorporate economic development opportunities, the government can only facilitate and incentivise investment from businesses and the private sector. The Lufhereng project's success depends on the active participation of a range of government actors and private commercial investors, which at the time of writing had not yet been secured and the portions of the development that are planned to include economic opportunities remain undeveloped. This is an example of how government plans sometimes attempt to influence factors not necessarily within their formal remit (Murdoch, 2000). Thus, projects progress through implementation with the hope, but no certainty, that the supportive services and economic opportunities will develop over time, which places significant risk to the project's economic sustainability.

The case studies highlight that poor connectivity between housing developments, and economic and social amenities do not necessarily arise due to a lack of planning, but rather as project plans confront powerful political agendas, and where poor follow-through and departmental priorities derail intended outcomes. The lack of coordination and misaligned priorities between housing, social services and economic development play fundamental roles in undermining both sustainability and justice.

Building settlements that are integrated across housing, businesses and social amenities is already highly complex, before adding additional challenges of ensuring relevant departments follow through with commitments to achieve this integration. Thus, facilitating mobility-based access rather than proximity-based access can be easier, lower risk and potentially cheaper to build.

However, housing developments that rely on mobility-based access, such as Pennyville (by design) and Lufhereng (in practice), externalise transport costs onto residents that can contribute to marginalisation and exacerbate negative environmental consequences.

In principle, both Lufhereng and Pennyville were designed to address both social and environmental objectives, despite taking very different forms. The Lufhereng case demonstrates that the potential efficiencies and opportunities associated with large integrated projects can be undermined by slow implementation (Charlton, 2017). Although some scholars and practitioners argue that urban expansion projects have greater potential to address the scale and urgency of the housing demand than infill projects (Angel et al., 2011), the evidence in this study does not support these claims, particularly because of project delays. Delays are caused by many factors such as the need to acquire and consolidate different land parcels; the complexity of integrating a number of land-uses; upgrading bulk infrastructure networks; and in some cases stimulating economic development. This study does not, however, conclude that infill development is necessarily superior for achieving just sustainability. The cases highlight that neither infill nor urban expansion projects are without constraints and associated complexity. Pennyville confronted post-mining related issues and high living costs for residents despite being strategically positioned from the City's perspective.

These cases suggest that in addition to conflicting rationalities between justice and sustainability, what undermines their concurrent achievement is fundamentally influenced by conflicting rationalities between political motivations, priorities, practical considerations, and decisions with unintended consequences. By addressing contradictions between spatial plans at different scales, misalignments between government spheres and departments, and disconnections between housing, social services and economic opportunities, the challenge of furthering just sustainability through government-led housing would be reduced.

5.4.1 Conclusion

This paper has explored the rationalities that influence the outcomes of government housing projects, and the implications for environmental sustainability and social justice. The paper has explored different approaches to balancing housing needs and priorities in South African cities – which are characterised by unsustainable and unjust urban forms and grapple with resource constraints and high inequality.

By exploring elements from the design, planning and implementation phases of two government housing developments, this paper has revealed examples of where deviations occurred from the project plans in ways that undermined social justice or environmental sustainability outcomes or both. Different rationalities influence how housing projects are conceptualised and how they contribute towards justice and sustainability goals. These case studies have also revealed how conflicting rationalities between project planning and political agendas, and between different departments play out.

In addition to providing many housing opportunities, one of the strong motivations for large scale peripheral housing developments is their ability to be fully integrated settlements, enabling residents to access a wide range of amenities and economic opportunities, and thus benefit from proximity-enabled access. While acknowledging the negative environmental consequences of increased infrastructure and resource implications of urban expansion projects, this study highlights that achieving just and sustainable housing is influenced more by practical project-level decisions and institutional dynamics, and less by the different rationalities of underpinning infill versus urban expansion.

This paper has revealed that the inability to further just sustainability is not necessarily from a lack of commitment or deliberate planning, but rather a set of unanticipated conflicting rationalities. The value of this empirical study is that it surfaces these tensions and how they manifest in contradictions within three realms – conceptual, institutional and practical. Conflicting rationalities play out between political agendas and spatial plans, misalignments between government spheres and departments, and disconnections between housing, social amenities and economic opportunities. These conflicts are not necessarily centred on the disconnect between justice and sustainability, as proposed in the literature, but rather on a range of more subtle political and institutional factors that combine over time to undermine the translation of vision into reality, and as a result undermine just sustainability.

Translating policies and plans to project-level outcomes is fundamentally influenced by the context, history and specific needs of the communities that these housing developments aim to serve. In many instances there are conflicting rationalities between government plans and objectives, and the needs or desires of communities (Watson, 2003). Thus, evaluating attempts to deliver just and sustainable housing cannot be static across multiple developments or focused primarily on the plans, but rather need to be responsive to specific temporal and spatial contexts,

and sensitive to different community needs. This paper highlights the current disconnect between policies and project outcomes, and need to seek mechanisms to bring these closer together.

To make progress towards the dual goal of just sustainability, both theory and practice need to engage proactively and explicitly not only with the obvious conflicting rationalities between justice and sustainability, but also the mundane practices and decision-making processes that fundamentally influence outcomes.

6 Analysis and reflection

The preceding two chapters have presented the empirical findings of this research, addressing the first two research questions. These chapters correspond with the practical and policy elements withing the conceptual framework. The conceptual framework is designed around three interconnected elements as they relate to the boundary space between social justice and environmental sustainability. These include the practical, policy and theoretical elements. The understanding of these elements is fundamentally rooted in the methodological approach of this research, and the conceptual framework places the methodological element at its centre.

Key informant interviews and document analysis were used to interrogate the policy and decision-making processes related to the Lufhereng and Pennyville housing projects. By pairing large survey data with detailed respondent interviews, photographs and key informant interviews, the research could engage with multiple perspectives and scales. This set of multidisciplinary data allowed a variety of elements of social justice and environmental sustainability to be examined in conversation. The various datasets also enabled generalised conclusions about government-led housing to be made as well as nuances about the specific housing projects, decision-making processes and individual experiences to be revealed.

This chapter uses the conceptual framework to synthesise the research findings, extracting key themes and establishing connections with relevant literature. The practical, policy and theoretical elements are considered in turn, while also reflecting on the interconnections between the three key elements. Initially, the practical boundary space between social justice and environmental sustainability is examined revealed through the everyday experience of residents in Lufhereng and Pennyville, the government-led housing case studies. Subsequently, how power, interests and knowledge shape decision-making, particularly in the presence of conflicting rationalities is explored, and the implications for social justice and environmental sustainability. Lastly, the chapter reflects on the potential to build scholarship that is responsive to local realities, particularly those of cities in the global South, by expanding knowledge approaches. The multi-method approach adopted in this research facilitates this multifaceted analysis.

6.1 The practical boundary space between social justice and environmental sustainability

The outcomes of government-led housing have been assessed through a mixed method approach that incorporated statistical, qualitative and visual data. The open ended questions from the

resident survey and the photographs provide insight into the lived experience of residents, addressing a literature gap identified by Lemanski et al. (2017). The study found that government-led housing in Gauteng has significantly improved living standards for beneficiaries by enhancing access to basic services and formal accommodation. Despite scholarly criticisms of poor location (e.g. Adebayo, 2021; Haferburg, 2013; Landman, 2010), this research revealed that, on the whole, government-led housing developments in Gauteng demonstrated better access to amenities and public transport compared to informal settlements. The positive impact of this on social justice and environmental sustainability is significant, given that a considerable proportion of government-led housing beneficiaries previously lived in informal settlements. However, the study also found that access to economic opportunities for government-led housing residents is worse than for those in informal settlements, leading to high costs and limitations in job searches. Long commutes associated with poor access to economic opportunities have negative social and environmental consequences (Financial and Fiscal Commission (FFC), 2011; Suzuki, Cervero & Iuchi, 2013; Rode et al., 2014).

Government-led housing has faced consistent criticism for not meeting housing needs and perpetuating marginalisation, poverty and environmental issues (Goebel, 2007; Crane & Swilling, 2008; Adegun, 2018; Mahendra & Seto, 2019; Myeni & Okem, 2019; Turok, Visagie & Scheba, 2021). The debate on whether urban expansion or infill is preferable for advancing social justice and environmental sustainability adds another layer of complexity. Each approach is influenced by different rationalities and contributes to sustainable human settlements differently. Urban expansion projects focus on delivering housing at scale but may have negative environmental impacts (Biermann & van Ryneveld, 2007; Cirolia, 2014; Ballard, 2017). Infill developments are considered more environmentally sustainable but face challenges in delivering housing at scale due to limited available land.

Despite the potential of infill developments, in Pennyville, the lack of services and economic opportunities within the settlement leads to negative outcomes for both social justice and environmental sustainability. Resident interviews highlight challenges for residents in accessing amenities and job opportunities in both well-located Pennyville and peripheral Lufhereng. Despite this, Pennyville benefits from good access to various public transport options, enhancing residents' ability to access amenities and job opportunities compared to Lufhereng. The findings underscore a nuanced interplay between social justice and environmental sustainability, with outcomes aligned in some instances and conflicting in others.

Table 6.1 and Table 6.2 present a detailed assessment of Lufhereng and Pennyville's impacts on social justice and environmental sustainability across different factors, including: access to basic services and shelter; development type; urban form and land-use; location; accessibility, mobility and transport; and access to economic opportunities. Each element is evaluated for its positive or negative contribution to social justice and environmental sustainability, and then the combined impact is assessed as aligned and positive, aligned and negative, or mixed. These tables serve as heuristic tools to demonstrate the complexity of defining and achieving just sustainability within government-led housing (Charlton & Meth, 2017), they are not definitive assessments and are subject to interpretation.

The assessment of Lufhereng (Table 6.1) reveals mixed outcomes. The positive contributions of the settlement's integrated design to social justice and environmental sustainability, include well-designed settlement that prioritises accessibility and good urban form, and which leverages clever innovations such as the strategic use of bright house colours to help navigating the suburb and support liveability (see Photograph 2 from Photo essay 1). However, these positive elements are undermined by delayed delivery of amenities, resulting in negative current realities. The combined impact of each factor on social justice and environmental sustainability is either mixed or aligned and negative. Despite innovations in settlement design, the environmental impact of connecting to the infrastructure network outweighs the gains.

Pennyville's outcomes (Table 6.2) also show mixed results but with more instances of positive alignment than Lufhereng, and fewer of negative alignment. Proximity to economic opportunities and access to public transport in Pennyville contribute to positive outcomes for social justice and environmental sustainability (Mete & Xue, 2021). However, challenges arise from the primarily residential nature of Pennyville, leading to long walks or costly transport options for residents to access services.

Comparing Lufhereng and Pennyville's urban form and land use designs reveals a paradox. Pennyville's simplicity and residential focus contributed to a quicker completion. However, the lack of services within the settlement poses long-term challenges and higher ongoing costs for residents. In contrast, Lufhereng's integrated design aimed to accommodate various land uses and facilitate easy access to services and opportunities relatively quickly for a large number of recipients. However, Lufhereng faced significant delays due to its complexity, and has struggled to translate the design into reality. The paradox lies in the inability of either approach to provide socially just and environmentally sustainable housing developments.

Table 6.1: Comparing social justice and environmental sustainability outcomes of Lufhereng

Lufhereng				
	Design & reality	**Social justice**	**Environmental sustainability**	**Just sustainability**
Access to basic services & shelter	*Designed to provide housing and basic services for 24 000 households*	Improved living conditions. Vast majority of residents (83%) feel life is better/easier than before.	Increased resource consumption (construction & daily use) Solar geysers	Mixed
Development type	*Urban expansion development*	Spacious, suburban development with subsistence agriculture opportunities	Beyond urban development boundary & various environmental issues on site	Mixed
Urban form & land use	*Greenfield development designed as internally integrated across land use types*	Mixed use & designed for vibrant public space. Designed to support liveability Currently homogenous land-use – residential	Walkable with efficient housing & infrastructure layout. Designed to support liveability Low density, greenfield development	Mixed
Location	*Beyond the urban development boundary, west of Soweto*	Poor connection with services & opportunities beyond settlement	Dolomitic area with various grassland biome areas. Long infrastructure networks	Aligned – negative
Accessibility, mobility and transport	*Designed to enable access by proximity, but currently is mainly mobility-enabled access*	Walkable & liveable design Currently limited transport options. Services & amenities far	Low resource requirements of walkability & public transport (design) Currently dependent on long taxi commutes (high resource use)	Mixed *(design aligned positive, reality aligned negative)*
Access to economic opportunities	*Few economic opportunities near settlement except limited resident-owned small businesses & potential agricultural opportunities*	Majority of residents feel it's very hard to find jobs from the area. Transport costs prohibitive for job search	Long commutes & trips to look for work	Aligned – negative

Table 6.2: Comparing social justice and environmental sustainability outcomes of Pennyville

Pennyville				
	Design & reality	**Social justice**	**Environmental sustainability**	**Just sustainability**
Access to basic services & shelter	*Designed to eradicate Zamimpilo informal settlement. Provided housing and basic services for 2 751 households*	Improved living conditions. Vast majority of interviewees (87%) feel life is better in Pennyville than before	Increased resource consumption (construction & daily use) Solar geysers	Mixed
Development type	*Infill development within old mining belt, primarily residential*	Health & safety risks from mine shafts & adjacent dumps	Within existing urban boundary – compaction Greenfield development	Mixed
Urban form & land use	*Greenfield development with only residential land use*	Homogenous land use – residential. Businesses are illegal, except limited spaza shops	Compact urban form with combination of dwelling types	Mixed
Location	*Centrally located in the city*	Lower time & financial cost to access services	Lower emissions & resource requirements of travel	Aligned – positive
Accessibility, mobility & transport	*Mobility enabled access*	Good access to public transport Public transport costs	Public transport is an efficient form of mobility Resource & infrastructure requirements for all travel	Mixed
Access to economic opportunities	*Close proximity to an industrial areas, but further than Zamimpilo is to these areas*	Job options close by Transport costs prohibitive for job search	Well located to jobs	Mixed

Contrary to the perception that urban expansion projects are faster (Angel et al., 2011), Lufhereng has been a prolonged undertaking, particularly in delivering services and amenities. The first housing recipients, although gaining access to better basic services and shelter, face poor access to amenities and opportunities. While residents appreciate improved living conditions, they express

dissatisfaction with the location, citing challenges in accessing shopping, economic opportunities and social grants. Residents experience prolonged waiting periods, initially for promised houses and subsequently for services and opportunities to materialise. Waiting, as argued by Oldfield and Greyling (2015), pushes residents into a grey space, compelling reliance on informal practices in the interim.

