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Linking Rooftop Farms, Urban Regeneration and Sustainable Housing in Berea, Johannesburg:

The case of the Urban Agriculture Initiative at Coronia Gardens

A Research Report submitted to the School of Architecture and Planning in partial fulfilment of the requirements for the degree:
Master of Urban Studies in Housing and Human Settlements (MUS HHS)

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University of the Witwatersrand
Johannesburg, 4 November 2022

Declaration

I declare that this research report is my own unaided work. It is being submitted for the degree of Master of Urban Studies in Housing and Human Settlements to the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.



Yasmin Shapurjee

4 November 2022

Abstract

Rooftop farms serve multiple functions in cities and are increasingly acknowledged as potential drivers for sustainable development. This research explores the relationships between rooftop farms, urban regeneration and sustainable housing in Berea, Johannesburg, using a qualitative case study of the Urban Agriculture Initiative rooftop farm at Coronia Gardens. In-depth interviews were conducted with a sample of project partners, urban farmers and residents. Findings indicate how rooftop farming aligns with certain urban regeneration goals, providing benefits including employment creation, skills development, land use efficiency, and social capital for farmers. However, resident benefits have not been realised. Challenges include limited involvement and engagement in the rooftop farm, low awareness levels, a lack of food crop diversity, and a disconnect between rooftop farms and ground-level activities. Greater integration between various inner-city urban agriculture projects is recommended, along with strategies to include rooftop farms in existing and planned affordable inner-city housing developments across Johannesburg.

Key words: Rooftop farm, urban agriculture, urban regeneration, sustainable housing, Johannesburg, inner city, Berea

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List of Acronyms and Abbreviations

BIA – Building-Integrated Agriculture

CBD – Central Business District

CoJ – City of Johannesburg

COVID-19 – Coronavirus

FAO – Food and Agricultural Organisation

GCR – Gauteng City-Region

GCRO – Gauteng City-Region Observatory

GDS – Growth and Development Strategy

JICP – Johannesburg Inner City Partnership

JPOMA – Johannesburg Property Owners Management Association

RA – Rooftop Agriculture

SACN – South African Cities Network

SD – Sustainable Development

SDF – Spatial Development Framework

SDG – Sustainable Development Goal

StatsSA – Statistics South Africa

UA – Urban Agriculture

UAI – Urban Agriculture Initiative

UHI – Urban Heat Island

UN – United Nations

UN-HABITAT – United Nations Centre for Human Settlements

UR – Urban Regeneration

WCED – World Commission on Economic Development

ZFarming – Zero-Acreage Farming

1. CHAPTER ONE: INTRODUCTION

> 'As urbanising cities face the double threats of urban food insecurity and land scarcity, multi-functional urban land uses that integrate rather than separate agriculture from other land uses could be a critical adaptation for the sustainability of future cities.'
>
> (Diehl, Sweeney, Wong *et al*. 2020: 1)

1.1. Introduction

Urban agriculture (UA) plays an important role in cities of the twenty-first century, but its presence is not new within cities. UA takes many forms and operates at different scales ranging from commercial urban farms; community farms; backyard gardens; school vegetable gardens; vertical farms[1]; rooftop gardens; and rooftop farms. In recent years, rooftop farming, a method of growing food crops on top of buildings, has garnered worldwide attention alongside research interest due to its potential to support sustainable development objectives (see Specht, Freisinger, Opitz, *et al*. 2014; Azunre, Amponash and Peprah *et al*. 2019; Mancebo, 2019). By '[g]rowing food crops on buildings [rooftop farms] could reduce our environmental footprint, cut transportation costs, enhance food security[2], save energy within the building envelope, and enrich the physical and psychological comfort of building occupants and city dwellers.' (Puri and Caplow, 2010:230). Such a range of outcomes reflects the multifunctional role of rooftop farming (see for example Lovell, 2010; Pillay, 2017; Chandia, 2020; Harada and Whitlow, 2020).

[1] Vertical farms are multiple-storey indoor greenhouses, using highly advanced farming methods and technologies to grow food in cities. (See Despommier, 2010).

[2] Food security refers to the state 'when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'. (World Food Summit, 1996: unpaginated)

Green spaces within cities have historically given way to other land use functions, specifically housing, commercial and retail activities due to the benefits associated with proximity to jobs, services and amenities in core urban areas, alongside higher land values. Introducing UA within inner-city areas allows for a re-integration of green spaces in cities in addition to supporting local food production and distribution (Santo, Palmer and Kim, 2016). For many city governments committed to climate change mitigation and adaptation, UA could represent a positive contribution to strategic and more sustainable urban planning (Mancebo, 2019). For instance, the Milan Urban Food Policy Pact (see https://www.milanurbanfoodpolicypact.org/) commits to strengthening sustainable food systems and promoting knowledge exchange and learning among member cities of its global network.

Generally, urban farming projects have tended to focus on direct, tangible outcomes such as economic development indicators, thereby overlooking other indirect benefits. Poulsen, Neff and Winch (2017) reveal how urban farms in Baltimore, Maryland are, beyond employment creation and local food supply, enhancing social connectedness and community cohesion, reviving degraded spaces, improving neighbourhood reputation, and providing opportunities for education and youth development. These 'diverse functions of urban farms… serve to improve, and potentially revitalise neighbourhoods.' (Poulsen *et al*. 2017:1425). In a South African context, there is limited research into the impacts of urban farming on residential communities, especially the potential impacts of rooftop farming that are integrated with residential land uses. My research aims to fill this gap in the local literature by exploring the relationship between rooftop farms, urban regeneration and sustainable housing at a micro-scale – at a building level – at Coronia Gardens in Berea, a high-density residential building in inner-city Johannesburg. Using a qualitative research approach and methods, I reflect on the case of the Urban Agriculture Initiative (UAI): a non-profit UA organisation working to transform the inner city through rooftop farming projects.

1.2. Background

Arguments for UA relate to its potential to enhance *food security* by increasing local city food supply and sustainable access to food by farmers and residents (see for example Poulsen, McNab, Clayton *et al*. 2015). However, Hamilton, Burry, Mok *et al.* (2013) note the limited ability of UA to address food insecurity and poverty at scale, especially in developing countries. Therefore, UA should not be viewed as a widespread solution to meeting urban food demands but rather as one component of a larger, more self-reliant urban food economy. Based on these limitations, and in a South African context, Battersby, Haysom, Kroll *et al*. (2015) advocate greater policy support at a national, provincial and local scale and targeted local project implementation strategies to address the multiple dimensions of urban food insecurity.

Another theme in UA literature is its *economic development* outcomes. Community gardens and urban farms in various cities in the United States have been shown to generate employment, improve capital investment and revitalise previously blighted inner-city neighbourhoods, where buildings were once derelict, oftentimes unsafe and underutilised (Vitiello and Wolf-Powers, 2014). In cities of the global South, UA provides a means for gainful employment and has been shown to strengthen the social and economic livelihoods of community farmers (see Battersby and Marshak, 2013; Hamilton *et al*. 2013; World Bank, 2013; Malan, 2015; Bisaga, Parikh and Loggta, 2019; Olivier, 2019).

Adding to the economic outcomes are the related *social outcomes* of UA. Different forms of UA comprise much more than spaces in which food crops are grown. They are sites of social engagement, education, skills development, and places of reprieve (Santo *et al*. 2016). Urban farms, including community gardens, play a beneficial role in enhancing both the physical health of farmers as well as their mental health, with these health benefits in some cases extending to residents who engage with various UA typologies (*ibid*). Despite UA's social benefits, there are potential risks and threats related to UA. For example, gentrification can threaten the viability of UA projects due to competing demands for higher-value land related

to rising inner-city property prices (*ibid*). This process, especially if not managed by appropriate municipal policy and planning regulations, could ultimately displace poorer inner-city populations. Additionally, UA is not automatically equated with greater sustainability when compared to conventional farming in peri-urban and rural areas (Azunre *et al*. 2020). Important aspects that still need to be addressed in the global South are greater resource efficiency in terms of recycling and re-using farming inputs, as well as alternative forms of power generation across UA sites (*ibid*), both aspects that are relevant to UA that is embedded into buildings as is the case with rooftop farms.

UA has demonstrated positive *environmental* and *ecological outcomes* mostly in high-income countries. In a study focusing on rooftop farming in Bologna Italy, Orsini, Gasperi, Marchetti *et al*. (2014) argue that rooftop farms, alongside their contribution to increasing food and nutrition security, are also capable of supporting environmental and ecological goals. For example, rooftop farms, especially those using soilless systems such as hydroponic farms, an intensive farming method that grows crops using recycled nutrient-rich water, can potentially strengthen urban green infrastructure[3] networks within cities, provide a range of ecosystems services such as carbon sequestering and reducing the urban heat island (UHI) effect, and biodiversity improvements (*ibid*). Hydroponic farming uses up to 95% less water than conventional farming occurring in the hinterlands and peri-urban areas (Buehler and Junge, 2016), and therefore is a popular and attractive farming method that might support greater sustainability in both farming design and farming outputs.

In Johannesburg, UA projects are spatially dispersed with only a few established community gardens in the metropolis. Examples of noteworthy UA projects within the inner city include

[3] Green infrastructure refers is defined as 'any vegetative infrastructure system which enhances the natural environment through direct or indirect means.' (https://worldgreeninfrastructurenetwork.org/key-definition-green-infrastructure/). These include, but are not limited to, parks, open spaces, rivers, lakes, wetlands, trees, and various UA types.

the Siyakhana Initiative: a community garden in Bezuidenhout Valley, (see Nicolle, 2011); the Bertrams Inner City Farm (see Haffejee, 2021); and the community garden located at Victoria Yards in Lorentzville (see Platt, 2020). In recent years, however, there has been an increasing interest in and enthusiasm for UA, particularly, rooftop farming. The City of Johannesburg (CoJ) has actively promoted rooftop farming, arguing that this type of UA provides benefits such as enhanced food security, entrepreneurship development, and the opportunity to support inner-city households through greater food access (Burger, 2017). Presently, there are several productive rooftop gardens in Johannesburg, mostly clustered in the inner-city areas of Bertrams and Braamfontein, but also other areas such as Alexandra, Orange Farm and Riverlea (*ibid*). Whilst many of these rooftop gardens are at a pilot stage, some have progressed from community initiatives into well-functioning economic enterprises (*ibid*).