Challenges in accessing economic opportunities due to locational disadvantage or transport costs lead government-led housing beneficiaries to engage in auto-construction to enhance earning potential. Auto-construction can contribute to densification and environmental sustainability and social benefits of earning potential and increased housing that is connected to formal services (Lemanski, 2009; Turok & Borel-Saladin, 2016; Scheba & Turok, 2020). However, unregulated practices may result in negative social and environmental impacts, such as sinkhole development, strained infrastructure and social issues like overcrowding (Turok, 2020). Despite potential benefits, government-led developments are not designed to facilitate auto-construction due to concerns about these negative impacts on both environmental sustainability and social justice, and persistent scorn among planners for informality (Turok, 2020).

This section highlights the intricate practical boundary space between social justice and environmental sustainability in the case studies. The findings raise questions about the possibility of concluding that a development is environmentally sustainable or socially just if any element is negative. It prompts consideration of whether a housing development can truly contribute to just sustainability in the presence of contradictions. The study prompts further exploration into whether social justice can be achieved independently of environmental sustainability and whether all forms of justice are equally crucial. Furthermore, how to prioritise short-term versus long-term outcomes remains fraught, along with how to manage differing perspectives and interests that emphasise different elements as the most important.

6.2 Obscured rationalities in policy and decision-making processes

This research has demonstrated the complexity of the boundary space between social justice and environmental sustainability, revealing conflicts and alignments between these imperatives (see Table 6.1 and Table 6.2). It emphasises that achieving social justice and environmental sustainability simultaneously is intricately linked to institutional practices, political dynamics and decision-making processes. This section delves into the influence of different factors and conflicting rationalities on decision-making, and the resultant outcomes for social justice and environmental sustainability.

Key informant interviews expose a discrepancy between envisioned outcomes and reality in both Lufhereng and Pennyville. Unintended consequences and diverging institutional dynamics, politics and rationalities of influential stakeholders deviated each project from the initial vision. Conflicting rationalities within each project become apparent when different forms of political pressure shifted respective outcomes. In Pennyville, for instance, the initial plan by the CoJ for housing development to eradicate the Zamimpilo informal settlement was altered by the agendas of provincial politicians and local councillors to provide houses for people in other areas. This resulted in perceived failure of the project to eradicate the informal settlement. In Lufhereng, political pressure to expedite Phase 1 in advance of a provincial and national election exemplifies the tension between delivering housing quickly and ensuring access to a broader set of amenities. The expedited project phases provided houses, but at the expense of an integrated settlement. Elected officials tend to use the promise of housing provision to secure votes (Figure 6.1) – and in the context of the ANC's declining support base, these votes are highly valued. The study reveals how political influence in Lufhereng led to the subversion of project management processes by the provincial government, and where political motivations undermined outcomes for recipients (Mtapuri & Myeni, 2019).

Empirical evidence from the study challenges the linear relationship between intentions and outcomes. In Pennyville, interventions framed as socially sustainable (e.g. providing a municipal park and planting street trees) contributed to environmental outcomes. This non-linear relationship between visions and outcomes, also noted in the literature (e.g. Patel, 2006a; Westman & Castán Broto, 2021), demonstrates the importance of engaging with the complex factors that emerge in decision-making during post-design phases. Furthermore, actual progress toward just sustainability necessitates alignment between the rationalities that guide plans and visions, and local capacity and capabilities (May & Perry, 2017).

Misalignments in capacities and priorities between government spheres and departments posed challenges for both projects. Poor coordination and follow-through, often due to conflicting mandates, undermined project plans and visions. Even when social justice and environmental sustainability were conceptually integrated, their simultaneous achievement was affected by political motivations, practical considerations and unintended consequences. Misalignments were seldom blatant and in many cases, there was initial buy in and support across various departments and government spheres; however, over time delays and de-prioritised projects revealed the disconnect between different objectives (Charlton, 2014; Turok, 2016b). Conflicts arising from divergent departmental mandates hindered real collaboration.

Figure 6.1: Madam and Eve cartoon, 'All I Got Was This Lousy T-shirt' (Francis & Rico, 2021)

The results (see sections 5.3.1 and 7.4) also reveal how considering different scales – city-region, project, or individual – shapes conclusions about social justice, environmental sustainability, and the boundary space between them. Actions that enhance social justice and/or environmental sustainability at one scale might impede their achievement at another. This has significant

implications for decision-making toward transitioning to a more socially just and environmentally sustainable society. Housing developments are typically assessed individually at the project scale, neglecting cumulative effects. Conversely, city-scale strategies can be challenging to translate to the project scale, and broad-scale assessments can overlook local injustices (Gupta et al., 2020). This research has demonstrated the importance of multi-scalar assessment (Lawhon & Patel, 2013; Pasgaard & Dawson, 2019), and that focusing on incremental adjustments at the city scale, rather than seeking perfect alignment at the project scale, can contribute to system-wide transformation.

This study illuminates some of the tensions that hinder the simultaneous achievement of social justice and environmental sustainability in government-led housing projects. It emphasises the influence of conflicting rationalities in various and nuanced ways, and in contrast to some literature propositions (Campbell, 2016; Pasgaard & Dawson, 2019; Westman & Castán Broto, 2021), this research suggests that outcomes are not solely influenced by the disconnect between social justice and environmental sustainability. Instead, conflicting rationalities manifest in contradictions within spatial plans, misalignments between government spheres and departments, and disconnections between housing, social amenities and economic opportunities. This research extends Watson's (2003) use of conflicting rationalities, which focused on relations between communities and government, and shows how it is a relevant concept for understanding the boundary space between social justice and environmental sustainability. Furthermore, this research has coined the term 'obscured' rationalities to denote subtle or underlying conflicts. This research argues that focusing on obvious conflicting rationalities, such as social justice versus environmental sustainability, or infill versus urban expansion, may divert attention from the more subtle factors that fundamentally impact just sustainability. The obscured rationalities within political and institutional systems, rather than the conflicts between social justice and environmental sustainability, over time contribute to the failure of translating a vision of just sustainability into reality.

The study argues that the disconnect between visions and outcomes is less about the obvious conflicts between social justice and environmental sustainability and more about unanticipated and obscured conflicting rationalities influencing the ability to further just sustainability. This highlights the non-neutral and value-laden nature of decision-making processes, which are shaped by power dynamics. The assumption that social justice and environmental sustainability can be seamlessly integrated overlooks the role of power in decision-making, where outcomes favour those with influence. Watson (2006) draws on Flyvberg and Foucault to argue that this assumption neglects the role of power in decision-making. Because power fundamentally influences decision-

making processes, in the context of conflicting rationalities it is nearly impossible to reach consensus, with outcomes falling in favour of those with power (Martin, 2013).

Those with influence often shape projects in subtle ways, through setting project definitions and priorities (Mummery & Mummery, 2019). The absence of a unified definition of just sustainability allows decision-makers to interpret its meaning according to their agendas, mandates and available capacity. This can lead to narrow definitions and visions being adopted, and result in superficial changes, greenwashing or even perpetuation of injustices. This underscores the need to acknowledge and address power imbalances in decision-making to foster more socially just and environmentally sustainable outcomes (Campbell, 2013; Mummery & Mummery, 2019; Pasgaard & Dawson, 2019; Hughes & Hoffmann, 2020). Scholars argue that promoting participatory justice is a way to counter these risks by involving diverse perspectives in decision-making (e.g. Leach et al., 2018).

While this research primarily focuses on distributional justice due to its intersection with environmental sustainability, procedural and recognitional justice are crucial components of socially just and environmentally sustainable cities (Leach et al., 2018; Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020; Menton et al., 2020). In South Africa's government-led housing programme, limited engagement or participation with recipients during the design and implementation phases has led to project designs that do not address the specific realities and needs of recipients (Charlton, 2010). Residents, living with the consequences of decisions made by others, lack opportunities to participate or influence priorities and trade-offs (Nastar et al., 2019). Poor communication with residents regarding decision-making processes further burden residents with day-to-day consequences and externalised costs (Goh, 2019). However, ensuring meaningful participation by future recipients is challenging. The discrepancy between anticipated and actual recipients, coupled with spatial misalignment and poor data management, makes participatory processes logistically difficult. This is exacerbated by the fact that different spheres of government are responsible for developing housing projects and allocating houses to recipients. Marginalised groups, the primary focus of housing programmes, are often located in areas not suitable for formal housing developments, which adds complexity to bringing potential recipients together for participation processes. These logistical challenges are compounded by poorly maintained data on housing needs and recipient contact details. Social justice imperatives could be fostered in government-led housing by finding ways to incorporate the voices of recipients in a meaningful way (Adegun, 2018), and ensuring better alignment between the departments responsible for project development and allocating houses.

6.3 Developing just sustainability theory through expanding knowledge approaches

This research argues that the challenge of aligning social justice and environmental sustainability in practice through policy and decision-making processes, is fundamentally influenced by the theorisation of just sustainability. Consequently, the third focus of this study is theoretical, considering the knowledge production processes that inform thinking and decision-making around just sustainability. Castán Broto and Westman (2019) argue for a complex understanding of just sustainability that is grounded in cases, and in this way they push back against propositions that a single approach to achieving just sustainability is possible. This aligns with the broader Southern Urbanism scholarship, which emphasises the importance of transdisciplinary methods and perspectives, and echoes calls for a nuanced understanding that is grounded in case studies.

In adopting a multidisciplinary approach, this research responds to global calls for more comprehensive knowledge on just sustainability (Petts, Owens & Bulkeley, 2008; Robinson, 2008; Culwick & Patel, 2017; Culwick et al., 2019). This study considers various interpretations of social justice and environmental sustainability from different stakeholder perspectives, using both quantitative and qualitative data, and provides a dynamic assessment of government-led housing outcomes and decision-making processes. It underscores the complexity of planning urban developments that are responsive to social justice and environmental sustainability imperatives (Patel, 2006a; Vogel et al., 2016b; Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020).

Brown-Luthango (2019; 2023) argues that inadequate policy responses arise from poorly reflected lived realities, and given the paucity of research into the lived experiences of government-led housing residents (Lemanski et al., 2017), the insufficiency of existing responses and plans for socially just and environmentally sustainable government-led housing is unsurprising. This underscores the significance of understanding the experiences of government-led housing residents. By contributing case studies, this research aims to refine theorisation and inform policies toward more socially just and environmentally sustainable housing and cities.

The study highlights the influence of power dynamics and vested interests in identifying what definitions and assessment criteria are used (Martin, 2013). The lack of deliberate engagement with the definitions guiding decisions about housing location and form perpetuates dominant and narrow perspectives that shape visions and projects, which reinforces existing patterns of injustice and environmental degradation (Nastar et al., 2019). The research advocates for challenging these

dominant framings through research and debates that include diverse perspectives, ultimately interrogating whose interests are served (Hodson & Marvin, 2017; Castán Broto & Westman, 2019).