1.3. Problem statement and rationale

In South Africa, urbanisation trends and population growth, coupled with high rates of unemployment, pose significant threats to improving urban livelihoods and quality of life. The challenge of food insecurity has become more acute, due to the negative impacts of the Coronavirus (COVID-19) pandemic (Food and Agriculture Organisation (FAO), 2020). In South Africa, COVID-19 amplified inequalities across urban settlements (Turok and Visagie, 2021). Despite providing temporary welfare instruments in the form of COVID-19 R350 relief grants, the country faces widespread job losses, an economy in recession, and increased challenges relating to the food supply, food insecurity, and hunger, especially amongst the poorest population (Wills, Patel and van der Berg, 2020). One proposal to address these challenges is to support and implement more UA projects. In a recent publication by the Gauteng City-Region Observatory (GCRO), Nino, Lane, Okano, et al. (2020:8) argue that 'urban agriculture can create multifunctional green assets in the form of urban farms and food gardens… [and] [w]hen planned accordingly…can contribute to addressing a range of issues in the Gauteng City-Region (GCR)' such as job creation, poverty reduction strategies, adding

green spaces to cities, improving biodiversity, and potentially reducing the GCR carbon footprint in the long-run (*ibid*). An analysis of the local literature reveals limited research focus on rooftop gardens and, more specifically, on rooftop farms in South African cities, most likely due to their relative novelty, in a context where literature has focussed mainly on traditional urban farming configurations such as community gardens and urban farms (see Dunn, 2010; Battersby and Marshak, 2013; Olivier and Heineken, 2017, Bisaga et al. 2019; Olivier, 2019). While previous studies on rooftop gardening in Johannesburg used *technical* lenses to argue for greater support of UA in existing urban and green infrastructure planning (Ansell, 2017), there has been a limited perspective of the *relational* nature of UA and rooftop farming from an inner-city housing perspective. I have specifically chosen a rooftop farming residential case study site in Berea because I believe rooftop farms could lead to incremental neighbourhood improvements in Berea in the long term by bringing communities together, creating a greater connection to UA that supports education, awareness and knowledge-sharing.

In terms of positionality, I am a multi-passionate urban planner with interests in urban regeneration, urban economies, sustainable housing, and affordable housing more broadly. I believe that conscious urban planning that accounts for resident needs is critical to ensuring sustainable urban development and improved housing and living quality within Berea and across lower-income, high-rise residential precincts in the inner city. Due to the multiple and diverse roles that rooftop farming could play in Berea, I believe that my research can provide an integrated and layered analysis of the rooftop farming phenomenon in a specific micro-level context at the UAI Coronia Gardens rooftop farm. Thinking about how to incorporate rooftop farming into existing and future inner-city affordable housing is also significant to promote land-use efficiency, multifunctionality and more diverse urban environments, and opportunities for resident engagement in growing food and equally in UA education, awareness and acceptance.

1.4. Research objectives

The objectives of the research study are:

- To analyse the role and function of rooftop farms in urban regeneration
- To explore the social and environmental outcomes of inner-city rooftop farms
- To explore how rooftop farms are influencing inner-city residents
- To understand if and how rooftop farms can support sustainable housing development in Berea and the broader Johannesburg inner city.

1.5. Research question

What are the policy, functional, social and spatial relationships between rooftop farms, urban regeneration and sustainable housing at the UAI Coronia Gardens Rooftop Farm in Berea?

1.6. Research sub-questions

- How can the organisational role and function of the UAI support existing urban regeneration goals within Berea, and in the broader Johannesburg inner-city?
- Which specific social and environmental rooftop farming outcomes can be attributed to the Coronia Gardens Rooftop Farm?
- How is the Coronia Gardens rooftop farm influencing the building's residents and their living environments?
- How can the UAI rooftop farm case study support greater sustainable housing development in Berea and the Johannesburg inner-city?

1.7. Defining my research objects and process

In conceptualising my research, it was important to define my research objects and explain the relations between them. My first research object is rooftop farms but specifically those operated by the UAI. In my research, rooftop farms are defined as productive agricultural land uses that are integrated with high-rise buildings and are spatially located on top of flat building

roofs. The UAI rooftop farms are discussed in more depth in Chapter three. My second research object is that of the Coronia Gardens building and its high-rise, high-density residential land use function. Details of the Coronia Gardens building are provided in Chapter three. Thirdly, the Coronia Gardens Rooftop Farm is a research object that integrates the activity of rooftop farming into a residential building, thereby spatially locating the research at a site level within Berea. Lastly, the Johannesburg inner city is a research object in my study.

1.8. Expected research outcomes

I anticipated finding a beneficial relationship between UA and UR within Berea. Although the causal link between the UAI rooftop farms and UR could not be measured at this stage, I expected to note that UAI rooftop farms could complement existing and ongoing inner-city housing and development projects by supporting employment generation, providing much-needed green spaces in the inner city, and inspiring future partnership-driven UR initiatives in Johannesburg. Regarding Coronia Gardens residents, I expected to uncover benefits such as a greater connection to nature and urban green spaces, strengthening community and social ties, understanding of the importance of urban food security, and increased access to food and healthier food options, which may have led to increased household savings. Additionally, I hoped to find that the Coronia Gardens rooftop farm is making a positive contribution to the residential building itself in terms of sustainable housing functions linked to urban greening, enhanced biodiversity and efficient resource use.

1.9. Methods

According to Mohajan (2018:23) '[research must involve an explicit, disciplined, systematic (planned, ordered, and public) approach to find out the most appropriate results.' The choice of methods in the research cycle is therefore crucial and must relate to the research objectives and research question while also corresponding to the type of research approach that is adopted. Drawing from my qualitative research approach, I adopted the case study research

strategy. Yin (2003:13) explains that a ‘case study is an empirical enquiry that investigates a contemporary phenomenon when the boundaries between the phenomenon and context are not clearly evident and where multiple sources of evidence are used.’ Case studies, therefore, allow for a detailed investigation of a particular phenomenon in a real-life context (*ibid*). Orum and Feagin (1991:8) add that ‘the case study seeks to capture people as they experience their natural everyday circumstances, [offering] a researcher empirical and theoretical gains in understanding larger social complexes of action, actors and motives.’ An important aspect of case study analyses is therefore relational observations and subjective interpretation of participants’ experiences within a specific context. However, I am aware of the limitations inherent in case studies relating to the inability to generalise or transfer findings. Despite these limitations, my case study allowed me to document an in-depth analysis of the UAI and therefore could provide lessons for others. I hope that my research case is used to motivate future similar and complementary studies.

The case study method was appropriately matched to my qualitative research approach and exploratory research questions. The UAI was chosen as a relevant case study because of its linkages to broader inner-city development goals, as well as the key network of partners involved in the initiative. In terms of the specific UAI rooftop farm site, I chose Coronia Gardens in Berea based on the building’s residential land use function and its management under Jozi Housing because this specific site allowed me to deepen my understanding of the links between rooftop farming, urban regeneration and housing development. These functions, although complex, can also be complementary if planned for in an integrated and considered manner. According to Guba and Lincoln (1981), case studies can be categorised as *factual*, *interpretive* and *elaborative*. Broadly, *interpretive* case studies align with *exploratory* research, while *factual* and *elaborative* case studies align with *descriptive* case studies. In my research, my case is largely *interpretative*, as I aimed to explore and reveal new and detailed insights on the UAI and its rooftop farm in Berea. To carry out my case study, I followed the case study protocol designed by Yin (2003) that outlines the necessary steps to plan for, collect and

analyse data to ensure rigour. Through taking detailed fieldwork notes, I was able to reflect on my research methods and analysis during and after my fieldwork phase, thus enabling me to learn from earlier interviews and iteratively apply my learnings. Qualitative research methods were suited to my research topic given the exploratory nature of my research. To ensure data triangulation, I sought a multi-perspective approach when sampling my research respondents to gain a more balanced view of my case study context and what insights the case could invoke for housing and human settlement planning, research, and policy. in Johannesburg. My sample size was relatively small and consisted of ten individual respondents. Table 1.1 describes and categorises the research respondents in my study.

Table 1.1: *Research respondent categories*

Respondent Category	Description	Number
UAI Project partners	UAI project partners are identified as key stakeholders in the UAI project initiation and implementation	3
UAI Farmers	Farmers working for the UAI and who have worked in or engaged with the UAI Rooftop Farm at Coronia Gardens	2
Coronia Gardens Residents	Residents (tenants) living at Coronia Gardens in Berea	5
		TOTAL: 10

My choice of respondents relied on both purposive, convivence and snowball sampling. I chose to interview my research respondents in a particular sequence based on the strategy that gaining knowledge from UAI project partners would form a solid base to understand the nature and function of the UAI. Through establishing connections with my key informants, I was aided by being referred to two UAI urban farmers, one of whom lives and works at Coronia Gardens and who serves as the Farming Manager of the rooftop farming site. Access to residents was facilitated through the Coronia Gardens Building Manager and the UAI Farm Manager who invited residents to speak with me and who shared the relevant ethics participant information sheets that explained my research purpose, objectives and the nature

and requirements of their participation. Overall, the choice of respondents was based on my research objective to gather three different perspectives on rooftop farming in Johannesburg. The first perspective is from the UAI itself and how urban farming activities take expression in the inner city, against the backdrop of urban regeneration. The second perspective is the experiences of urban farmers working for the UAI. And the third perspective is from Coronia Gardens residents who reside in the inner city, and who relate to rooftop farms and UA in different ways. Due to the COVID-19 pandemic and the potential risks associated with collecting data in the field, all interviews were scheduled and conducted virtually, online, via the Microsoft Teams platform, and through telephonic calls with selected Coronia Gardens residents. Given situational limitations as well as the limited time in which to meet the Research Report deadline, I chose to use a smaller sample size, especially because qualitative data collection is intensive and demands detailed analysis. My interviews were structured around qualitatively designed questionnaires that I designed (See Annexure D for examples of my questionnaires per respondent category). All data were collected through semi-structured interviews with respondents. Additionally, I drew on participant observation of my respondents by analysing their body language, and their tone and noting how each respondent reacted throughout the respective interviews. Photographs of the Coronia Gardens building and the rooftop farm were facilitated through prior permission from the UAI and Jozi Housing. I have obtained permission from respective urban farmers and residents to use their respective photographs in this Research Report. After the data collection phase, I transcribed my interviews verbatim. Making sense of data requires a systematic and thorough analysis using specific techniques to categorise, classify and organise data before interpreting and analysing patterns within datasets. Vaismoradi, Jones, Turunen *et al*. (2016:101) note how 'data are not simply containers of meaning. A text may involve multiple meanings and their identification requires researchers' efforts in the process of analysis.' Therefore, I used thematic analysis specifically grounded in the process of data coding to unpack recurring themes in my data.

1.10. Challenges encountered during the study

This research was conceptualised, planned and conducted during the unprecedented COVID-19 pandemic. One of the major challenges I faced was not being able to conduct face-to-face interviews with my respondents. Nevertheless, I was able to build a rapport with my respondents by being open, engaging carefully listening to each viewpoint. I found that interviews with the UAI project partners were more easy to set up and conduct. UAI project partners spoke freely, openly and honestly and reflected a passion for the UAI. My experience in interviewing residents was much more challenging. Resident participants were quite difficult to access and approach and were most reluctant to be interviewed. I was fortunate to be previously involved with researching the UAI case study as part of the Good Hood Stories project (see https://www.sacities.net/good-hood-stories/) funded by the South African Cities Network (SACN), with research outputs produced by Our Future Cities. Working as a Researcher with Our Future Cities enabled me to make connections with UAI stakeholders and understand the organisation's background and operations. I was also privileged to have visited one of the UAI rooftop sites in New Doornfontein in April 2021 where Our Future Cities was conducting fieldwork and shooting the Good Hood Stories film for the UAI case in Johannesburg. I was therefore able to see and take photos of two of the UAI's rooftop farms and the UAI's seedling farm in Braamfontein.

1.11. Ethical considerations

All ethics protocols were meticulously followed, namely distributing participant information sheets; obtaining signed informed consent or verbal consent before interviews began; permission to audio record online interviews; the guarantee of anonymity during and after the research process including data collection, data storage, and the writing up of findings. The research carried minimal risk as the participants identified for this research did not fall into a vulnerable population category. Confidentiality was guaranteed in that any information deemed or disclosed as confidential either by the researcher or the participant remained

confidential and I did not share the audio recordings or the typed transcripts with anybody else. Anonymity was applied in my findings and analysis chapter. Whilst the anonymity of key informants cannot be guaranteed due to their potential affiliation with the UAI project, I still ensured to protect their identities by labelling these participants in the broader term of 'UAI project partner', rather than affiliate individual respondents with their respective institutions. Proof of ethics clearance, indicating the Wits Ethics protocol number associated with my research project, is attached in Annexure A of this Research Report.

1.12. Chapter outlines

Chapter 1 introduces the research, providing the context, rationale, research questions, and methods employed.

Chapter 2 provides an overview of UA and a critical discussion of key research concepts and themes regarding rooftop farming within broader UA literature. The social and environmental outcomes of rooftop farms and their potential impact on sustainable housing and Johannesburg's inner-city housing sector are discussed in the context of UR. The chapter also discusses key features of inner-city regeneration and housing development in Johannesburg. The conceptual framework is presented at the end of this chapter.

Chapter 3 contextualises the case study in Johannesburg and within the inner city suburb of Berea. The chapter then describes the UAI, its role and function in Johannesburg and presents the Coronia Gardens Rooftop Farm.

Chapter 4 presents the findings from my fieldwork, together with a critical analysis of recurring themes emanating from qualitative interviews. Key themes from Chapter 2 and Chapter 3 are brought into the discussion and analysis to build my argument.

Chapter 5 summarises and signifies my research findings, provides recommendations for future research related to my topic and reflects on the overall research process and research relevance.

Chapter 6 provides a full reference list of all literature and other data sources cited in this Research Report

Annexures are also attached at the end of the Research Report.

2. CHAPTER TWO: ROOFTOP FARMS AS POTENTIAL DRIVERS FOR URBAN REGENERATION AND SUSTAINABLE HOUSING

2.1. Introduction

The purpose of this literature review is to understand how rooftop farms fit into the greater UA system, both spatially and functionally. This chapter aims to characterise the context and scope of UA, particularly the role and function of rooftop farms in Johannesburg. The chapter starts firstly with a brief discussion on the history and evolution of UA to its current prominence in research terms. Secondly, I critically analyse key concepts. Thirdly, my analysis foregrounds the local literature by assessing rooftop farms' social and environmental outcomes in South Africa. Thereafter, I discuss inner-city regeneration in Johannesburg, reflecting on key insights related to affordable housing delivery. Lastly, and central to my research, I draw connections between rooftop farms, UR and sustainable housing.

2.2. The history and evolution of urban agriculture

Before defining UA, it is important to briefly explain its history and evolution. Fig. 2.1 outlines the history of UA, from its earliest forms to its modern-day configurations.

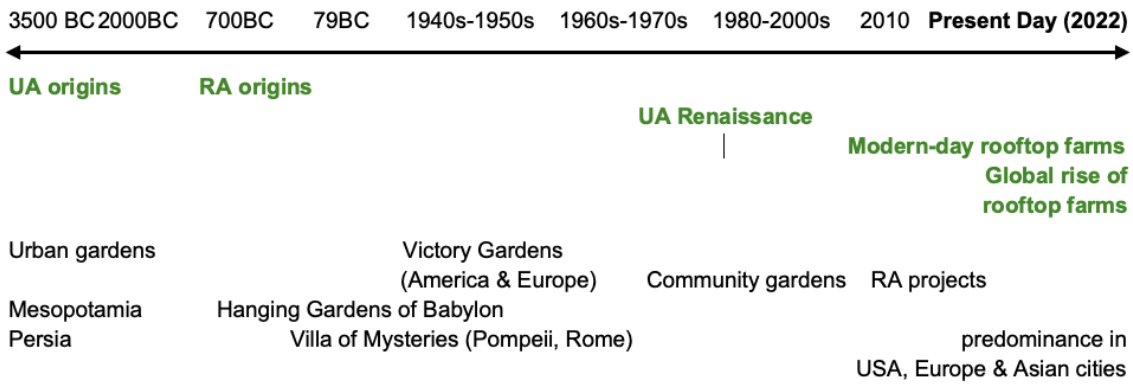


Figure 2.1: *The evolution and trajectory of UA and rooftop farming (compiled by Author, 2021, UA timeline sourced from Green 2012, Santo et al. 2016, Appolloni, Orsini, Specht et al. 2021)*

As illustrated in Fig. 2.1, various forms of urban gardens have existed in some shape or form dating back to 3500 BC, where Mesopotamian farmers distinguished separate plots on which to cultivate food within growing cities (American Society of Landscape Architects, cited in Green, 2012). 1500 years later, in Persia, archaeological evidence suggests similar practices of small-scale urban food production (*ibid*). The earliest forms of rooftop farming can be traced back to the Hanging Gardens of Babylon and the Villa of Mysteries in Pompeii, Rome (Rahman and Ahmad, 2011). Both of these gardens cultivated crops for consumption, due to advantageous geographical features. Significantly, the role played by UA's integration into cities must be acknowledged. For example, during the post-World War II period, Victory Gardens were established and popularised in the United States and Europe as a means to ration food. Victory Gardens were subsequently promoted in the post-war period of both World War I and II, viewed as signs of hope, prosperity, and patriotism, despite post-conflict challenges, including poverty and unemployment (Bischoff, 1995). The Victory Gardens gave American citizens of all socioeconomic classes, a sense of autonomy and further allowed them to connect with nature in times of hardship (*ibid*).

Of relevance to my research topic is the 'renaissance' of UA that took place in the late 20th century (the 1970s and 1980s), where UA was acknowledged as a strategy to support the local economic development of cities, while also meeting the food demands of local city inhabitants (Orsini, Pennisi, Michelon *et al*. 2020). During UA's renaissance period, cities in the United States were facing many complex challenges that included increasing rates of urbanisation, rising poverty and inequality, and economic decline brought about by the de-population of some urban centres. UA enterprises allowed for new approaches and business models to support the notion of productive cities, which previously mostly operated as consumptive systems by using labour, purchasing food from peripheries, using non-renewable resources, and not recycling waste products (Orsini *et al*. 2014).

Today, the global footprint of rooftop agriculture (RA) projects is concentrated in the global North with over 80 projects (Appolloni *et al*. 2021). This is followed by Europe (49 projects) and Asia (39 cases) (*ibid*). In the global South, rooftop farming cases are significantly lower (*ibid*). Some of the reasons for the low frequency of cases in developing cities of the Global South will be discussed in the sections below.

2.3. Defining and evaluating key concepts

2.3.1. Urban agriculture (UA)

UA is a concept with many different definitions and multiple, diverse objectives (Specht, Weith, Swoboda *et al*. 2016). The most common definition is provided by the United Nations (UN) Food and Agriculture Organisation (FAO) (1996:1) as 'being food production that occurs within the confines of cities…[taking] place in backyards, on rooftops, in community vegetable and fruit gardens and on unused public spaces.' Despite early definitions that focused solely on *food production* within urban areas, other scholars have adopted broader definitions. For example, Mouquet (2000:11) defines UA as 'an industry located within or at the fringe of a town, city or metropolis, which grows, raises or processes, and distributes a diversity of food and non-food related products…' Mougeot advocates for integrating UA in the 'urban ecosystem', noting the important linkages between UA, peri-urban agriculture, and *larger food systems and networks*. Although the focus of this research report is not on peri-urban agriculture, I acknowledge peri-urban agriculture's important role within overall city-region food production systems, and its potential relational benefits regarding UA sites within city boundaries.

In an appraisal of UA in American cities, Santo *et al*. (2016) outline the scope of UA by painting a picture of all its components. Fig. 2.2 illustrates UA's different configurations and locations within cities. The different forms of UA have different impacts based both on their locations within cities and their size of operations (*ibid*).