The task of refining the framings of the urban and improving definitional clarity is important for aligning theory with the practical realities within cities. Although the dominant framings of what urban development 'should' look like have been developed in response to dynamics and practices in global North cities (Dempsey & Jenks, 2010), they nonetheless influence local visions and plans in the global South, despite their potential inappropriateness. The misalignment between dominant definitions and practical reality in the South, is most acute in relation to urban informality. This study challenges the conventional scorn of informal practices in urban development, revealing the potential of auto-construction to foster both environmental sustainability and social justice within government-led housing. It stresses the need to reframe ideas around informality, particularly in the global South, to build cities that are responsive to contemporary social and environmental crises, echoing other Southern scholars (Roy, 2005; Pieterse, Parnell & Haysom, 2018; Bhan, 2020).

While acknowledging the value of the term 'just sustainability', the study warns against its oversimplification, cautioning that mainstreaming a single term and definition could perpetuate dominant interpretations and their inability to respond to local realities in the global South (Pasgaard & Dawson, 2019). The call for a more complex discourse around just sustainability, enriched by case studies and research from the global South, seeks to avoid overlooking the lived experiences of those who are most affected by social and environmental crises. This requires a deliberate integration of theory and practice. Although these are often considered distinct and dealt with separately, this research has demonstrated how this separation can be problematic for addressing both social justice and environmental sustainability. Adopting transdisciplinary approaches, as advocated by Southern Urbanists, is a powerful way to bring theory and practice together. Furthermore, it provides a more relevant space for intervening within cities towards better alignment between social justice and environmental sustainability.

6.4 Conclusion

Although this study has explored a range of aspects related to government-led housing, decision-making and their implications for social justice and environmental sustainability, it does not attempt to provide a comprehensive report on government-led housing programmes. Rather, the study uses the case of government-led housing to reveal the complex interactions between different outcomes and interpretations of social justice and environmental sustainability.

Aligned with the conceptual framework, this research has illustrated the interdependence of practical, policy and theoretical boundaries between social justice and environmental sustainability. Moreover, it has emphasised the significance of expanding methodological approaches to knowledge generation to build nuanced and complex understandings reflective of the realities in the global South. This research argues that assuming it is necessarily possible, if sufficient care is taken, to bring environmental sustainability and social justice into synergy, oversimplifies a sometimes complex interaction. Such oversimplifications can be at best unhelpful and at worst detrimental to social justice, environmental sustainability, or both together. This study argues that pursuing development that simultaneously advances social justice and environmental sustainability requires consideration of complex relationships and engagement with conflicting rationalities. It emphasises the need for more nuanced debates, analyses and case studies from the global South to inform a comprehensive understanding of just sustainability. The research contributes to ongoing efforts to build cities that effectively address contemporary environmental and social challenges.

7 Towards just sustainability through government-led housing: Conceptual and practical considerations

Preface

This chapter is a verbatim reproduction of a paper published in *Current Opinion in Environmental Sustainability* in 2022 (https://doi.org/10.1016/j.cosust.2022.101150), as part of a special issue of which explored the role of infrastructure in societal transformations. This chapter forms a theoretical contribution of the thesis, focusing on the third research question. It considers how the conceptualisation of just sustainability can be developed to support just and sustainable housing delivery in Southern contexts. This chapter examines how the challenge of integrating social justice and environmental sustainability is both conceptual and practical in nature. The chapter first considers the hybrid notion of just sustainability and then shows how government-led housing provides a relevant lens through which to explore the interaction between social justice and environmental sustainability. South African government-led housing examples are used to reflect on the practical challenges of aligning social justice and environmental sustainability outcomes. The potential for auto-constructed dwellings to support both environmental sustainability and social justice within the housing sector is discussed in this chapter and mirrored in photograph 3 in the first photo essay.

Reflecting critically on relevant and recent literature, the chapter argues that understanding the trade-offs and structural barriers to just sustainability is a prerequisite for realigning these interactions within society, over time and across scales. One of the key theoretical contributions that this chapter makes is in demonstrating how the challenges of applying just sustainability in practice are linked with the need to deepen the conceptualisation of the boundary space between social justice and environmental sustainability. The process of building understanding and knowledge is an important pathway towards achieving just sustainability. Given that the dominant framings of just sustainability have been inadequate in making real progress to this goal, the dominant knowledge approaches on which these understandings have been developed needs to be deepened. The adoption of multidisciplinary research that engages deliberately with conflicting rationalities is critical for making progress towards better understanding social justice and environmental sustainability. Furthermore, broadening the geography of knowledge through elevating research from the global South is critical to this task.

Abstract

Government-led housing is linked explicitly to building socially just and environmentally sustainable cities. However, marrying justice and sustainability remains an intractable challenge. This paper reveals how this challenge is both conceptual and practical. This review considers the hybrid notion of just sustainability and how these ideas are reflected within government-led housing, using South African examples to reflect on practical application. Understanding trade-offs and structural barriers to just sustainability is a prerequisite for realigning these interactions within society, over time and across scales. Furthermore, the challenges of applying just sustainability in practice are tied to the limitations of uneven knowledge approaches. Progress towards just and sustainable housing in theory and practice requires engaging with conflicting rationalities through transdisciplinary research and broadening knowledge approaches to consider non-dominant perspectives.

7.1 Introduction

The proposition that environmental sustainability and social justice are interrelated issues has permeated academic and public discourses (Pasgaard & Dawson, 2019). Despite agreement that urban development must respond to both of these imperatives, implementation into practice remains an intractable challenge.

Government-led housing is linked explicitly to furthering social justice (Culwick & Patel, 2020; Turok, 2020) and building environmentally sustainable cities. Together with associated infrastructure networks, housing fundamentally influences urban resource consumption, environmental degradation, and multiple socio-economic impacts (Mete & Xue, 2021).

This paper explores both the conceptual and practical challenges of achieving just sustainability, and examines how these play out within government-led housing, using South African examples to reflect on practical application. Particular attention is paid to literature published between 2019 and 2021 with an emphasis on articles from the global South. Literature was sourced using keyword searches on Google scholar, a snowball method of scouring reference lists, and perusing recent journal issues with relevant scopes (e.g. Environment and Urbanization, Local Environment).

Understanding conflicting rationalities and structural barriers to just and sustainable cities is necessary for realigning these interactions. To build just and sustainable cities, theory and practice need to be brought together through transdisciplinary research, broadening knowledge approaches and for imaginaries to be informed by multiple and cross global perspectives and cases.

7.2 Conceptualising just sustainability

Just sustainability lies at the interface between social justice and environmental sustainability (from here on 'justice' and 'sustainability'), where efforts to stay within planetary boundaries (Rockström et al., 2009; Steffen et al., 2015), and to address poverty and inequality are interconnected (Pasgaard & Dawson, 2019). Despite the acknowledgement of their interlinkages, there has been limited systematic investigation into the boundary between sustainability and justice (Leach et al., 2018; Kremer, Haase & Haase, 2019; Ciplet & Harrison, 2020), with the existing research arising mostly within environmental fields. Despite the growing focus on these respective fields, divisions between justice and sustainability persist, in part because of the different histories and trajectories within each respective field (Campbell, 2013). Ignoring this disconnect not only weakens the relevance of theory, it also makes achieving just sustainability in practice unlikely.

Sustainable development (SD) could be considered the process of achieving just sustainability. SD brings together environmental, economic and social considerations and is central to numerous global and national policies and plans (Mohamed, 2019). The concept has endured in part because it does not challenge dominant economic systems (Hodson & Marvin, 2017), it has evolved due to contestation and attempts to apply it in practice (Campbell, 2013), and it has found resonance across a wide range of disciplines - deliberately interdisciplinary (Kremer, Haase & Haase, 2019). However, SD has been critiqued for being top-down, disproportionately favouring the powerful (Malloy & Ashcraft, 2020), and overly focused on future generations, with insufficient attention to immediate justice issues (Agyeman, Bullard & Evans, 2002) or shifting structural socio-economic systems. These critiques have inspired grassroots activism and environmental justice (EJ) scholarship (Agyeman, Bullard & Evans, 2002).

EJ challenges the tendency for negative environmental impacts to be disproportionately borne by the poor - the least responsible for these impacts (Davis, 2010; Gupta et al., 2020; Malloy & Ashcraft, 2020; Menton et al., 2020; Pineo, 2022; Rockström et al., 2021). Climate change exemplifies these dynamics, where inequality and climate change vulnerability are correlated, and influence over decision-making is skewed against the most vulnerable (Hughes & Hoffmann, 2020; Westman & Castán Broto, 2021). Climate justice has emerged as a subset of EJ and received significant attention (Mummery & Mummery, 2019; Ziervogel, 2019; Malloy & Ashcraft, 2020; Westman & Castán Broto, 2021).

Just sustainability transitions emerged initially from within bottom-up EJ movements (Agyeman et al., 2016), specifically the labour movement (Mummery & Mummery, 2019). Contemporary just

sustainability discourse brings top-down and bottom-up approaches together (Ziervogel, 2019), emphasising the role of global action to uproot the deep systems that contribute to both environmental crises and inequality, whilst acknowledging the role of local actors in effecting change and ensuring accountability (Ziervogel et al., 2022).

The justice and sustainability interface has been conceptualised in various ways and across different fields. Distributional considerations have received significant attention because the extent and spread of resource consumption drive both inequality and environmental degradation, Many models, such as Raworth's doughnut (Raworth, 2017) and the early planetary boundary (Rockström et al., 2009) models, pursue an equitable distribution of resources (both costs and benefits) to ensure universal wellbeing without overshooting available resources and planetary boundaries (Rockström et al., 2021). However, scholars also emphasise that communities can have multiple and sometimes conflicting needs, and thus "a purely distributional notion of justice can be problematic by flattening identities and failing to recognize the uniquely different needs of marginalized publics" (Hughes & Hoffmann, 2020: 3). Furthermore, universalised assumptions regarding needs and minimum standards of well-being undermine differentiated perceptions of what is just (Pasgaard & Dawson, 2019). Recent models thus incorporate procedural justice and justice of recognition (Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020; Menton et al., 2020) along with distributional justice, emphasising the meaningful participation of affected communities, ensuring that they can influence decision-making (Gupta et al., 2020) and without discrimination.

Many models implicitly assume that justice and sustainability are mutually attainable through 'win-wins' (Campbell, 2016; Pasgaard & Dawson, 2019; Westman & Castán Broto, 2021). However, this assumption 'depoliticises' social differences (Thörn et al., 2020) and reduces just sustainability into simple and reconcilable interactions able to invoke broad consensus. However, like critiques of the climate change consensus (Jankó et al., 2020) scholars caution against overstating the potential alignment between justice and sustainability, because although it can be useful for garnering support from politicians and society (Jankó et al., 2020; Tyler & Cohen, 2021), not engaging with their complex interactions restricts analysis (Leach et al., 2018), inhibits debate (Krueger, Freytag & Mössner, 2019) and obscures where real conflicts exist. Not engaging with tensions is a critical weakness of many models that consider both justice and sustainability (Rockström et al., 2021). Despite debates around just sustainability evolving over two decades and primarily from the global North, the inability to reconcile justice and sustainability in practice persists. Thus, examining trade-offs is increasingly considered as generative for furthering just sustainability in both theory

and practice (Pasgaard & Dawson, 2019; Culwick & Patel, 2020; Lu et al., 2021; Rockström et al., 2021).

Tensions can arise between and within justice and sustainability. Scholars caution that an unjust transition to sustainability is highly likely (Marcuse, 1998; Swilling, 2019), while conversely, a just but unsustainable outcome is also possible (Leach et al., 2018; Ciplet & Harrison, 2020). Tensions can also arise between different elements of sustainability (Kremer, Haase & Haase, 2019) and justice. For example, building resilience through redundancy can undermine resource efficiency (Meerow & Newell, 2017). Likewise, although procedural justice is argued as necessary to achieve just and sustainable outcomes, a just process can lead to unjust distribution of resources or persistent environmental degradation (Harvey, 2003; Ziervogel et al., 2022). The components of justice (distributional, procedural, recognitional) (Leach et al., 2018; Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020) can intersect to create complex forms of privilege and disadvantage, that are further complicated in relation to sustainability. Attempts to smooth over these conflicts and focus only on potential alignment between justice and sustainability not only overstates this alignment, they can also give a short-term perception of progress, but leave the structural tensions in place, thus undermining any real progress towards just sustainability (Campbell, 2013).

7.2.1 Conflicting rationalities

Defining the boundaries of just sustainability is political and subjective (Pasgaard & Dawson, 2019), influenced by justice and sustainability for whom and to what end (Campbell, 2013; Pasgaard & Dawson, 2019), and by feedback loops across space and time (Leach et al., 2018). Assessing what is just or sustainable is guided by technical and political considerations, which are in turn influenced by different forms of knowledge, underlying assumptions, and different philosophical, ethical and moral positions (Patel, 2006b). There is growing acknowledgement of the multitude of actors and logics shaping urban development, often driven by conflicting motivations (Ballard, Hamann & Mosiane, 2021).

Conflicting rationalities, coined by Watson (Watson, 2003) concerning state and community engagements, refers to diverging perspectives that cannot necessarily be resolved through consensus building. Misalignment does not necessarily arise from poorly understood ideas or a lack of will, but rather deep differences, influenced by worldviews and oftentimes competing goods. Goh (2019), for example, shows how efforts to build flood resilience in Jakarta, which was considered a public good and sustainable, nevertheless dispossessed people of their homes. Where conflicting rationalities exist, assuming potential alignment between different positions can trivialise real

difference, skewing outcomes in favour of those with power and influence. Conflicts can occur within individuals, where cognitive dissonance undermines action against injustice or environmental damage, despite knowledge of these issues (Swyngedouw, 2021). Trade-offs are likely to emerge across different scales - each influenced by different priorities and objectives (Lu et al., 2021).

Attempts to find mutually constructive solutions by engaging binary framings (e.g. just and unjust) or identifying 'shared values' to resolve conflicts (Lu et al., 2021) can not only oversimplify complex interactions, they can undermine where real conflicting rationalities exist. For example, a just process might not result in a sustainable or distributionally equitable outcome, thus rendering different but equally valid ethical positions in opposition. Rather, engaging deliberately with diverse perspectives, values and contexts, as revealed through conflicts, can deepen knowledge and expand the scope for alternative solutions (de Satgé & Watson, 2018; Kremer, Haase & Haase, 2019; Lu et al., 2021).

Negotiating conflicting rationalities towards achieving just sustainability is intrinsically practical and requires engagement with how decisions are made, what knowledge influences different positions, and how knowledge and power are used to influence different outcomes (Patel, 2006b).

7.3 Just and sustainable housing

Housing shapes urban infrastructure networks, influencing access to services and economic opportunities, and overall well-being (Culwick & Patel, 2020), with inadequate housing contributing towards poverty, poor health and disaster vulnerability (Zerbo, Delgado & González, 2020). Housing and infrastructure are significant drivers of environmental degradation and carbon emissions, creating path dependency and locking cities into resource consumption trajectories (IRP, 2018; Pineo, 2022). Government-led housing can improve the urban poor's living conditions (Adegun, 2019; Culwick & Patel, 2020), provide opportunities to intervene in urban development patterns, and in turn justice and sustainability (Turok, Visagie & Scheba, 2021). However, sustainability considerations are seldom considered within housing projects (Adegun, 2018), particularly in Africa (Adegun, 2019).

Improving access to housing and services can include re-blocking and in situ informal settlement upgrading, relocation to serviced sites, or relocation to fully constructed houses (Adegun, 2019). For example, South Africa's housing programme focuses on addressing the housing crisis that was left in the wake of apartheid, where in 2011 some 3 million people were living informally (Statistics

South Africa (StatsSA), 2011). The programme aims to build sustainable and inclusive human settlements by either relocating residents to newly constructed houses or in situ upgrading of informal settlements. The programme is designed as a spatial restructuring tool (Parnell & Crankshaw, 2013; Culwick & Patel, 2020) to redress historical inequality and marginalisation (Rebel Group, 2016). Although lauded for improving access to housing and services for millions of people, the programme has entrenched urban fragmentation and further marginalised poor communities (Adegun, 2018, 2019; Culwick & Patel, 2020; Turok, Visagie & Scheba, 2021).

Governments' overemphasis on basic services has resulted in neglecting key aspects of housing such as access to services and opportunities, which is a primary objective of housing (Visagie & Turok, 2020). Access can, however, be interpreted in different ways (e.g. via proximity or mobility) (Mete & Xue, 2021), is influenced by housing location and form (Rode & da Cruz, 2018; Culwick & Patel, 2020), it can change over time, and there are often misalignments between access to services and economic opportunities (Culwick & Patel, 2020). Housing that results in high transport costs, cannot be considered just (Chan & Adabre, 2019), however, peripheral developments are often justified as providing more units quickly compared to 'well-located' options. Although a simplification, this demonstrates potential conflicting rationalities between equally valid motivations of maximising adequate shelter and basic services versus better overall access to services and opportunities for fewer people. Similarly, although improving the energy efficiency of affordable housing, which lowers life cycle and operating costs (Chan & Adabre, 2019), is a strategic intervention for both justice and sustainability, it increases per unit-costs, thus increasing benefits but for fewer people.

Relocation projects have proved to be financially unsustainable, potentially exclusionary of poorest groups (Goh, 2019), disrupt social networks and can exacerbate urban inequality (Adegun, 2019). In light of such failings of top-down, government-led housing, where people are typically considered beneficiaries rather than participants (Mitlin & Bartlett, 2020), there is growing support for residents co-producing housing (Mitlin & Bartlett, 2020) in furthering just sustainability (Adegun, 2018, 2019). Housing co-production includes *inter alia* informal settlement re-blocking and upgrading, auto-construction of serviced sites, and improving existing dwellings (Culwick & Patel, 2020; Mitlin & Bartlett, 2020). Community participation in these processes enables active inclusion of disadvantaged groups (Adegun, 2018), countering the tendency to exclude recipients from decision-making processes (Nastar et al., 2019) that result in unjust outcomes (Goh, 2019). Providing serviced sites for recipients to auto-construct their own houses has gained support in South Africa (Mabin, 2021) and is argued as having potential to lessen the government's burden to

provide houses. However, this approach still requires government involvement and is harder to ensure dense or integrated settlements. Auto-constructed backyard dwellings in South Africa have increased urban density and housing availability, and provided income generation opportunities - positives for both justice and sustainability. However, falling outside formal housing policy and regulation (Turok, 2020), auto-constructed backyard dwellings can lead to overburdened infrastructure, overcrowding, poor building quality, health and environmental risks, and social tensions (Culwick & Patel, 2020; Turok, 2020). Invoking the support of non-governmental organisations (NGOs) and community groups (Newton, 2013) has been argued as being able to support housing co-production, however these processes have proved to be slow and have not guaranteed good social outcomes for communities (Brown-Luthango, 2019).

One concern around co-production is that it eases the constitutional responsibility for states to ensure adequate housing for all (Adegun, 2018), and the necessary shift from the state being the housing 'provider' to 'facilitator' (Adebayo, 2020). State intervention is arguably critical for achieving justice sustainability for numerous reasons: to enable poor groups to enter the market-driven housing systems and reduce inequality in housing access (Caldeira, 2017; Mitlin & Bartlett, 2020; Mete & Xue, 2021); to facilitate access to services through networked infrastructure; and to maximise density-related benefits (Visagie & Turok, 2020). However, South Africa's housing subsidy, being primarily ownership-based, has proved unaffordable for the poorest groups, despite recent innovations (Mitlin & Bartlett, 2020). Furthermore, many of the most marginalised groups do not qualify for subsidies and they can be displaced by informal area upgrading projects (Mitlin & Bartlett, 2020). Beyond the South African context, these types of concerns have sparked interest in the potential of co-housing as an alternative housing option that could foster both justice and sustainability (Thörn et al., 2020).

In addition to focusing on the poor, furthering just sustainability at a societal scale requires state intervention not only among poor groups but also in reducing affluent consumption (Hickel et al., 2021). Capping the per capita house size and shifting the housing sector away from a market-based system, which depends on continuous growth and consumption, is argued as the most effective way to achieve just and sustainable housing (Mete & Xue, 2021). However, many municipal revenue systems depend on commodified housing systems and increasing property values. Additionally, reducing housing-related consumption would equally reduce economic growth. Degrowth and reduced consumption are not currently considered among likely scenarios (Hickel et al., 2021), and pursuing such shifts in the housing system would face insurmountable political and market resistance. Furthering just sustainability through government housing intervention requires re-

conceptualising housing models, multi-scalar considerations (Adegun, 2018) and enabling co-production.

7.4 Building just & sustainable cities in the South

Despite the acknowledged role of cities in furthering just sustainability (Malloy & Ashcraft, 2020), and the ongoing debates that highlight conflicts between social, environmental and economic objectives, urban climate change projects tend to entrench inequalities, and axes of privilege and disadvantage (Robin & Castán Broto, 2021). Literature on just sustainability transitions in cities is dominated by global North scholarship (Hughes & Hoffmann, 2020) and has proved inadequate in describing and guiding processes in the global South (Khosla & Bhardwaj, 2019). Innovations designed from global North assumptions, rather than local understanding, tend to fail, allowing environmental and justice issues to persist or worsen (Jasanoff, 2018; Bond et al., 2019). Understanding how to achieve justice and sustainability concurrently requires new imaginaries around shifting existing systems (Hallowes & Munnik, 2019). For example, finding ways to incorporate auto-construction into government housing solutions to mobilise justice and sustainability outcomes, rather than considering it a signifier of failed housing programmes (Turok & Borel-Saladin, 2016; Moore, Eiró & Koster, 2022).

Southern scholars that challenge neoliberal views of the city and its infrastructure, call for expanding the geographical focus of analysis (Robin & Castán Broto, 2021). However, rather than rejecting the established and dominant theories and the existing and ongoing debates, they call for a range of research to build more complex understandings of cities (Roy, 2009; Parnell & Pieterse, 2016). Considering Southern perspectives can facilitate new ways of thinking, reveal where sustainability plans intersect with the structures that perpetuate inequality and open up opportunities to re-examine Northern cities and theories (Robin & Castán Broto, 2021).

The just sustainability literature increasingly highlights the need to address knowledge biases, engage with plural perspectives, co-produce knowledge and push back against universalised solutions (Campbell, 2013; Mummery & Mummery, 2019; Pasgaard & Dawson, 2019; Hughes & Hoffmann, 2020). It further emphasises the importance of co-producing knowledge and conceptualisations (Campbell, 2013). Acknowledging differences across space and incorporating non-dominant perspectives (de Satgé & Watson, 2018), creates possibilities for different endpoints and pathways, not limited by a single imagination (Jasanoff, 2018). Considering multidimensional elements of socio-ecological systems through transdisciplinary methods reveals different trade-offs, and provides complex and nuanced understandings to inform decision-making (Lu et al.,

2021). We need to look "outside dominant circuits of knowledge and market-led interventions" (Robin & Castán Broto, 2021: 7), to make progress towards sustainability while addressing social injustices.

Although scholars argue that tackling trade-offs is facilitated by focusing on the regional and national levels (Lu et al., 2021), case study research reveals fundamental disconnects between regional and local community scales (Pasgaard & Dawson, 2019). The scale of problems related to justice and sustainability are often disconnected from the scale of governance response. Additionally, furthering justice and/or sustainability at one scale, can have different impacts at other scales (Lawhon & Patel, 2013). Achieving just sustainability requires multi-scalar perspectives and assessments across a range of dimensions (Ziervogel, 2019). Although scholars call for deliberate planning rather than retroactive, or responsive action (Adegun, 2018), choices that further justice and sustainability now might not do so under future conditions, thus strategies need to be dynamic and responsive to context changes over time (Lu et al., 2021).

To make real progress towards just and sustainable cities (rather than short term solutions that exacerbate unsustainable and unjust outcomes), the root causes of unsustainability and injustice need to be addressed, rather than the superficial or peripheral symptoms (Malloy & Ashcraft, 2020; Swyngedouw, 2021). The dynamic interplay between inequality and environmental issues is intrinsically linked with uneven knowledge approaches, and the exclusion of non-dominant perspectives (Gupta et al., 2020; Hughes & Hoffmann, 2020). Thus rectifying unjust knowledge production practices is critical for realigning the structural elements of inequality and unsustainability (Hughes & Hoffmann, 2020), such as the financialisaton of the housing system, and the consumerist, growth-centred nature of the global economy.

7.5 Conclusion

Housing is a coalescing point for infrastructure and urban development, and fundamentally affects both justice and sustainability. Government-led housing has consistently failed to meet housing needs (Mitlin & Bartlett, 2020), and what is provided is often inadequate in addressing a range of social, environmental and economic factors. In its current form, it is unlikely to advance just and sustainable cities (Mete & Xue, 2021). However, this is neither reflective of a lack of will or relevant strategies, but rather due to a complex set of factors, trade-offs and biases in decision-making and knowledge creation.

This paper considered the conceptualisation of just sustainability as a hybrid concept and how these ideas could be developed to support just and sustainable housing delivery. Achieving justice and sustainability through government-led housing requires reimagining city visions, reconsidering the role of government and potentially for those in power to relinquish influence to enable co-production. Spatial and temporal dimensions are critical when considering just sustainability (Heffron & McCauley, 2018; Pineo, 2022), together with assessing multi-scalar impacts (Lawhon & Patel, 2013; Pasgaard & Dawson, 2019).

Appreciation is growing for where justice and sustainability do not intersect, and the role of understanding trade-offs in furthering just sustainability (Pasgaard & Dawson, 2019; Ciplet & Harrison, 2020; Culwick & Patel, 2020; Rockström et al., 2021). Because it is unreasonable to focus on either justice or sustainability, or one before the other (Adegun, 2019), it is necessary to engage with conflicting rationalities. This can be generative for developing new practices around knowledge generation, project design and management, and informing decision-making (Lu et al., 2021). Without understanding conflicting rationalities or bringing together different perspectives, rethinking problems and expanding the imagination beyond current trajectories will be near impossible (de Satgé & Watson, 2018).