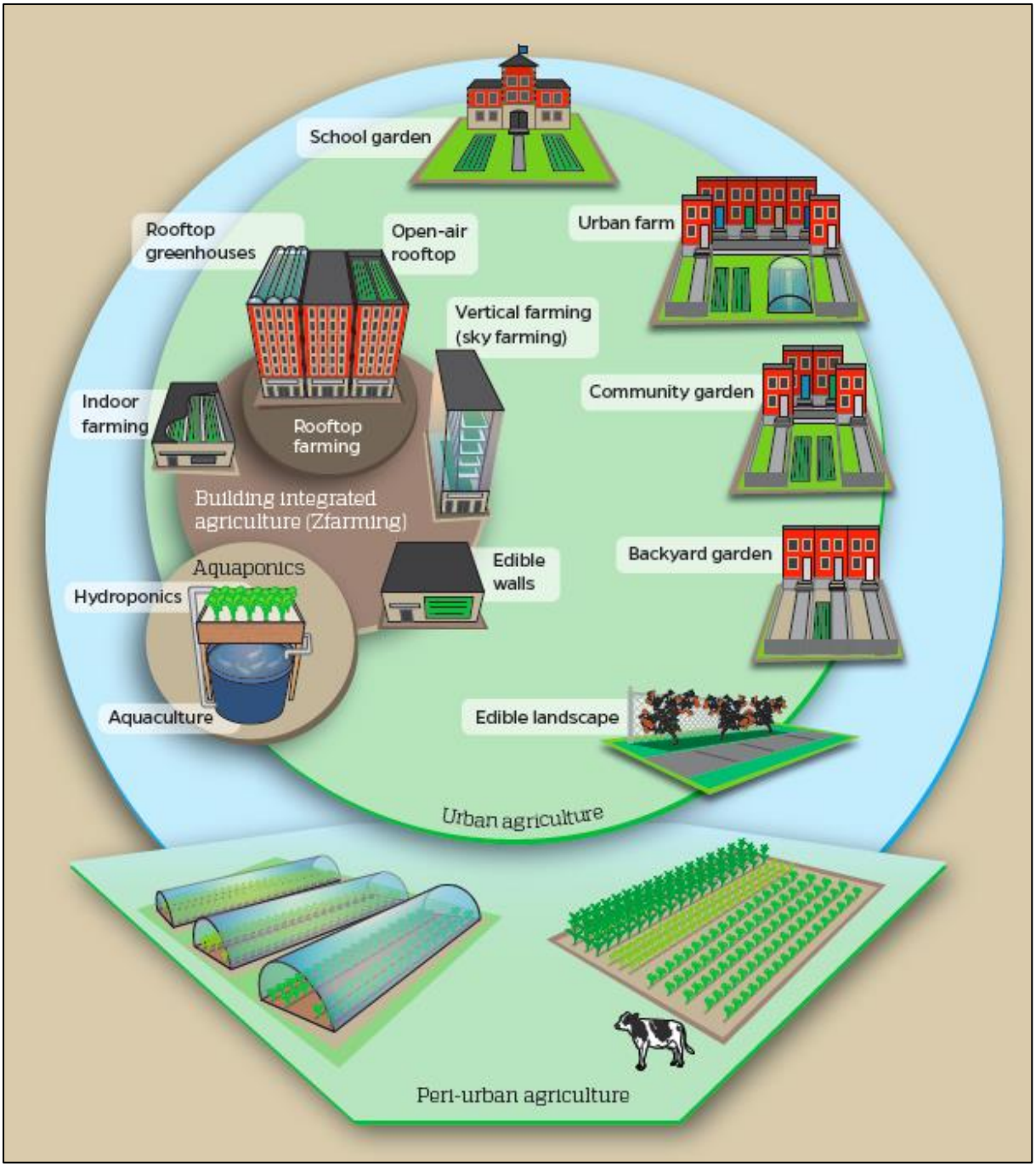


Figure 2.2: *The scope of urban agriculture (Santo et al. 2016:2)*

From examining Fig 2.2, UA can be classified into four broad categories, namely:

1) Urban farms
2) Urban gardens (including community gardens, backyard gardens and school gardens)

3) Building-integrated agriculture (BIA) (vertical farming, open-air rooftop farming, rooftop greenhouses, indoor farming, and edible walls) – also called *Zero Acreage Farming* (*ZFarming*) (see Thomaier, Specht, Henckel *et al*. 2014)
4) Edible landscapes[4]

Each typology has a specific function within the overall UA system. Based on the nature of my research, a definition of rooftop farms is provided below.

2.3.2. Rooftop farms

Rooftop farms, like other UA typologies, vary in scale, size, location, spatial footprint, and production capacity (Dubbeling, Orsini and Gianquinto *et al*. 2017; Orsini *et al*. 2020). The majority of rooftop farms are located in population and dwelling-dense urban environments, typically in inner-city areas. Appolloni *et al*. (2021) characterise RA into five different categories, based on their dominant function. These include: 1) commercial; 2) social-educational; 3) image; 4) innovation or 5) urban living quality. From their appraisal, the authors' findings show a predominance of RA cases that take the form of open-air farms, with limited examples of rooftop greenhouses. Furthermore, global case studies reveal the majority of rooftop farming projects are targeted at social-educational goals or towards improving urban living quality (*ibid*).

Fig. 2.3 provides a schema of the various forms of BIA and contextualises rooftop farms as a specific typology within this broader category of UA. As seen in Fig. 2.3, a distinction can be made between monofunctional buildings that employ vertical farming exclusively and multifunctional buildings that incorporate UA activities in the interiors of buildings, on balconies, on walls or rooftops.

[4] Edible landscapes refers to food plants that are designed into landscapes. These plants are used both for aesthetic value as well as consumption (for more information, see https://www.newlifeonahomestead.com/edible-landscaping-design-plants-choose/).

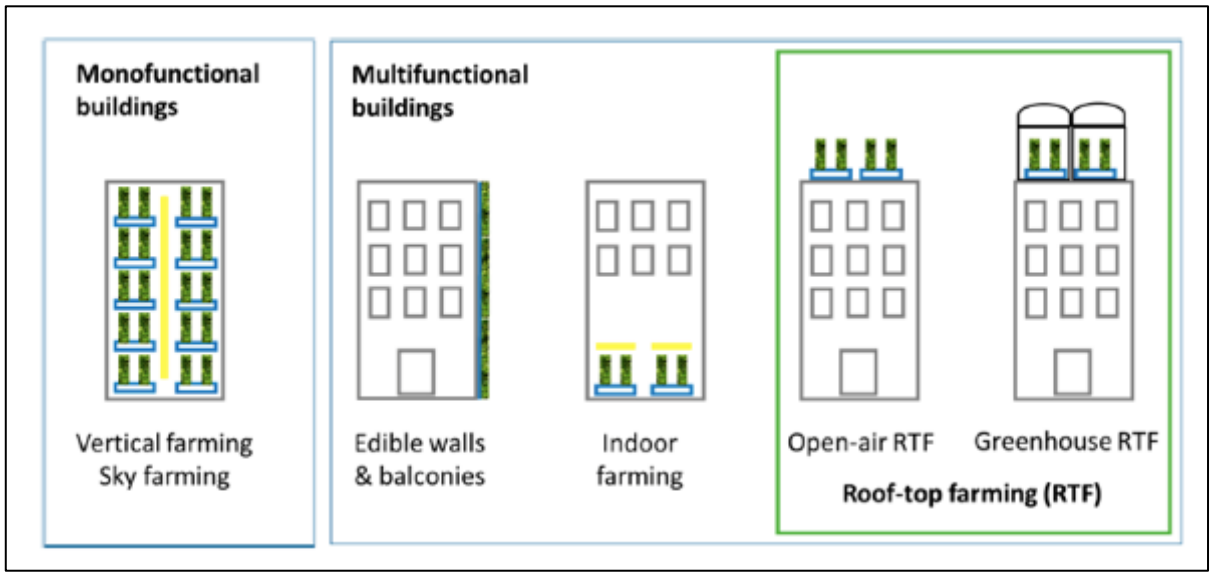


Figure 2.3: *Typologies of building-integrated agriculture (Source: Buehler and Junge, 2016:2)*

There are two main typologies of rooftop farming, namely *open-air rooftop farms* and *greenhouse rooftop farms*, also known as *rooftop greenhouses*. What distinguishes open-air farms and rooftop greenhouses is typically the configurations of the respective RA projects. Open-air rooftop farms are characterised by non-protected rooftop farming methods, while rooftop greenhouses are characterised by protected farming methods (enclosed structures) that typically use hydroponics and focus on producing high-quality, speciality crops (Appolloni *et al*. 2021). The choice of which RA typology to implement largely depends on the structural integrity of the building on which farms are located. Soilless systems are used in both open-air farms and rooftop greenhouses (Orsini, *et al*. 2020). There are however examples of large-scale soil-based rooftop farms such as Brooklyn Grange in New York City. Brooklyn Grange operates as a privately owned and operated agricultural business, which opened in 2010, and is currently 'the largest urban farm and intensive green roof business' in the world producing over 100 000 pounds of organically fresh produce annually (https://www.brooklyngrangefarm.com/). Presently, Brooklyn Grange has established three open-air rooftop farms spanning 5.6 acres (2.27 hectares) with a total cultivated area of 135 000 square feet (equivalent to 12 542 square metres) (*ibid*).



Figure 2.4: *One of Brooklyn Grange's open-air rooftop farms at the Brooklyn Navy Yard, Brooklyn, New York (Source: Anastasia Cole Plakias, 2016, cited from https://www.brooklyngrangefarm.com/)*

Fig. 2.4 provides an aerial view of one of Brooklyn Grange's three open-air rooftop farms, located at the Brooklyn Navy Yard. Brooklyn Grange benefits from a close collaboration with community members who serve as farm volunteers and has been lauded for its tangible impacts related to greater local food access and diversity and support with food security within Brooklyn. In a mega-city like New York, such a large-scale investment in local food production will likely accommodate the future food demands of inhabitants.

Elsewhere in Asia, Singapore provides an inspiring example of a city-state that is accelerating its local food production capabilities. Once relying almost exclusively on food imports, the country has embraced rooftop farms with many roofscapes being transformed into productive food production sites. Fig. 2.5 provides a glimpse into the largest commercial rooftop greenhouse in Singapore, operated by *ComCrop*. The company refers to itself as 'Singapore's urban farming pioneer' aiming to build sustainable models of food production and land use.



Figure 2.5: *A farmer attending to crops in ComCrop – a commercial rooftop greenhouse in Singapore (Source: AmHydro, 2018, cited from http://comcrop.com/)*

To realise rooftops' untapped value in cities requires considering alternative approaches to urban planning; architectural and landscape design; retrofitting of buildings; resource management; and alternative forms of energy use. This holistic approach that connects buildings with agriculture was briefly described in section 2.3.1. referred to as building-integrated agriculture. Below, I provide a detailed definition of building-integrated agriculture, adding insights into the opportunities and challenges when thinking of how to mainstream rooftop farming projects in cities.

2.3.3. Building-integrated architecture (BIA)

BIA is a specific type of adaptive agricultural production within buildings and on top of buildings that applies high-performance soilless cultivation methods (Puri and Caplow, 2010). Three types of building-integrated agriculture are most commonly found in cities, including rooftop greenhouses, open-air farms and vertical farms. There have also been experiments with other

types of indoor farming such as shipping container farms, as well as aeroponics[5], but these farms are still relatively new, with limited applications. Building-integrated agriculture provides opportunities for proactively planning and creating the institutional and regulatory frameworks to support the upscaling of rooftop farming projects. In particular, outcomes such as increased local food production, supporting the prominent greening of cities agenda, the potential to contribute to circular economy[6] city models, future property and capital investment, all occurring alongside job creation and local economic development, can have tangible benefits for communities and neighbourhoods, especially in population and dwelling dense urban environments (*ibid*).

Despite these positive benefits and potentials, challenges remain in mainstreaming building-integrated agriculture projects at scale, especially in developing cities. For example, zoning codes and land-use rights may impose restrictions on existing and future-planned land uses correlated with building sites, therefore excluding multifunctional building planning and design. Similarly, the overall planning, regulatory and legislative burdens already present in some cities may hinder progress towards a greater application and presence of building-integrated agriculture projects. Questions remain around relevant incentives for developers to initiate these projects and how planning policies at all government levels could encourage more sustainable building design and operations. Above all, the economic conditions within inner-city environments need to be fairly favourable to integrate agricultural entrepreneurialism with architecture and construction, as all three processes are both financially and labour-intensive.

[5] Aeroponics refers to a farming method where crop roots are suspended in the air while a nutrient-laden solution is circulated in the form of a fine mist to help their growth (Barth, 2018).

[6] The circular economy is explained as 'a systems solution framework that tackles global challenges like climate change, biodiversity loss, waste and pollution… by decoupling economic activities from [consuming] finite resources and designing waste' (Ellen McArthur Foundation, 2021, unpaginated).

2.3.4. Urban regeneration (UR)

The term UR is also conflated with other terms such as urban renewal and urban revitalization, both of which place a strong focus on enhancing economic values and property prices, thereby minimising the social and cultural aspects of UR. I have chosen to adopt the United Nations Human Settlement Programme (UN-HABITAT) definition of UR as '[the process of] bring[ing] back underutilised assets and redistribute[ing] opportunities, increasing urban prosperity and quality of life…ensur[ing] affordability, access to services and involvement of residents to promote local economic development, where public space is a key element of interventions, and cities reduce environmental impact and greenhouse gas emissions.' (UN-HABITAT, 2021, unpaginated). From an intuitional perspective on UR, Carter and Roberts (2017) reiterate the important role of strategy and partnerships within UR processes. Therefore, it becomes necessary to develop a strategic vision and approach to UR, whilst simultaneously managing various partnership processes along the way (*ibid*). UR has its flaws too, manifested in negative unintended outcomes, for example regarding culture-led UR (see Neluheni and Boshoff (2022) on the case of Maboneng in inner-city Johannesburg). Further, Neluheni and Boshoff reveal the trade-offs when attempting to improve neighbourhoods and communities, especially through private property investment. It is therefore important to understand how to deliver responsive and inclusive UR projects, aiming to protect particularly the most vulnerable residents within targeted UR neighbourhoods. Taking a longer-term outlook on UR efforts is vital, especially if working incrementally towards sustainability goals.

2.3.5. Sustainable housing

To understand what comprises 'sustainable housing', it is important to acknowledge the concept of *Sustainable Development* (SD), with its origins found in the Brundtland Report, which defines SD as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs…sustainable development does imply limits – not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the

effects of human activities.' (World Commission on Economic Development (WCED), 1987:16). Despite SD's popularity and pervasiveness in policy proposals and development agendas in cities across the world, the gap between SD theory and practice remains a critical challenge (Mensah, 2019). A parallel argument is that SD cannot be viewed as a blanket term, with one definition, which in the past has proven to be quite vague (*ibid*). Furthermore, in a South African context, the meaning of SD across different geographic regions and settlement types makes it difficult to both develop and effectively measure sustainability indicators (du Plessis and Landman, 2002). Having noted the conceptual limitations of SD, it is still necessary to outline relevant sustainable housing literature to frame my research. At a broad level, SD has always acknowledged the important *interplay between the economy, the environment and equity*, arguing for a balance in the three dimensions of development (WCED, 1987). The UN-HABITAT (2012) adds a fourth dimension to SD and that is the cultural dimension. People are key actors within cities and equally in other settlements. Their lived experiences and their everyday actions have a direct bearing on their environments. This is particularly relevant to the housing sector. In the global South context, the UN-HABITAT recognises the importance of planning and designing sustainable housing as an integrated strategy to promote greater sustainable cities in the developing world.

> 'Sustainable housing offers a great spectrum of opportunities to promote economic development, environmental stewardship, quality of life and social equality while mitigating the precarious convergences of the problems related to population growth, urbanisation, slums, poverty, climate change, lack of access to sustainable energy, and economic uncertainty. (UN-HABITAT, 2012:6).

In this regard, a holistic approach to housing is advocated that acknowledges the role of housing as a multifunctional asset that is directly tied to residents' livelihoods (*ibid*). With more conscious and equitable urban planning and development priorities comes an improvement to larger built environment outcomes. For example, increasing densification in strategic areas,

typically on or near public transport routes, can create adequate thresholds to support more compact city forms and functions (Dave, 2010). More compact cities result in less reliance on vehicular transport (favouring and promoting cycling and walking), a reduction in greenhouse gas emissions, cleaner air quality, and improved health (Organisation for Economic Co-operation and Development, undated).

2.4. The social and environmental benefits of rooftop farms

Rooftop farms maximise land-use efficiency due to not occupying or acquiring existing land within cities at the ground level (Buehler and Junge, 2016; Gasperi, Pennisi, Rizzati *et al*. 2016; Dubbeling *et al*. 2017; Appolloni *et al*. 2021). In this way, and from an urban planning and land use management perspective, rooftop farming can be seen as a viable tool in the requalification of land, specifically vacant areas, within cities (*ibid*). If rooftop farms were applied on a larger scale, they may hold potential for more mixed-use, compact, and sustainable cities. From a functional and environmental perspective, growing food on top of buildings results in fewer food miles, i.e., the distance produce travels from the producer to the consumer. Reducing food miles has many benefits such as minimising air population due to significantly fewer transportation requirements, increased freshness of produce, and enhancing local food access and distribution (Orsini et *al*. 2014). Recent studies are beginning to explore the social dimensions of rooftop farming. For example, in the high-rise, high-density urban setting of Hong Kong, rooftop farming activities are providing multifaceted social values for participants aligned to their perceived benefits of rooftop farming to support sustainable living, generate environmental and agricultural knowledge, and improve social networks and social interactions (Wang and Pryor, 2019). Table 2.1 categorises various factors that influence social benefits derived from urban rooftop farming in Hong Kong. Table 2.1 provides quite an extensive list of social benefits derived from rooftop farming. However, one should note that not all benefits are automatically realised but rather represent the potential embedded in rooftop farming and related economies and land uses.

Table 2.1: *Social benefits of rooftop farming (Source: adapted from Wang and Pryor, 2019:4)*

	Factors	Social benefits
Social benefits	Health	Improves physical health
		Improves mental health
		Enhances healthy habits and diet
	Education	Increases environmental awareness
		Promotes sustainable living
		Increases organic food knowledge and demand
		Provides practical skills by working in urban rooftop farms
	Community recreation	Provides extra open space for communities
		Provides visual aesthetic value
		Increases comfort in an open space
	Urban improvement	Serves as a planning tool to fill vacant spaces in cities
		Could extend roofs' life expectancy
		Diverse functions of roof spaces (multifunctionality)
		Appropriate for urban building retrofitting
	Social empowerment	Improves users and residents' life satisfaction
		Enhances community participation
		Develops leadership
		Provides employment opportunities to communities
	Social group integration	Empowers marginalised groups
		Supports the lifestyle of elderly populations
		Enhances parent and children relationships
		Supports social networks
		Creates social solidarity among diverse groups

Additionally, I acknowledge that generalisations from findings cannot be made across different rooftop farming cases and geographies. Nevertheless, the social benefit framework outlined by Wang and Pryor (2019) is useful to analyse and compare results across various rooftop farms in different cities.

Similarly, from the perspective of exploring rooftop farming's social dimensions, Ghosh, Accarigi and Giovanangeli, (2016) in their ethnographic study of two rooftop gardens in Sydney, identify two common threads tying rooftop farms to improving social conditions and well-being. The first was a shared interest in growing food within cities, and the second was a shared outlook and commitment to carving out community links and networks (*ibid*). In another study, the mere presence of UA has been found to positively correlate with consumer perceptions of UA, relating to enhancing sustainability, a greater connection to nature, education and employment opportunities, and environmental enhancements (Grebitus, Chenarides, Muenich *et al*. 2017).

Two relevant studies are Pillay's (2017) *explanatory assessment* of community perceptions of rooftop gardens in eThekwini, as well as Ansell's (2017) *exploratory study* of rooftop gardens in Johannesburg. Pillay (2017) notes that while challenges remain around initial installation costs for rooftop gardens, as well as relatively low levels of community awareness of rooftop gardens in the eThekwini central business district (CBD), rooftop gardens provide many positive impacts relating to job creation, initiating local food production systems, supporting biodiversity and limiting the UHI effect, alongside continued advocacy and enthusiasm amongst key role-players taking part in rooftop gardens (*ibid*). On the other hand, Ansell (2017) argues that rooftop gardens in Johannesburg serve important land use functions that enhance green infrastructure planning and support sustainability goals by providing outcomes such as passive thermal control and contributions to improved food security, as well as opportunities to link food production to renewable energy systems. Thus, the emergence of rooftop gardens in Johannesburg warrants policy intervention that acknowledges the 'productive purposes [of rooftop gardens] such as generating power, or growing food [that] have clear benefits' (Ansell, 2017:109). Fig. 2.6. provides a schematic SWOT, indicating the strengths, weaknesses, opportunities and threats of RA as a land use, activity and function in South African cities specifically focussing on the RA's social and environmental outcomes and potential benefits.