The challenge of applying just sustainability in practice, particularly in the global South, highlights the need to deepen theorisation. Opening up debates and acknowledging different perspectives enriches theory and supports the implementation of just sustainability across different contexts. Understanding interlinkages across different domains and expanding imaginaries around how to build both just and sustainable cities requires transdisciplinary research (Leach et al., 2018) and consider non-dominant ways of seeing the world. Universal definitions for just and sustainable housing are not only weak bases for decision-making, but they can lead to unjust and unsustainable outcomes. Rather, multi-scalar approaches that consider multiple perspectives are critical for understanding the dynamics at play, and revealing opportunities to build just and sustainable cities.

8 Conclusion

This chapter brings this thesis to conclusion by summarising the study argument, its contributions and limitations. A number of key issues raised by this study warrant further investigation, and are discussed, together with opportunities to extend this research to address its limitations. These are considered using the four structural elements of the conceptual framework, which is based on the premise that the practical, policy, theoretical and methodological components of understanding and fostering just sustainability are interconnected. The following sections discuss these four elements in turn, followed by some concluding remarks.

8.1 Developing a complex understanding of the practical outcomes

Contrary to the critique of government-led housing in South Africa by both scholars and practitioners that these projects have led to negative social and environmental outcomes, the evidence shows that the relationship between social justice and environmental sustainability is complex. In some instances they are conflictual and other times mutually beneficial. Given this complex relationship, assessment criteria need to be considered critically as different measures can be biased in one or other direction. This research has shown that focusing only on measures related to access to adequate shelter and basic services could lead to conclusions that these housing developments have provided only positive outcomes for recipients. Whereas, also considering access to economic activities as a measure of the success of government housing developments, reveals mostly negative results. Furthermore, an over emphasis on objective, statistical measures can hide complexity and nuance that is revealed through qualitative data and subjective measures. The photo essays demonstrate the value of pairing visual and creative methods with statistical analyses to bring to life and humanise the findings.

Because environmental sustainability and social justice are each individually complex and multifaceted, focussing on only one element or interpretation can miss key issues. Furthermore, assuming that 'just sustainability' means only one thing is unhelpful for reconciling these imperatives in both theory and practice. The process of defining what is concurrently socially just and environmentally sustainable is both political and subjective (Pasgaard and Dawson, 2019), and is influenced by considerations around justice and/or sustainability for whom and to what end (Campbell, 2013; Pasgaard and Dawson, 2019). Thus, it is important to draw on diverse methods and consider multiple perspectives.

The study concludes that understanding both alignment and conflict between social justice and environmental sustainability is a prerequisite for realigning their interactions and the structural systems that are active within society, over time and across scales. Importantly, context matters, and plans and visions need to respond directly to the specific characteristics and dynamics within a case, rather than developing general approaches and solutions that aim to apply to a range of contexts. This research has reasserted the importance of considering the broader implications of housing in furthering just sustainability – in facilitating access to goods, services, and economic opportunities. However, more work needs to be done to develop robust definitions of 'well-located' and a deeper understanding of how different types of access influence quality of life and with what implications for environmental sustainability. This underscores the importance of acknowledging contextual nuance and the risk of adopting one-size-fits-all approaches or uncritical adoption / appropriation of strategies designed elsewhere.

The study was limited geographically to Johannesburg and to two case studies of contrasting typologies. Although this helped to surface how different logics influence just sustainability and enabled rich understandings to be developed, understanding how government-led housing can further just sustainability would benefit from a wider range of contexts, including other Southern cities and other housing typologies. This would allow alternative perspectives on how social justice and environmental sustainability interact within government-led housing. Insights from multiple contexts could reveal innovations and potential ways to manage conflicts, and bring social justice and environmental sustainability into closer alignment. These could also uncover novel modalities and incentives to encourage private investment and economic development within or alongside government-led housing developments.

Auto-constructed backyard dwellings and informal businesses are common in government-led housing developments. Despite often contravening government plans and bylaws, these actions by residents could support more liveable and economically viable settlements, and foster environmental sustainability. However, the governance, management and partnerships required to support the potential benefits of auto-construction remain largely unexplored. The idea of housing co-production, where both residents and government contribute towards housing provision, has significant potential. However the existing modalities tend to be drawn-out and with potentially negative social outcomes for the poor. New modalities are needed through which government and communities can collaborate to address the housing crisis in Southern cities while also furthering just sustainability. These findings challenge the assumption that government-led housing should adhere strictly to formal plans and bylaws. However, the findings suggest that informal practices

such as auto-constructed backyard dwellings and informal businesses are common and actually contribute meaningfully to achieving socially just and environmentally sustainable cities. It further challenges the assumption that government is the primary role-player in housing provision, whereas in reality residents play a significant role, which needs to be better incorporated into theories of urban development and governance.

The study has demonstrated how the boundary space between social justice and environmental sustainability is not constant over time. For example, established housing developments tend to have better access to services and amenities as these have had time to develop. Some might argue that peripheral developments seeming to replicate apartheid spatial form, might in the long term address a range of social justice and environmental sustainability issues, and are thus justifiable. Longitudinal analyses would be valuable in assessing the changes in social justice and environmental sustainability outcomes over time. Longitudinal studies would help uncover any unintended consequences of housing developments on social justice and environmental sustainability. This could help policymakers and planners ensure that interventions do not exacerbate existing inequalities and that the benefits of development are distributed equitably. By examining changes over time, a longitudinal approach would provide a deeper understanding of how the boundary space between social justice and environmental sustainability evolves. This would allow researchers to identify trends, patterns, and tipping points where the relationship between these two concepts shifts.

This study focused on only one component of social justice – distributive justice – because of the obvious connection between social justice and environmental sustainability of resource distribution. However, interrogating a wider set of social justice components (e.g. restorative, procedural and recognitional justice) would enable a more comprehensive understanding of the boundary space between social justice and environmental sustainability.

8.2 Policy implications and obscured rationalities

The conceptual framework draws on Watson's (2003) idea of conflicting rationalities, extending its application and demonstrating its relevance and usefulness for understanding the boundary space between social justice and environmental sustainability. Understanding how conflicting rationalities play out can be generative for developing new practices around knowledge generation, project design and management, and informing decision-making. Without understanding trade-offs and conflicting rationalities, it will be near impossible to rethink problems and expand imaginaries beyond current systems and trajectories.

The term 'obscured rationalities' was coined in Chapter Five to denote the idea that an over-focus on the obvious and overt conflicts between social justice and environmental sustainability can deviate attention from the underlying and often more subtle conflicting rationalities that undermine ultimate alignment between social justice and environmental sustainability. This demonstrates how the obvious or anticipated trade-offs are not the only (or possibly even most important) considerations for furthering just sustainability. Institutional dynamics, politics and even the mundane practices around decision-making have embedded conflicting rationalities that can result in poor outcomes for social justice and/or environmental sustainability, even when initial plans and visions bring these goals into alignment. Practical application is thus influenced less by conceptual differences between social justice and environmental sustainability, and more by seemingly unrelated factors within decision-making processes and the underlying structures and systems that drive and manage urban changes.

This research has contributed towards gaining a better understanding of the multiple influencing factors in the boundary space between social justice and environmental sustainability. It is not sufficient to focus only on the material outcomes or changes, it is necessary to consider the underlying structures and systems that drive and manage these changes. The inclusion of photographs has supported this aim in this thesis, supporting the analysis to move beyond the conclusions revealed by traditional data and methods. This is a critical contribution of the multidisciplinary approach adopted in this research.

Empirical evidence provides rich opportunities to engage with the multiple and sometimes competing goals of economic growth, social justice and environmental sustainability. It also opens the possibility for policy and planning to respond effectively to these goals. The case of government-led housing in South Africa has been useful in demonstrating that although government officials are working deliberately to balance environmental sustainability and social justice, this can require aspirational pragmatism. In other words, officials must at times allow some negative consequences in one or other outcome, in order to make strategic advances in other outcomes. Ethnographic research would be valuable for understanding these incremental processes and to gain a better sense of how government is trying to navigate the boundary space between social justice and environmental sustainability,

8.3 Deepening theorisation of just sustainability

The challenge of bringing together social justice and environmental sustainability (i.e. furthering just sustainability) is both a practical and theoretical. On the one hand, defining, in theory, what

just sustainability encompasses must consider its practical application and be influenced by contextual factors. On the other hand, progress towards just sustainability in practice must reflect how conflicting rationalities are defined and navigated, and in whose or what interest.

This study reinforces Southern Urban Theorists arguments that evidence, case studies and theories from the global South are critical for better understanding cities across the world. Furthermore, progress towards just sustainability depends on broadening knowledge approaches and the types of knowledge that inform the conceptualisation and application of just sustainability. In this way, the theoretical turn towards Southern Urbanism, and considering cases and contexts from the global South is relevant for gaining a broader understanding the boundary space between social justice and environmental sustainability in the context of complex urban challenges.

The challenge of applying just sustainability in practice, particularly in the global South, highlights the need to deepen theorisation, and incorporate different perspectives on just sustainability to enrich theory and support implementation across a range of contexts. Understanding interlinkages across different domains and expanding imaginaries around how to build both socially just and environmentally sustainable cities requires transdisciplinary research and to consider non-dominant ways of seeing the world. To counter the pitfalls of universal definitions of just sustainability, projects with multi-scalar approaches that include impacts at the individual, community and societal scales should be undertaken. This is critical for decision-makers' understanding of the complex dynamics at play, and to identify opportunities to build just and sustainable cities.

8.4 Methodological innovation and expanding knowledge approaches

This research has intentionally sought multiple views on and interpretations of social justice and environmental sustainability by examining a range of data sources and methods. This approach is particularly innovative in its juxtaposition of statistical data in the published papers and visual data in the photo essays. This has enabled depth and nuance in the understanding the boundary space between social justice and environmental sustainability to emerge. Engaging with both the tensions and alignments between social justice and environmental sustainability, has revealed a rich and complex insights – the type of understanding which is critical to empower urban decision-making towards transformative change. Not only is the assessment of both social justice and environmental sustainability innovative within government-led housing research, the adoption of multiple and differing methods helps to overcome some of the limitations of single-disciplinary studies that have dominated the related scholarship.

The practical, policy and theoretical boundaries between social justice and environmental sustainability have been examined through a carefully tailored method that is appropriate for each respective element. The practical boundary space was analysed using survey, resident interview and photographic data. The survey data enabled conclusions to be drawn about government-led housing and the two case studies in general, while the open-ended responses from interviews and the photo essays surfaced the individual lived experience of residents. Multiple methods and multidisciplinary approaches helped build a complex and nuanced understanding of government-led housing projects, and to locate sites of conflict, beyond the obvious. This demonstrated the importance of considering a range of different perspectives for drawing conclusions about these projects. Understanding the outcomes of government-led housing through residents' lived experience "can powerfully illustrate the housing programme's multifaceted effects"(Charlton & Meth, 2017: 91). It is uncommon for visual methods such as photo essays to be included in academic theses, and especially in combination with quantitative data. This unusual pairing of contrasting datasets and methodologies has delivered a profound complementarity between objective and subjective understandings of government-led housing.

The policy boundary space has been interrogated using key informant interviews and document analysis. By pairing large survey data with detailed respondent interviews, photographs and key informant interviews, the analysis engaged with multiple perspectives and scales. This set of multidisciplinary data allowed a variety of elements of social justice and environmental sustainability to be examined in conversation. The various datasets also enabled generalised conclusions about government-led housing to be made as well as nuances about the specific housing projects, decision-making processes and individual experiences to be revealed. By drawing connections across different datasets and analyses, obscured conflicts were surfaced, which would not have been possible through a single methodological approach. Furthermore, during fieldwork, definitions of environmental sustainability and social justice were left open to interpretation by key informants, which enabled them to bring their own understandings and interpretations to the interviews.

Explicit connections have been drawn between applying interdisciplinary research methods and the theoretical debates around just sustainability, and the need to incorporate non-dominant voices and perspectives. The challenges of applying just sustainability in practice are fundamentally linked with uneven knowledge approaches and requires robust engagement with complex interactions between just sustainability and pushing back against over-simplification.

The case studies focus recipients of government-led housing who typically have limited power over decision-making processes and resulting outcomes. To move the whole of society towards just sustainability, powerful actors beyond government, such as elites (e.g. individuals, households and businesses) must be considered and their respective impacts on building socially just and environmentally sustainable cities. Research projects and methodologies are required to examine powerful groups and their role and influence over the just transition. Focusing on powerful groups also broadens the analysis beyond government intervention and into the role of private investment and actions on social and environmental systems.