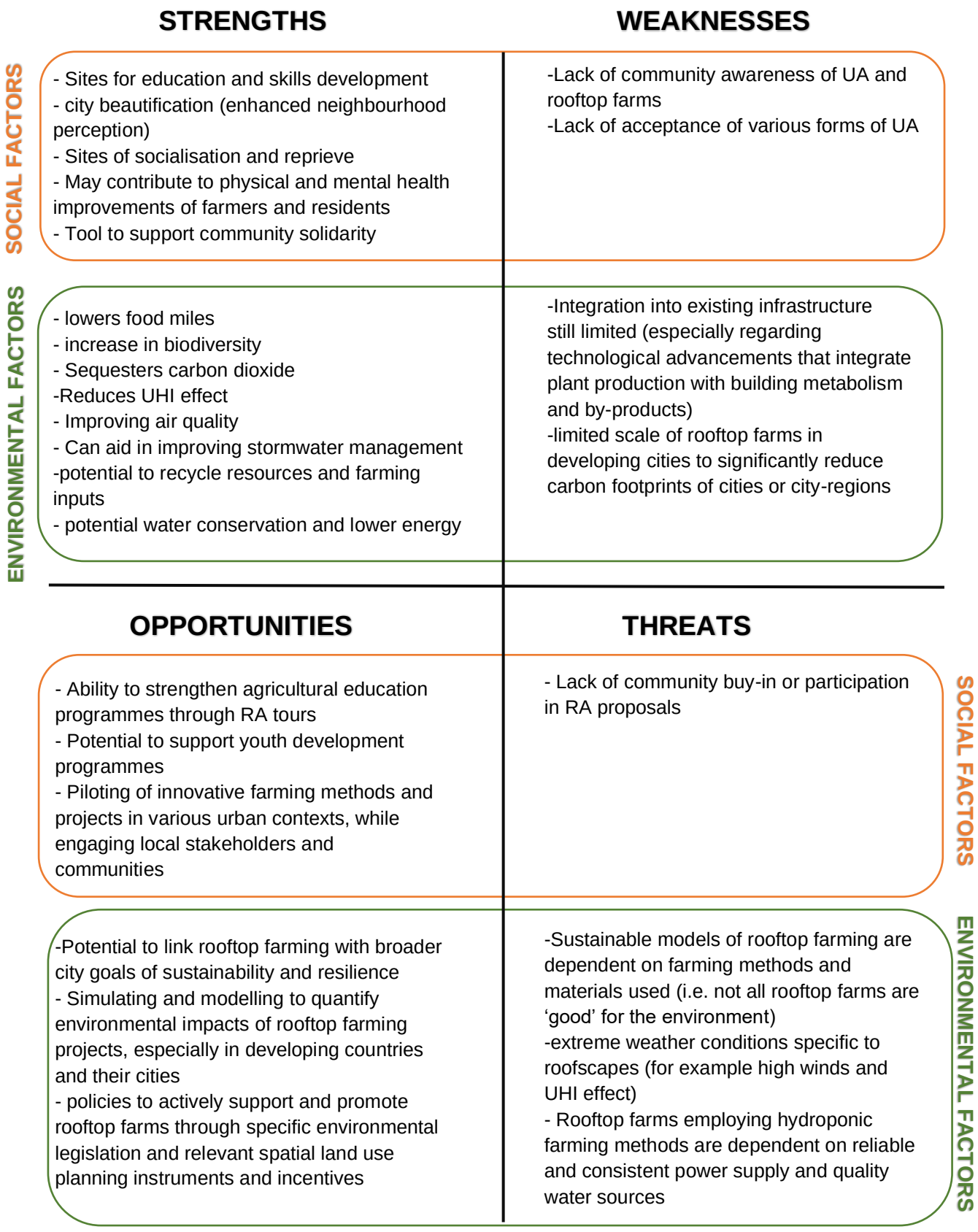


Figure 2.6: *An assessment of social and environmental benefits of RA projects in South African cities (Source: adapted from Ansell, 2017; and Pillay, 2017).*

The SWOT above echoes evaluations made by Orsini, Kahane, Nono-Womdim *et al*. (2013) and Appolloni et al. (2021) of RA in both broader terms across developing city contexts and more recent reflections by Lawrence, Rumbo and Jeeva (2022) in the case of South Africa. The social and environmental dimensions of rooftop farms outlined in this chapter are generally linked to technical and more tangible outcomes. There are, however, other social (and policy dimensions) associated with UA (including rooftop farming) such as partnership building, policy alignment, environmental stewardship, and broader environmental advocacy (Battisti, 2020). Currently, there is a gap in contemporary academic literature focussing on these aspects, signalling an important avenue for further research. An exceptional case combining social and environmental advocacy, collaboration, and mutual learning in sustainable food production is the case of Brooklyn Grange in New York City described in section 2.3.2. Brooklyn Grange as socio-economic and social justice organisation combines both technical and grassroots social outcomes, thereby providing a model from which to learn about the importance of partnership, social justice, education campaigns and collaboration across academic and community sectors (see Griswold, 2019). Of relevance to my case study are rooftop farming projects that primarily promote social-educational and urban living quality functions. These projects are 'often developed without profit aims, concentrating more on the integration of minorities, the education of young people, and the amelioration of living conditions for urban dwellers by offering recreational and community spaces for personal food production.' (Appolloni *et al*. 2021:2). Therefore, it is important to understand the relationship between rooftop farms and urban residents' housing experiences. The next section provides an analysis of the Johannesburg inner-city housing landscape in the context of UR.

2.5. Inner-city regeneration and housing development in Johannesburg

UR policies within the Johannesburg inner city were prompted by the rapid economic and physical decline of the inner city, alongside "white flight" from the City's high-rise residential housing stock that was reserved exclusively for white populations under apartheid. (Bremner, 2000). The process of steady economic decline began in the 1970s but became more acute

in the 1990s, in a context of relaxed influx controls that led to the rapid urbanisation of Black African populations into the Johannesburg CBD (Bethlehem, 2013). Between the 1990s and early 2000s, economic disinvestment in the Johannesburg CBD corresponded with rising levels of crime and grime. The inner city became a “no-go area”, based on perceptions that the area was unsafe, unsightly and a home to criminals (*ibid*). Based on the immense demand for housing, and with a municipality unable to cope with this demand, alongside massive service delivery backlogs, and various institutional and political challenges, the CoJ was faced with a conundrum – how to promote economic re-investment into the CBD, while also providing affordable accommodation and improving service delivery in the area.

UR policies found expression mainly after 2000 when the CoJ consolidated to form a metropolitan government under one administration and authority. The first policy to mention UR was the iGoli plan of 2002, corresponding with the City’s vision to become a ‘World Class African City by 2030’ (Bremner, 2000). The City’s aspiration to be world-class was supported by key municipal urban planning instruments such as the Growth and Development Strategy (GDS) and the Spatial Development Framework (SDF), both of which sought to promote economic investment in key areas of the city. Regarding UR plans focussing on affordable housing development, the following CoJ plans can be identified, cited in Robb (2018).

1) The Bad Buildings Programme (BBP) of 1999, later re-named the Better Buildings Programme of 2003;
2) The Urban Development Zone - initiated in 2004;
3) The Inner City Regeneration Charter and the Inner City Action Plan, 2007
4) The Inner City Property Scheme, 2007
5) The Inner City Transformation Roadmap, 2013; and
6) The Inner City Implementation Plan, 2014

Many of these UR plans and incentives were implemented with aims focusing on enhancing economic development and improving investor confidence in the inner city, as a means to compete with other global cities (Bremner, 2000). Specifically, the BBP aimed to address the widespread problem of informal rental housing within the inner city, including the phenomenon of hijacked buildings. Large-scale affordable housing shortages in the inner city have resulted in two forms of informal rental housing provision, namely small-scale informal rental through the subletting of rooms (see Mayson and Charlton, 2015); and hijacked buildings where slumlords – unofficial landlords - rent spaces to dwellers within inner-city disused buildings to maximise profit. In many instances, hijacked buildings operate illegally and also represent health and safety risks due to limited or non-existence water, electricity and sanitation service provision.

The BBP sought to renovate identified hijacked buildings and restore services such as water and sanitation alongside adequate building and safety standards. The BBP has been criticised for its limited impact in protecting urban poor residents in Johannesburg's inner city. As argued by Rubin (2015:1) 'the World Class City project [of the CoJ] was underlain by a clear and hegemonic urban vision of creating an orderly, neat and "modern" inner city, which housed international capital and middle-class residents to the exclusion of poor people.' The BBP outcomes were closely tied to private property-led redevelopment that pushed up property prices, thereby displacing poor urban residents, and disrupting their livelihoods (*ibid*). Further, the BBP programme justified several evictions throughout the inner city. The eviction of residents from San Jose, an identified "sinkhole" (an inner-city area characterised by urban decay, decline, crime and failing infrastructure) in Hillbrow was ruled unconstitutional (see Brkic, 2010), creating legal precedent for the CoJ to provide alternate and well-located accommodation in future cases that would necessitate evictions.

Despite many plans and strategies aimed at addressing widespread housing demand in the inner city, there has been limited implementation of affordable rental housing, despite high

levels of demand for this type of housing in the inner city, especially by lower-income earners and new urban migrants (Robb, 2018). The inner-city housing market can be viewed as a dual housing market comprising informal rental tenure options, mentioned above, and formal rental options in the forms of social housing, inclusionary housing and gap market housing. In general, housing affordability is the main driver of housing choices within the inner city. Furthermore, as Tissington (2013) notes, social housing is generally mismatched with inner-city residents' household affordability levels, resulting in higher occupancy rates of buildings, especially in areas of the inner city that are near jobs and transport routes and interchanges such as Berea.

In contemplating the relationships between UR and affordable housing in Johannesburg, Mosselson (2017) advocates for nuance and complexity in his appraisal of urban change through private-sector-led regeneration and housing development, noting that '[r]egeneration [in the Johannesburg inner city] is formulated within a neoliberal paradigm, yet through creative strategies and interventions is also achieving developmental goals and expanding the provision of affordable, centrally-located housing. Neluheni and Boshoff (2022) offer a different perspective, where culture-led UR developments in the Maboneng precinct have resulted in gentrification and have thereby displaced previous tenants of buildings that were targeted for redevelopment. In their case study, Neluheni and Boshoff demonstrate the advantages and disadvantages of culture-led UR and how it impacts the actors involved. While the benefits include economic and property investment, safety, and cleanliness, increased rental revenue, and a boost for local tourism, there is a downside in the form of gentrification, where displacement often leads to a weakening or rupturing of existing social ties and networks, alongside income and job insecurity (*ibid*). Both these cases illustrate the need to devise UR and affordable housing strategies that are responsive to inner-city residents' needs by being rooted in local contexts, yet flexible. It is important to note that the private sector, to date, has largely driven UR, albeit spatially localised in areas such as Braamfontein, Newtown, Maboneng, and the newly constructed Jewel City. As one example of the scale of this private

development, the property company Divercity has delivered 6500 housing units across the Johannesburg inner city, and a further 90,000 square metres of commercial and retail floor space, with a combined R3.4b investment (https://www.divercity.co.za).

From a local government perspective, the CoJ's commitment, at least in policy terms, to inner city redevelopment is commendable. It is important to note that Divercity, as a private property company, is not acting in isolation but has already forged public-private partnerships to leverage affordable housing delivery in well-located inner-city locations. Such a co-delivery model provides a means to create greater spatial and socio-economic inclusion, alongside sustainable land use and functions. Incorporating food production and other greening investments may enhance the liveability of residential areas, particularly in inner-city areas that have historically experienced economic decline, disinvestment and physical neglect. In my view, inner-city housing-led regeneration in Johannesburg could benefit from an inclusionary, integrated and multisectoral approach to affordable housing delivery and design.

2.6. Linking rooftop farms, urban regeneration, and sustainable housing

A link can be made between rooftop farming as an urban activity and efficient land utilisation strategy, and the UN Sustainable Development Goals (SDGs). Fig. 2.7 outlines the 17 SDGs that contribute to safer, more environmentally friendly, and socially and economically equitable cities. In particular SDGs 7 (affordable and clean energy), 11 (sustainable cities and communities), 12 (responsible consumption and production), and 13 (climate action) can be linked to UA activities, especially if these are managed with a conscious awareness of the multi-layered impacts (positive, neutral and negative) of all UA types in cities. Building sustainable cities and communities takes a concerted effort by many role players each playing their part whilst also working collaboratively to work towards a more socially, economically and environmentally just society.



Figure 2.7: *The 17 SDGs (Source: UN, 2016)*

UR goals also aim to improve overall living environments and human well-being within targeted neighbourhoods or precincts, or even at a project or building level. If rooftop farms are activated and implemented within inner-city residential buildings, it could result in residents having enhanced access to fresh and good-quality produce. It could also provide benefits to the overall management of residential inner-city buildings, which predominantly take the form of rental units. For example, rooftop farms can add to buildings' insulation, therefore improving their thermal performance (Appolloni *et al*. 2021). Over time, this would likely lead to reducing heating and cooling costs and promoting greater energy savings (*ibid*).

Inner-city housing in Johannesburg is comprised mainly of rental stock, some of which operate informally and even illegally, in the case of hijacked buildings. The inner-city housing landscape thus is markedly different from suburban contexts that are largely based on homeownership models and characterised by generally sprawling, considerably lower-density housing and settlement configurations. The inner-city housing population is also distinguished from suburban demographic profiles, particularly in Johannesburg's northern suburbs, with the inner city made up of a predominantly young, Black African population. Black Africans comprise 97% of the inner-city inhabitants (CoJ, 2020). Regarding population growth and

dynamics, Johannesburg has experienced consistently high levels of in-migration, both from neighbouring countries such as Zimbabwe, Malawi and Mozambique and within South Africa's borders. Between 2018 and 2019, 160 000 migrants entered the city (CoJ, 2020). Household mobility is also more apparent in the inner city, where many residents make housing choices based on affordability and more importantly access to jobs and economic opportunities.

It is vital to take a longer-term outlook on the potential benefits rooftop farms can provide. As argued in the literature, rooftop farming will likely be a necessary and permanent feature of many cities in the future (Orsini *et al*. 2014, 2020; Appolloni *et al*. 2021). With adequate support from local government authorities alongside the initiation of pilot rooftop farming projects, UA projects could have more benefits in the form of sustainable local food access, resident engagement with green spaces, and creating multifunctional intensive inner-city land uses, adding flexible and adaptive capacity to respond to changes and risks in urban environments (Appolloni *et al*. 2021).

2.7. Conceptual Framework

In previous sections of this chapter, I have critically discussed the contextual, definitional and relational aspects of rooftop farming and explored which potential roles rooftop farms' can play in an inner-city residential context in Johannesburg. The conceptual framework, represented in Fig. 2.8 shows the nested relationships between key concepts in my research. UA is an interdisciplinary concept and practice, spanning various fields ranging from economic development, community development, social development, environmental studies, urban planning, and architecture (Santo *et al*. 2016). The concept of rooftop farming cannot be discussed in isolation, therefore, I located rooftop farming as *one specific form* of UA. Adopting a systems thinking approach that accounts for complexity, interconnectedness, and where a sum of parts makes up the whole (Meadows, 2009), my conceptual framework shows the interrelated relationships between key concepts.

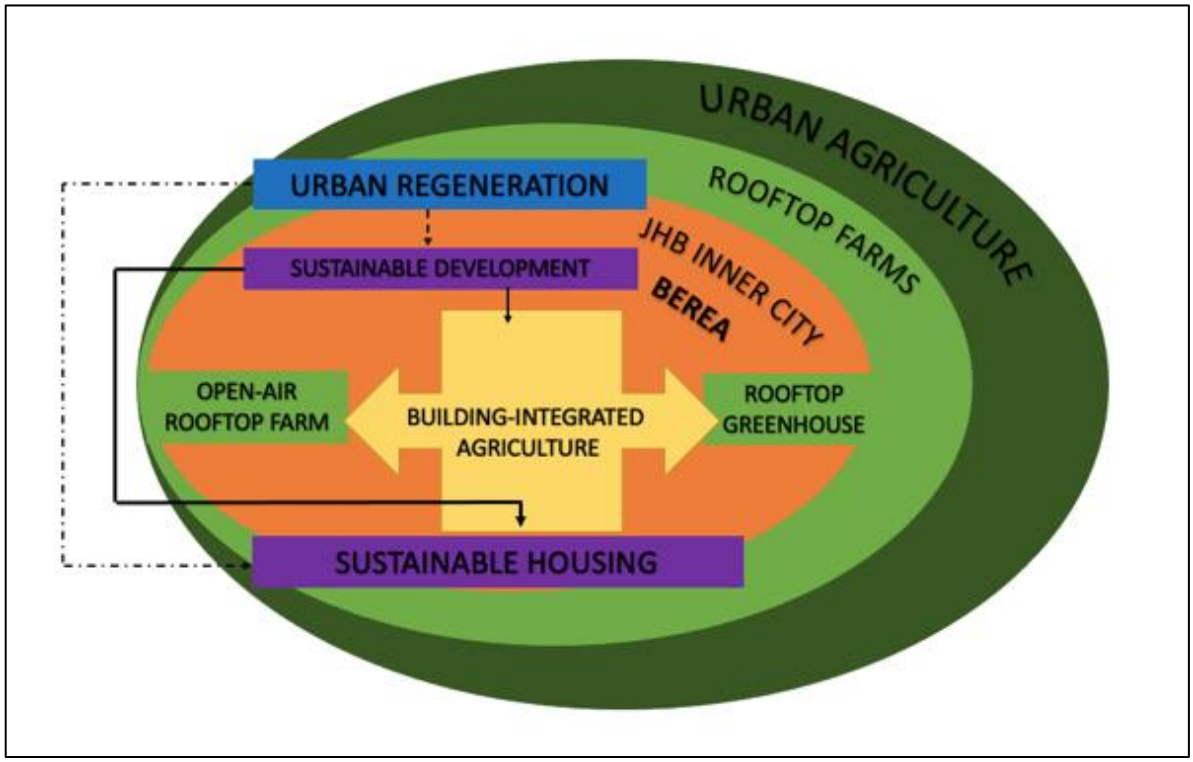


Figure 2.8: *Conceptual framework (Drawn by author, 2022)*

Rooftop farming within inner cities occurs on top of buildings and forms one component of BIA. Rooftop Agriculture (RA) represents one form of BIA and is split into two typologies, namely open-air rooftop farms and rooftop greenhouses. For conceptual clarity, RA is the umbrella term for all forms of plant cultivation on rooftops (including both rooftop farms and rooftop gardens) (see Dubbeling *et al*. 2017). Other important concepts are that of *urban regeneration* and *sustainable housing* which are framed through the lens of *sustainable development* literature. Finally, the links between rooftop farms, urban regeneration and sustainable housing are located within inner-city regeneration and housing development in Berea and the Johannesburg inner-city more broadly. Tying back to my research question, I argue that these links have policy, functional, social and spatial dimensions and outcomes.

2.8. Conclusion

This chapter has illustrated UA's scope and multiple roles within cities. The historical significance of UA in cities in centuries past has in recent years re-emerged, with rooftop farming as a popular, dynamic and exciting research field. Growing global research is motivated by rooftop farms' role in addressing many contemporary urban challenges such as rapid urbanisation, food insecurity and climate change). Rooftop farm typologies and their role and function within cities can also be characterised by their societal benefits, ranging from technological innovation, city beautification, social-education or urban living quality aims (Orsini, et. 2020; Appolloni, 2021). This chapter also discussed inner-city redevelopment in Johannesburg, revealing a mismatch between many UR strategies and plans and the needs of the majority urban poor population that live in the inner city. Johannesburg's inner-city market juxtaposes informal rental housing options, many of which are hidden and unregulated, and formal rental housing options that are dominated by the private sector, with a limited contribution by the state in the form of social housing. I also discussed the intersection of UR and affordable housing in the inner city, noting the risks and opportunities in the process of driving urban change through redevelopment. When planning UR projects, it is important to understand local contexts and especially the needs, hopes and aspirations of local communities. By focusing on the social and environmental outcomes of rooftop farms, I have explored the indirect and often under-researched aspects related to rooftop farms. Although nascent within South African major cities, rooftop farming projects hold significant potential to use technology and innovation to accelerate diversified urban food production across various farming projects within broader UA sectors and may offer additional spill-over benefits for communities and residents. However, risks and challenges remain in replicating and implementing rooftop farms. In South Africa, policy support and specific urban planning instruments are critical to both unlocking and accelerating RA projects in cities Appropriate and innovative funding instruments are also necessary to ensure rooftop farms' financial and economic viability.