8.5 Conclusion

If cities are to accommodate their growing urban populations in a socially just and environmentally sustainable way, an understanding of how social justice and environmental sustainability are envisioned and conceptualised is needed, and how knowledge, power and politics influence decision-making. Using innovative methods, this study has investigated the practical outcomes and policy processes related to social justice and environmental sustainability in government-led housing. It has also each reflected on how the theorisation of just sustainability could be developed to support just and sustainable housing delivery in Southern contexts.

This study reveals that what prevents real progress towards social justice and environmental sustainability, can in some cases stem from seemingly unrelated processes and decisions, resulting in disconnections rather than overt decision-making in favour of either social justice or environmental sustainability. To make progress towards the dual goal of just sustainability, both theory and practice need to engage proactively and explicitly not only with the obvious conflicting rationalities between social justice and environmental sustainability, but also the mundane practices and decision-making processes that influence outcomes. Methodologically, the study highlights the importance of multidisciplinary research and broadening knowledge approaches. Theoretically, the challenge of fostering just sustainability in practice and deepening the theoretical understanding of how social justice and environmental sustainability interact depends fundamentally on greater inclusion of studies and theorisation from the global South. Finally, from a policy perspective, it is critical that attempts to consider social justice and environmental sustainability simultaneously do not over-simplify their interaction as either mutually beneficial or conflictual, but rather in a way that allows for complex interactions that are rooted in contextual understandings.

Appendix 1: Lufhereng and Pennyville resident questionnaire

No.	Question	Code	Response options
A	Interview area	1 2	Lufhereng Pennyville
B	Start of interview time stamp		
C	Interview date		
E	GPS coordinate		
F	Respondent name		
G	Respondent contact details		
H	Consent form signed	1 0	Yes No
I	Consent for photograph	1 2 3	No Yes, of my property but not of me Yes, of me and my property
J	Consent to publish photograph	1 0	Yes No
	Fieldworker observation		
1	To which population group does the respondent belong?	1 2 3 4 5	African Coloured Indian/Asian White Other
2	What is the sex of the respondent?	1 2	Female Male
3	Which type of dwelling does this household occupy?	1 2 3 4 5 6 7 8 9 10 11 12 13 14	House, brick or concrete structure on a separate stand Traditional dwelling, hut or structure made of traditional materials Flat or apartment in a block of flats Cluster house in a complex Townhouse (semi-detached house in a complex) Semi-detached house not in a complex House, flat or room separate from main dwelling in backyard Informal dwelling or shack in backyard Informal dwelling NOT in backyard, e.g. in informal squatter settlement or on a farm Room or flat which is part of main dwelling or property Caravan or tent Unit in a retirement home or barracks etc. Hostel Other

	Dwelling and neighbourhood		
4	How many households live in this dwelling unit?	1 2 3 4 5 6 7	1 2 3 4 5 6 7+
5	How many people, including you, live in this household?	1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10+
6	Does this household own or rent this dwelling, or live here by some other arrangement?	1 2 3 4 5 6 7 8 9 10	Owned, but paying off a bond Owned and fully paid off Renting from private landlord Renting from government Free RDP house Used government housing subsidy and own contribution Transfer of title deed of existing government house Rent free Occupation of vacant dwelling Other
7	Does the owner of this dwelling have the title deed?	1 0	Yes No
8	Have you made any changes or improvements to the house / land since you moved in? (e.g. built additional structure, painted, built or added to main structure etc.)		Open ended
9	Has being in this home allowed you (or a household member) to get some income or run a business?	1 0	Yes (specify) No
10	In what year did you move to this place?		Year (2000-2018)
11	Tell me about how you came to be here (who applied for the house, when, how long did it take to get the house; is that person still living at the dwelling? Do you feel that life is better or worse living here?)		Open ended

12	Where did you live most recently before coming to live here?	1 2 3 4 5 6 7 8 9 10	Eastern Cape Free State KwaZulu Natal Limpopo Mpumalanga Northern Cape North West Western Cape Country outside South Africa Gauteng (Specify)
13	What type of dwelling were you living in before this one you currently live in?	1 2 3 4 5 6 7 8 9 10 11 12 13 14	House, brick or concrete structure on a separate stand Traditional dwelling, hut or structure made of traditional materials Flat or apartment in a block of flats Cluster house in a complex Townhouse (semi-detached house in a complex) Semi-detached house not in a complex House, flat or room separate from main dwelling in backyard Informal dwelling or shack in backyard Informal dwelling NOT in backyard, e.g. in informal squatter settlement or on a farm Room or flat which is part of main dwelling or property Caravan or tent Unit in a retirement home or barracks etc. Hostel Other
14	What is the most important reason why you live in this area?		Open ended
	How do you feel about life in this area compared to where you were before?		Open ended
15	How satisfied are you with the area or neighbourhood where you live now?	1 2 3 4 5	Very satisfied Satisfied Neither satisfied nor dissatisfied Dissatisfied Very dissatisfied
16	Did you or someone in your household take part in (or know of) any meetings to discuss and plan this housing development?	1 0	Yes (specify) No
17	What do you think of government's plans for this area?		Open ended

	Water		
18	What water sources does this household have access to?	1 2 3 4 5 6 7 8 9 10 11 12 13 14	Piped - in dwelling with no meter Piped - in dwelling with prepaid meter Piped - in dwelling with standard meter Piped - yard tap with no meter Piped - yard tap with prepaid meter Piped - yard tap with meter Street taps or stand pipes, free water Street taps or stand pipes, paid for Borehole or well Rainwater tank (e.g. JoJo tank) Flowing river or stream Dam, pool or standing water Water tanker or truck Other
19	How many buckets of water does this household use on average per day?		*numbers
20	How much does your household spend on water per month?	1 2 3 4 5 6 7 8 9	R0 R1 - R50 R51 - R100 R101 - R250 R251 - R500 R501 - R1 000 R1 001 - R2 000 R2 001 or more Don't know
21	Would you say the water you receive is always clean, usually, sometimes, hardly ever, never?	1 2 3 4 5	Always Usually Sometimes Hardly ever Never
22	Do you get a bill from the municipality for rates, water, rubbish removal?	1 0	Yes No
23	In the past year, how often, if ever, did you experience water interruptions?	1 2 3 4 5	Every week A couple of times a month Once a month A couple of times a year Never

24	What was the main source of water in your previous dwelling, before you came to live here?	1 2 3 4 5 6 7 8 9 10 11 12 13 14	Piped - in dwelling with no meter Piped - in dwelling with prepaid meter Piped - in dwelling with standard meter Piped - yard tap with no meter Piped - yard tap with prepaid meter Piped - yard tap with meter Street taps or stand pipes, free water Street taps or stand pipes, paid for Borehole or well Rainwater tank (e.g. JoJo tank) Flowing river or stream Dam, pool or standing water Water tanker or truck Other
	Waste		
26	What type of toilet facility is available to this household? *DC: If multiple toilet types available, select the main one*	1 2 3 4 5 6 7 8 9 10	Flush toilet connected to sewage system - full waterborne Flush toilet with septic tank Chemical toilet Ventilated improved pit latrine Basic Pit latrine - pit toilet without ventilation Bucket toilet Neighbour's toilet Communal toilet No access to toilet Other
27	What type of toilet facility did you have access to in your previous dwelling before you came to live here?	1 2 3 4 5 6 7 8 9 10	Flush toilet connected to sewage system - full waterborne Flush toilet with septic tank Chemical toilet Ventilated improved pit latrine Basic Pit latrine - pit toilet without ventilation Bucket toilet Neighbour's toilet Communal toilet No access to toilet Other
28	How is the refuse or rubbish of this household disposed of? **Do NOT read out the options** *DC: Select main option if there are multiple*	1 2 3 4 5 6 7 8 9	Refuse removed from the house at least once a week Refuse removed from the house less often Placed on communal refuse dump Placed on own refuse dump Burnt in pit Buried Thrown in the street or veldt No refuse removal service at all Other

29	Thinking about the large rubbish bags often used for household rubbish, how many bags of rubbish does your household throw away each week? *Excluding garden waste such as cut grass and waste you separate out for recycling.*		*numbers
30	Does this household recycle any of its own household waste? *This includes paper, glass, tin, plastic etc., but not food waste*	1 0 2	Yes No Don't know
31	How many large rubbish bags of recycling (all types) does this household produce each week?		*numbers
32	How many bags of food waste does this household produce each week? [Shopping bag?]		*numbers
	Electricity		
33	What type of electricity supply, if any, does this household have? READ OUT	1 2 3 4 5 6 7 8 9 10	Electricity with prepaid card Electricity with smart meter Electricity with conventional meter Other electricity supply: Solar or wind generators Other electricity supply: petrol or diesel generators Connection from neighbour's house Car battery Connection from elsewhere Do not know None
34	What energy source is MOST used for lighting in your household?	1 2 3 4 5 6 7	Electricity Gas or LPG Paraffin Wood Candles Solar Energy Other
35	What energy source is MOST used for cooking in your household?	1 2 3 4 5 6 7	Electricity Gas or LPG Paraffin Wood Candles Solar Energy Other
36	How many months of the year to you use an appliance for cooling your dwelling?		*numbers
37	How many months of the year to you use an appliance for heating your dwelling?		*numbers

38	What type of hot water geyser do you have	1 2 3 4	Electric geyser Solar geyser Heat pump Gas geyser
39	In the past year, how often, if ever, did you experience electricity interruptions?	1 2 3 4 5	Every week A couple of times a month Once a month A couple of times a year Never
40	How much does this household spend on electricity per month? **Do not ask for people who selected 'None' in Q33**	1 2 3 4 5 6 7 8 9 10	R0 R1 - R50 R51 - R100 R101 - R250 R251 - R500 R501 - R1 000 R1 001 - R2 000 R2 001 or more Don't know Not applicable
41	What was the main electricity connection at your previous dwelling, before you came to live here?	1 2 3 4 5 6 7 8 9 10	Electricity with prepaid card Electricity with smart meter Electricity with conventional meter Other electricity supply: Solar or wind generators Other electricity supply: petrol or diesel generators Connection from neighbour's house Car battery Connection from elsewhere Do not know None
42	On average how many litres of kerosene/paraffin does your household use per month?	1 2 3 4 5 6 7 8	None Less than 1 1-2 3-4 5-9 10-14 15-19 20+
43	On average how many candles does your household use per month?	1 2 3 4 5 6 7 8	None Less than 1 1-2 3-4 5-9 10-14 15-19 20+
44	Does your household have solar PV panels?	1 0	Yes No

	Access and transport		
45	Now, let's talk about transport Think about the trip that you make most often, from this dwelling, that involves walking or cycling or other mode of transport such as a taxi, car or train. What is the purpose of this trip that you make most often? **Coding note: Multiple mention**	1 2 3 4 5 6 7	To go to work To look for work (respondent is unemployed and travels looking for work) To go to the place where I study (school, college, university) Shopping Taking children to school To go to a place of leisure or entertainment Other purpose
46	I'm going to ask you some more questions about the trip you make most often, if you mentioned more than one purpose, which would you like to talk about?	1 2 3 4 5 6 7	To go to work To look for work (respondent is unemployed and travels looking for work) To go to the place where I study (school, college, university) Shopping Taking children to school To go to a place of leisure or entertainment Other purpose
47	Thinking still about the trip that you make MOST often, what time do you usually leave home for this trip?		24h clock
48	Can you describe this trip for me? (please include each step in the trip from the moment you leave home to when you get to your destination)		open end
49	How long after leaving home, does it take you to reach your destination?	1 2 3 4 5 6	Up to 15 minutes From 16 minutes to 30 minutes From 31 minutes to 45 minutes From 46 minutes to 60 minutes (1 hour) From 61 minutes to 90 minutes (1.5 hour) More
50	Think about the types of transport you use when you make this trip. What are all the different types of transport you use to make this trip? **Do NOT read out** *DC: Please prompt the respondent about walking if they do not mention this* **Coding note: Multiple mention**	1 2 3 4 5 6 7 8 9 10 11 12 13 14	Walk Bicycle Motorbike Car as driver Car as passenger Car as passenger though a lift club Minibus Taxi Train Gautrain ReaVaya or A re yeng bus (BRT/TRT) Other bus (e.g. Metrobus, Putco, City of Tshwane, Gautrain bus) School bus Other taxi (e.g. metered taxi, Uber, Taxify) Other type transport

51	Thinking about the LONGEST distance travelled as part of your trip, what type of transport do you use for this part of this trip? **Coding note: Only ask if more than one option selected in previous question; Choose 1 Option only; limited to those selected in previous question**	1 2 3 4 5 6 7 8 9 10 11 12 13 14	Walk Bicycle Motorbike Car as driver Car as passenger Car as passenger though a lift club Minibus Taxi Train Gautrain ReaVaya or A re yeng bus (BRT/TRT) Other bus (e.g. Metrobus, Putco, City of Tshwane, Gautrain bus) School bus Other taxi (e.g. metered taxi, Uber, Taxify) Other type transport
52	Approximately how much do you personally spend in total every month on transport? *DC: Cue card is available*	1 2 3 4 5 6 7 8 9	R0 R1 - R50 R51 - R100 R101 - R250 R251 - R500 R501 - R1 000 R1 001 - R2 000 R2 001 or more Don't know
53	How far a walk is the closest access point to public transport from your house? (i.e. taxi route, bus stop, train station) **Do NOT read out**	1 2 3 4 5 6	Up to 10 minutes From 11 to 20 minutes From 21 to 30 minutes From 31 to 40 minutes More than 40 minutes Don't know
54	How easy or hard is it for you to access the things you need from this area where you live? (e.g. job opportunities, services, shops)	1 2 3 4 5	Very easy Easy Neither easy nor hard Hard Very hard
55	How easy or hard is it for people to find jobs from this area?	1 2 3 4 5	Very easy Easy Neither easy nor hard Hard Very hard

	Household assets etc.		
56	How many, if any, of the following does this household have that are in good working order, that is not broken? **READ OUT** **Coding note: Yes/No list**	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	Landline Telephone Cell phone Television Satellite TV Personal computer, laptop or tablet Radio, cd player or music system Car Bicycle Electric Heater Gas Heater Fridge Washing Machine Microwave Water Kettle Electric Stove Gas stove Other (specify)
57	How many shopping bags of food does this household use per week?	1 2 3 4 5	0-5 6-10 11-15 16-20 20+
58	How much does this household spend in total on food per month? *DC: Cue card is available*	1 2 3 4 5	R0 - R500 R501 - R1 000 R1 001 - R2 000 R2 001 - R4 000 R4 001 +
59	Do you grow food or vegetables for your household to eat, sell, or not at all?	1 2 3 4	To eat To sell To eat and sell Do not grow any
	Business and work		
60	Have you ever tried to start a business?	1 0	Yes No
61	What does/did your business do? (both current and past businesses)		Open end
62	What has happened with this business? READ out	1 2 3 4	I started a business but it failed My business was a success and I sold it My business was a success but I stopped running it I am currently running my own business

63	Does your business employ any people besides yourself?	1 2 3 4 5 6 7 8	No, it's just me 1 2-5 6-10 11-49 50-99 100-199 200+
64	Now I'm going to ask you about activity or things you do to bring money into your household. In the past 7 days, did you do anything for which you got paid or expected to be paid (even if just for one hour)? This could include car washing or piece work or selling things, formal job work, ran your business). *DC: If respondent is employed, but has been on leave for the past 7 days, the answer to this question should still be 'yes'.*	1 0	Yes (Skip to Q72) No
65	Have you been appointed to a new job, but have not started yet?	1 0	Yes *(Skip to Q72)* No
66	Are you unemployed and looking for work?	1 0	Yes *(Skip to Q68)* No
67	Why are you not looking for work? **Do NOT read out**	1 2 3 4 5 6 7 8	I have given up looking for a job Do not need to work Do not want to work Disabled Housewife or homemaker Looking after family members for no pay School pupil or full time student Retired person or pensioner
68	During the past 7 days, have you taken any action to look for any kind of work?	1 0	Yes *(Skip to Q70)* No
69	During the past 4 weeks, have you taken any action to look for any kind of work?	1 0	Yes No
70	Would you be able to take up work if offered? **READ OUT**	1 2 3 4	Yes, immediately Yes, within 2 weeks Yes, but more than 2 weeks from now No

71	How long have you been unemployed for?	1 2 3 4 5 6	Less than 6 months *(Skip to Q75)* Six months to less than 1 year *(Skip to Q75)* One year to less than 2 years *(Skip to Q75)* Two years to less than 4 years *(Skip to Q75)* Four years or more *(Skip to Q75)* Never been employed *(Skip to Q75)*
72	How are you employed? *DC: If asked, say informal sector means not registered for VAT or Tax, and typically less than 5 employees*	1 2 3 4 5 6	Employed full time, formal sector Employed part time, formal sector Employed full time, informal sector Employed part time, informal sector Self-employed, own business, NOT working from home Self-employed, own business, working from home
73	What work do you do?		Open ended
74	How do you get to work?		Open ended
75	How did you find your last job? **Do NOT read out**	1 2 3 4 5 6 7 8 9 10 11	Employer directly Recruitment agency Labour broker I placed an advert Friend/family within household Friend/family outside household Responded to internet ad / listing Responded to newspaper ad Responded to pamphlet / neighbourhood info wall Other I've never had a job
76	What factor is/was most important to you when you look/looked for a job? **Do NOT read out**	1 2 3 4 5 6 7 8 9	Proximity (Transport cost and time) Pay (money) Status attached to job Able to be part time Being full time Job security Benefits (medical aid, pension fund, leave) Skills development Other

	Personal		
77	We are almost at the end now. I just have a few more questions about you. What is the highest level of school education you have completed? *DC: The relevant education had to be completed.*	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	No Education Grade 0 or Grade R Grade 1 or Sub A Grade 2 or Sub B Grade 3, Std 1 Grade 4, Std 2 Grade 5, Std 3 or ABET 1 Grade 6, Std 4 or ABET 2 Grade 7, Std 5 Grade 8, Std 6, Form I or ABET 3 Grade 9, Std 7, Form II, NQF 1 or ABET 4 Grade 10, Std 8, Form III, National Trade Certificate 1 Grade 11, Std 9 or Form IV Grade 12, Std 10, Matric A certificate from a college, technikon or university A diploma from a college, technikon or university Technikon or university degree Post graduate degree - e.g. Hons, MA, PhD Unspecified
78	What is your current age?		*numbers
79	How many members of this household are under 18 years old? *Remember a household is made up of the people living in the same dwelling and usually eating together for at least 4 nights per week or more*		*numbers
80	Think about the oldest child in this household that attends primary or high school, how long does it take them to travel to school? **Do NOT read out**	1 2 3 4 5 6 7	Up to 15 minutes From 16 minutes to 30 minutes From 31 minutes to 45 minutes From 46 minutes to 60 minutes (1 hour) From 61minutes to 90 minutes (1.5 hour) More No children attending primary/high school
81	Thinking about everyone in this household, please tell me which of the following activities, if any, bring any money into this household?	1 2 3 4 5 6 7	Formal employment Informal employment Support from family or remittances Support from friends Renting out a dwelling, flat, room, garage etc Savings or returns on investments (including stokvels) Government grants
82	Where do you go to get your grant?		Open ended

	You and your household *The Total Household Monthly Income should be the sum of ALL money actually brought into the household by all household members from Salaries, Grants, Pensions and any other source of income.*		
83	Can you tell me what is the total amount of money brought into the household per month by all household members? This is after deductions such as tax, medical aid and pension contributions. **Do NOT read out** *If the respondent says "No income", ask: "Are you absolutely sure that no money comes into the household at all, whether from wages, social grants, help from friends and family or any other source? Only if the answer is "yes" then enter as "No Income" otherwise get a value.*	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	R1 - R400 R401 - R800 R801 - R1 600 R1 601 - R3 200 R3 201 - R6 400 R6 401 - R12 800 R12 801 - R19 200 R19 201 - R25 600 R25 601 - R38 400 R38 401 - R51 200 R51 201 - R76 800 R76 801 - R102 400 R102 401 - R153 000 R153 601 - R204 800 R204 801 - R500 000 More No Income Don't know Respondent refused
84	Do you have anything else you would like to tell me about your life in this area?		Open ended

Appendix 2: GCRO QoL 5 (2017-18) survey questions used in this project

Table 1: Questions in the GCRO QoL 5 (2017-18) survey that were used for this analysis

No.	Question	Response options
A3	Which type of dwelling does this household occupy?	House, brick or concrete structure on a separate stand Traditional dwelling, hut or structure made of traditional materials Flat or apartment in a block of flats Cluster house in a complex Townhouse (semi-detached house in a complex) Semi-detached house not in a complex House, flat or room separate from main dwelling in backyard Informal dwelling or shack in backyard Informal dwelling NOT in backyard, e.g. in informal squatter settlement or on a farm Room or flat which is part of main dwelling or property Caravan or tent Unit in a retirement home or barracks etc. Hostel Other
1.01.02	How many people, including you, live in this household?	Numerical
1.7	What is the main water source for this household?	Piped - in dwelling with no meter Piped - in dwelling with prepaid meter Piped - in dwelling with standard meter Piped - yard tap with no meter Piped - yard tap with prepaid meter Piped - yard tap with meter Street taps or stand pipes, free water Street taps or stand pipes, paid for Borehole or well Rainwater tank (e.g. JoJo tank) Flowing river or stream Dam, pool or standing water Water tanker or truck Other
1.14-1.16	Besides the main water source does this household also get water from the following (response for each): - Borehole or well - Water tanker or truck - Rainwater tank	Yes No

1.18	How much does your household spend on water per month?	R0 R1 - R50 R51 - R100 R101 - R250 R251 - R500 R501 - R1 000 R1 001 - R2 000 R2 001 or more Don't know
1.20	What type of toilet facility is available to this household?	"Flush toilet connected to sewage system - full waterborne Flush toilet with septic tank Chemical toilet Ventilated improved pit latrine Basic Pit latrine - pit toilet without ventilation Bucket toilet Neighbour's toilet Communal toilet No access to toilet Other"
1.21	How is the refuse or rubbish of this household disposed of?	Refuse removed from the house at least once a week Refuse removed from the house less often Placed on communal refuse dump Placed on own refuse dump Burnt in pit Buried Thrown in the street or veldt No refuse removal service at all Other
1.24	How many large rubbish bags of recycling (all types) does this household produce each week?	Numerical, allowing one decimal
1.25	What type of electricity supply, if any, does this household have?	Electricity with prepaid card Electricity with smart meter Electricity with conventional meter Other electricity supply: Solar or wind generators Other electricity supply: petrol or diesel generators Connection from neighbour's house Car battery Connection from elsewhere Do not know None
1.27	What energy source is MOST used for lighting in your household?	Electricity Gas or LPG Paraffin Wood Candles Solar Energy Other

1.28	How much does this household spend on electricity per month?	R0 R1 - R50 R51 - R100 R101 - R250 R251 - R500 R501 - R1 000 R1 001 - R2 000 R2 001 or more Don't know
1.30	Do you have a solar water geyser?	Yes No
2.12	How satisfied are you with the public schools where you live?	Very satisfied Satisfied Neither satisfied nor dissatisfied Dissatisfied Very dissatisfied There are none
2.13	How satisfied are you with the health services that government provides where you live?	Very satisfied Satisfied Neither satisfied nor dissatisfied Dissatisfied Very dissatisfied There are none
2.15	How satisfied are you with the libraries in your area?	Very satisfied Satisfied Neither satisfied nor dissatisfied Dissatisfied Very dissatisfied There are none
3.1	In which province or country were you born?	Gauteng Eastern Cape Free State KwaZulu Natal Limpopo Mpumalanga Northern Cape North West Western Cape Country outside South Africa

4.7	Which of the following can you walk to within 15 minutes of this dwelling? **Coding note: Multiple mention**	Crèche / day-care Place where I can buy uncooked food (e.g. fresh vegetables, meat etc.) Place where I can buy cooked food Hardware/building suppliers Financial services / banks Internet café Business services (printing, photocopying etc.) Bars, taverns, shebeens or liquor store Post office Park or green public space Library Sport or recreation facility None
5.1	Think about the trip that you make most often, from this dwelling, that involves walking or cycling or other mode of transport such as a taxi, car or train. What is the purpose of this trip that you make most often?	To go to work To look for work To go to the place where I study (school, college, university) Shopping Taking children to school To go to a place of leisure or entertainment Other purpose I don't make any trips
5.3	Thinking about this trip that you make MOST often, where do you usually go (in other words, what is your final destination)?	-Province -Municipality -Main place -Subplace
5.5	How long after leaving home, does it take you to reach your destination?	Up to 15 minutes From 16 minutes to 30 minutes From 31 minutes to 45 minutes From 46 minutes to 60 minutes (1 hour) From 61 minutes to 90 minutes (1.5 hour) More
5.6	Think about the type of transport you use when you make this trip. What are all the different types of transport you use to make this trip?	Walk Bicycle Motorbike Car as driver Car as passenger Car as passenger though a lift club Minibus Taxi Train Gautrain ReaVaya or A re yeng bus (BRT/TRT) Other bus (e.g. Metrobus, Putco, City of Tshwane, Gautrain bus) School bus Other taxi (e.g. metered taxi, Uber, Taxify) Animal or animal cart Other type transport

5.7	Thinking about the LONGEST distance travelled as part of your most frequent trip, what type of transport do you use for this part of this trip?	Walk Bicycle Motorbike Car as driver Car as passenger Car as passenger though a lift club Minibus Taxi Train Gautrain ReaVaya or A re yeng bus (BRT/TRT) Other bus (e.g. Metrobus, Putco, City of Tshwane, Gautrain bus) School bus Other taxi (e.g. metered taxi, Uber, Taxify) Animal or animal cart Other type transport
5.15	Approximately how much do you personally spend in total every month on transport?	R0 R1 - R50 R51 - R100 R101 - R250 R251 - R500 R501 - R1 000 R1 001 - R2 000 R2 001 or more Don't know
5.18	How far a walk is the closest access point to public transport from your house? (i.e. taxi route, bus stop, train station)	Up to 10 minutes From 11 to 20 minutes From 21 to 30 minutes From 31 to 40 minutes More than 40 minutes Don't know
7.7	Do you grow food or vegetables for your household to eat, sell, or not at all?	"To eat To sell To eat and sell Do not grow any"
7.8	How much does this household spend in total on food per month?	R0 - R500 R501 - R1 000 R1 001 - R2 000 R2 001 - R4 000 R4 001 +
10.6	Can you tell me how satisfied or dissatisfied you are with your standard of living	Very satisfied Satisfied Neither satisfied nor dissatisfied Dissatisfied Very dissatisfied

11.12	In the past 7 days, did you do any type of work, business, or activity for which you got paid or expected to be paid (even if just for one hour)? This could include car washing or piece work or selling things and so on.	Yes (Skip to 11.20) No
11.13	Have you been appointed to a new job, but have not started yet?	Yes (Skip to 11.20) No
11.14	Are you unemployed and looking for work?	Yes (Skip to 11.16) No
11.15	Why are you not looking for work?	I have given up looking for a job Do not need to work Do not want to work Disabled Housewife or homemaker Looking after family members for no pay School pupil or full time student Retired person or pensioner
15.1	What is the highest level of school education you have completed?	No Education Grade 0 or Grade R Grade 1 or Sub A Grade 2 or Sub B Grade 3, Std 1 Grade 4, Std 2 Grade 5, Std 3 or ABET 1 Grade 6, Std 4 or ABET 2 Grade 7, Std 5 Grade 8, Std 6, Form I or ABET 3 Grade 9, Std 7, Form II, NQF 1 or ABET 4 Grade 10, Std 8, Form III, National Trade Certificate 1 Grade 11, Std 9 or Form IV Grade 12, Std 10, Matric A certificate from a college, technikon or university A diploma from a college, technikon or university Technikon or university degree Post graduate degree - e.g. Hons, MA, PhD Unspecified
15.10	Think about the oldest child in this household that attends primary or high school, how long does it take them to travel to school?	Up to 15 minutes From 16 minutes to 30 minutes From 31 minutes to 45 minutes From 46 minutes to 60 minutes (1 hour) From 61minutes to 90 minutes (1.5 hour) More No children attending primary/high school

15.12	Does anybody in this household receive a social grant of any type, such as an old age pension, child care or disability grant?	"Yes No"
15.14-15.19	Thinking about everyone in this household please tell me which of the following activities, if any, bring any money into this household? - Formal employment - Informal employment - Support from family or remittances - Support from friends - Renting out a dwelling, flat, room, garage etc. - Savings or returns on investments (including stokvels)	Yes No
15.20	What is the total amount of money brought into the household per month by all household members? This is after deductions such as tax, medical aid and pension contributions.	R1 - R400 R401 - R800 R801 - R1 600 R1 601 - R3 200 R3 201 - R6 400 R6 401 - R12 800 R12 801 - R19 200 R19 201 - R25 600 R25 601 - R38 400 R38 401 - R51 200 R51 201 - R76 800 R76 801 - R102 400 R102 401 - R153 000 R153 601 - R204 800 R204 801 - R500 000 More No Income Respondent refused

Appendix 3: Ethics clearance certificate

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

Faculty of Science
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E-mail: Rachel.Wynberg@uct.ac.za

29 August 2018

Ms Christina Culwick
Department of Environmental & Geographical Sciences

RE: ***Deconstructing sustainability and justice in low-income housing: Knowledge, power and competing rationalities in Gauteng***

Dear Ms Christina Culwick

I am pleased to inform you that the Faculty of Science Research Ethics Committee has approved the above-named application for research ethics clearance, subject to the conditions listed below.

- Implement the measures described in your application to ensure that the process of your research is ethically sound; and
- Uphold ethical principles throughout all stages of the research, responding appropriately to unanticipated issues: please contact me if you need advice on ethical issues that arise.

Your approval code is: **FSREC 65 - 2018**

I wish you success in your research.

Yours sincerely

Rachel Wynberg

A/Prof Rachel Wynberg
Chair: Faculty of Science Research Ethics Committee

Cc: Dr Zarina Patel (Supervisor)

Appendix 4: Participant information sheet

DEPARTMENT OF ENVIRONMENTAL AND GEOGRAPHICAL SCIENCES

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PRIVATE BAG X3
RONDEBOSCH 7701
SOUTH AFRICA

RESEARCHER: Christina Culwick
TELEPHONE: +27-21-650 2873
E-MAIL: CLWCHR001@uct.ac.za
URL: www.egs.uct.ac.za/

PhD research information sheet

Project Title: Social justice and environmental sustainability: A case study of low-income housing developments in Johannesburg

Project summary: The objective of this research is to understand the implications of low-income housing developments on social justice and environmental sustainability goals, and how knowledge and decision-making influence these outcomes. The objective will be explored through two low-income housing developments in Johannesburg, Pennyville and Lufhereng.

The following questions will guide the research:

1. How have social justice and environmental sustainability been conceptualised and operationalised in the two low-income housing projects?
2. To what extent do different approaches to urban metabolism allow for an understanding of the role of knowledge in the decision-making processes in each of the low-income housing developments?
3. What are the social justice and environmental sustainability implications of two low-income housing projects?

This research will draw on two sets of interviews, which will explore the decision-making processes regarding low-income housing projects in Johannesburg, and the resource consumption patterns and lived experiences of people in Pennyville and Lufhereng.

Intended benefits of the project: This research responds to need for enhanced understanding of the trade-offs between justice and sustainability imperatives evident in Gauteng debates around low-income housing. The research outcomes will be useful for future urban planning and decision-making. The academic contribution of this research will be in the transdisciplinary methodology used to build an understanding of how decisions are made in the face of competing rationalities, what role knowledge plays in influencing decision-making processes, and ultimately how these provide insight into the boundary space between social justice and environmental sustainability.

Researcher bio: Christina Culwick is a PhD student in UCT's Department of Geography and Environmental Sciences. Her research interests lie in areas of urban environmental sustainability, and social justice. She is particularly interested in the role of research in planning and decision-making in cities. Christina works as a researcher at the Gauteng City-Region Observatory (GCRO) – a research institute that conducts research that is relevant for government planning in Gauteng. Christina was born and grew up in Johannesburg, where she now lives with her husband.

Contact details: 083 458 3543 | CLWCHR001@uct.ac.za

Appendix 5: Participant consent forms

Resident consent form

DEPARTMENT OF ENVIRONMENTAL AND GEOGRAPHICAL SCIENCES

UNIVERSITY OF CAPE TOWN
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RESEARCHER: Christina Culwick
TELEPHONE: +27-21-650 2873
E-MAIL: CLWCHR001@uct.ac.za
URL: www.egs.uct.ac.za/

Informed Voluntary Consent to Participate in Research Study

Project Title: Household resource consumption and travel patterns in Pennyville & Lufhereng

Invitation to participate, and benefits: You are invited to participate in a research study conducted with heads of households in Pennyville and Lufhereng. The study aim is to develop an understanding of households in these areas, how they use resources such as electricity, water and food, and their travel patterns. I believe that your experience would be a valuable source of information, and hope that by participating you may gain useful knowledge.

Procedures: During this study, you will be asked to answer a set of questions about your household, the resource your household uses, and explain your daily travel patterns.

Recording: I may take photographs or record audio as part of the study. If you object to this, please indicate this below.

Risks: There are no potentially harmful risks related to your participation in this study.

Disclaimer/Withdrawal: Your participation is completely voluntary; you may refuse to participate, and you may withdraw at any time without having to state a reason and without any prejudice or penalty against you. Should you choose to withdraw, the researcher commits not to use any of the information you have provided without your signed consent. Note that the researcher may also withdraw you from the study at any time.

Confidentiality: All information collected in this study will be kept private in that you will not be identified by name or by affiliation to an institution. Confidentiality and anonymity will be maintained as pseudonyms will be used.

What signing this form means: By signing this consent form, you agree to participate in this research study. The aim, procedures to be used, as well as the potential risks and benefits of your participation have been explained verbally to you in detail, using this form. Refusal to participate in or withdrawal from this study at any time will have no effect on you in any way. You are free to contact me, to ask questions or request further information, at any time during this research.

I agree to participate in this research (tick one box) ☐ Yes ☐ No _____ (Initials)

I agree to be photographed / audio-recorded (strikethrough as applicable)

☐ Yes ☐ No _____ (Initials)

I agree to the use of properly anonymized photographs / audio recordings in websites and publications for research purposes (strikethrough as applicable)

☐ Yes ☐ No _____ (Initials)

Name of Participant	Signature of Participant	Date
Name of Researcher	Signature of Researcher	Date

Key informant consent form

DEPARTMENT OF ENVIRONMENTAL AND GEOGRAPHICAL SCIENCES

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Informed Voluntary Consent to Participate in Research Study

Project Title: Social justice and environmental sustainability: A case study of low-income housing developments in Johannesburg

Invitation to participate, and benefits: You are invited to participate in a research study conducted with decision-makers around low-income housing developments in Johannesburg. The study aim is to develop an understanding of the decision-making processes around low-income housing developments in Johannesburg, with a particular focus on Pennyville and Lufhereng. I believe that your experience would be a valuable source of information, and hope that by participating you may gain useful knowledge.

Procedures: During this study, you will be asked to answer some questions around how decisions were made, by whom and towards what objectives in Pennyville and/or Lufhereng developments.

Recording: I may record audio as part of the study. If you object to this, please indicate this below.

Risks: There are no potentially harmful risks related to your participation in this study.

Disclaimer/Withdrawal: Your participation is completely voluntary; you may refuse to participate, and you may withdraw at any time without having to state a reason and without any prejudice or penalty against you. Should you choose to withdraw, the researcher commits not to use any of the information you have provided without your signed consent. Note that the researcher may also withdraw you from the study at any time.

Confidentiality: All information collected in this study will be kept private in that you will not be identified by name or by affiliation to an institution. Confidentiality and anonymity will be maintained as pseudonyms will be used.

What signing this form means:

By signing this consent form, you agree to participate in this research study. The aim, procedures to be used, as well as the potential risks and benefits of your participation have been explained verbally to you in detail, using this form. Refusal to participate in or withdrawal from this study at any time will have no effect on you in any way. You are free to contact me, to ask questions or request further information, at any time during this research.

I agree to participate in this research (tick one box) ☐ Yes ☐ No _____ (Initials)

I agree to be audio-recorded ☐ Yes ☐ No _____ (Initials)

_____	_____	_____
Name of Participant	Signature of Participant	Date
_____	_____	_____
Name of Researcher	Signature of Researcher	Date

Appendix 6: Key informant interviews conducted

No.	Job title	Organisation/directorate/department/unit	Date	Duration	Interview details
1	Director	Urban Dynamics Gauteng Inc.	30/05/2019	0h 58min	SS / R&FT
2	Principal architect	26'10 South Architects	04/06/2019	1h 15min	SS / R&FT
3	Project manager	Housing Department, City of Johannesburg	06/06/2019	1h 47min	SS / R&FT
4	Project Manager	Urban Dynamics Gauteng Inc.	20/06/2019	2h 13min	SS / R&FT
5	CEO	Urban-Econ – Development Economists	26/06/2019	0h 55min	SS / N
6	Development Economist	Urban-Econ – Development Economists	26/06/2019	0h 55min	SS / N
7	Manager: Economic Planning Unit	Urban-Econ – Development Economists	26/06/2019	h 55min	SS / N
8	Assistant-Director	Development Planning and Facilitation, City of Johannesburg	09/07/2019	1h 10min	SS / R&FT
9	Specialist town planner	Land Use Management, City of Johannesburg	19/07/2019	0h 58min	SS / R&FT
10	Specialist town planner	Land Use Management, City of Johannesburg	19/07/2019	0h 58min	SS / R&FT
11	Chief Risk Officer	Bigen	23/07/2019	2h 7min	SS / R&FT
12	Business Unit Manager	Bigen	23/07/2019	2h 7min	SS / R&FT
13	Strategic Urban Planner	City Transformation and Spatial planning, City of Johannesburg	31/07/2019	0h 54min	SS / R&FT
14	Strategic Urban Planner	City Transformation and Spatial planning, City of Johannesburg	31/07/2019	0h 54min	SS / R&FT
15	Assistant Director	Land Use Management, City of Johannesburg	26/08/2019	1h 00min	SS / R&FT
16	Ex-CEO	Calgro-M3 group	09/10/2019	1h 10min	SS / R&FT

Key for interview details

Interview style: SS = semi-structured **Recording method:** R&FT = recorded and fully transcribed N = noted

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