3. CHAPTER THREE: TRANSFORMING INNER-CITY ROOFSCAPES: THE UAI AND THE CORONIA GARDENS ROOFTOP FARM

3.1. Introduction

The UAI is a non-profit agricultural organisation focusing on transforming inner-city disused building roofs to become productive urban rooftop farms. This chapter begins by providing the context of my case study within Johannesburg, specifically nested within the inner city. Johannesburg symbolises a place of economic opportunity and ambition for many new migrants entering the city from other parts of South Africa and neighbouring countries. Today, Johannesburg's inner city still functions as the historical core of the city, comprising mixed land uses and higher population densities compared with other mixed-use nodes such as Sandton, Rosebank, Midrand and other typically low-density suburban patterns across the city. I then discuss the context of Berea within the inner city, an area most notably characterised by high population and dwelling densities and that has largely experienced decline and neglect post-apartheid. Thereafter, I provide an overview of the UAI within the inner city and specifically at Coronia Gardens in Berea. The chapter concludes with reflections on the case study context.

3.2. Johannesburg and its inner-city context

Johannesburg is known as the economic heartland of South Africa and is the dominant financial and economic hub of Africa. Johannesburg is located in the Gauteng province as shown in Fig. 3.1. Gauteng has the largest urban population compared with other provinces, with 15.2 million residents, representing 25.8% of South Africa's total population. In 2019, Johannesburg had an estimated total population of 5.4 million (CoJ, 2020).



Figure 3.1: Johannesburg in the context of Gauteng and South Africa

(Source: CoJ, undated(b) and https://en.wikipedia.org/wiki/Gauteng

(for map insert of Gauteng within South Africa)

Between 2018 and 2019, the city's population growth rate was 2.35% (CoJ, 2020), mainly due to increasing in-migration, especially of younger populations. Contrary to widespread perceptions on migration trends in Johannesburg, the majority of in-migration is driven by movement within South Africa, as people come to Johannesburg from smaller towns or rural areas in other provinces within the country. The CoJ (2020:unpaginated) notes that '58% of the population were born in Gauteng, 10% have migrated to the city from other countries and

nearly a third of the people in the city have come to Johannesburg from other parts of South Africa'. Fig. 3.2 provides a map of Johannesburg showing the City's regions (A-G). The inner city is located in the south-eastern portion of the city, in region F.

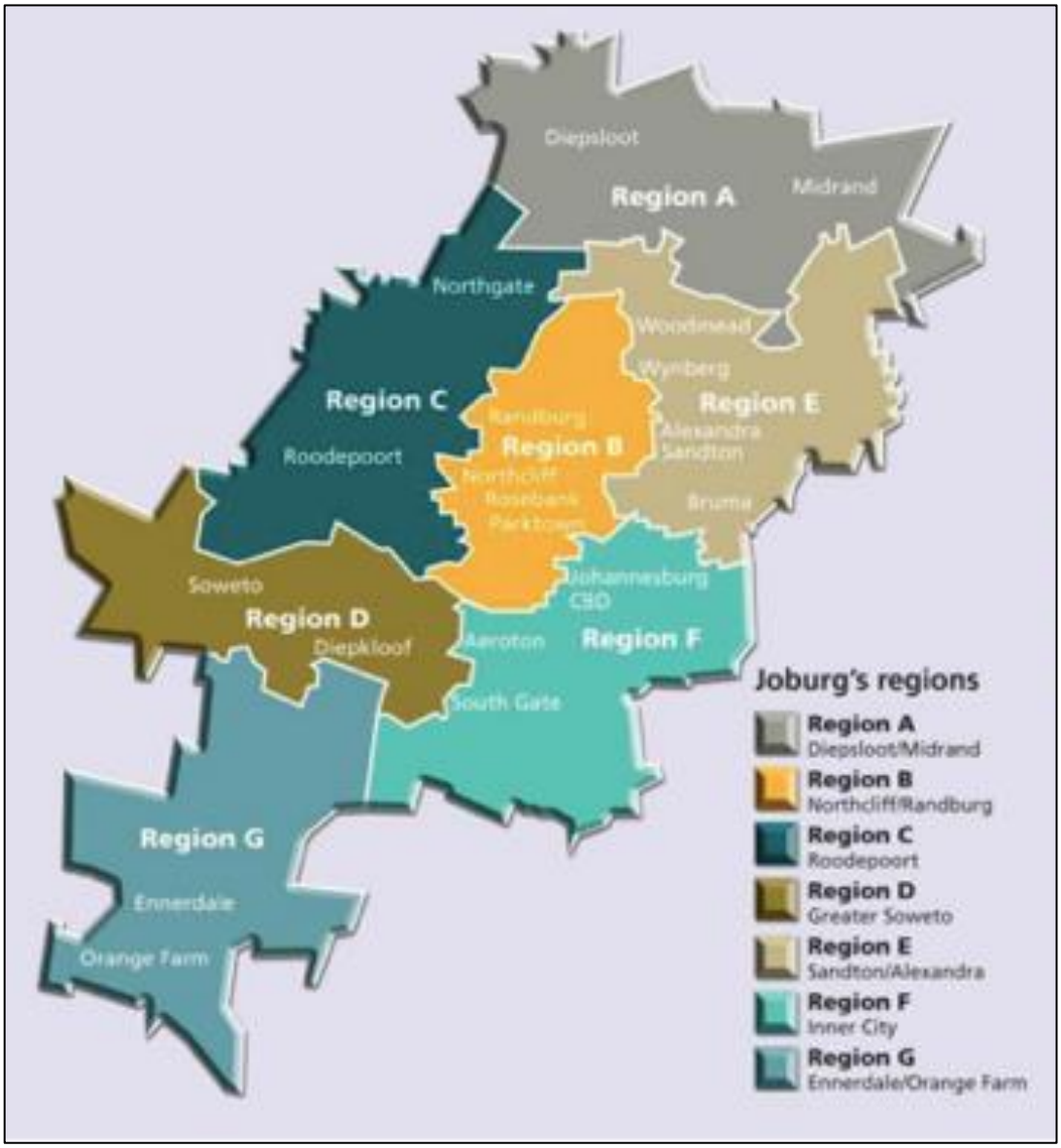


Figure 3.2: *The City of Johannesburg administrative regions*
(Source: CoJ, 2016:54)

The inner city consists of various, often mixed, land uses including commercial, economic and financial, residential and light industrial sites. The following section briefly describes Berea's spatial, socio-economic and physical context.

3.3. Location, history, and current housing dynamics in Berea

Fig 3.3. demarcates Berea within the inner city, bordered by Hillbrow (in the west), Yeoville (in the northeast) and New Doornfontein (in the southeast).

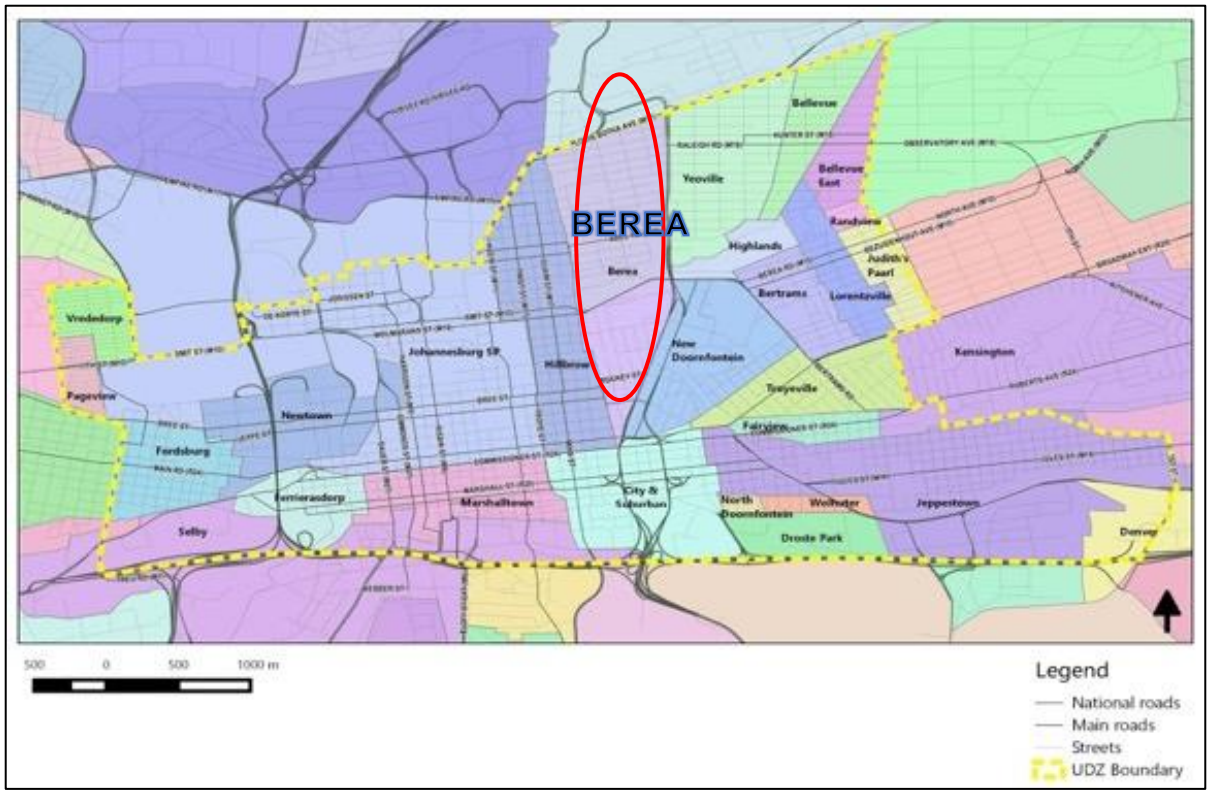


Figure 3.3: *Locating Johannesburg's inner city and Berea in the context of the UDZ boundaries (Source: adapted from CoJ, cited by Gauteng Precinct Management Association, undated)*

Berea was established as a residential area in the 1890s and predominantly functioned as a residential area consisting of semi-detached houses (Morris 1994, Schmidt, 2004, cited in Silverman and Zack, 2008). During the height of the apartheid years, inner-city areas were exclusively reserved for white populations of all classes. Both Hillbrow and Berea were known as sought-after residential suburbs that were valued by residents for their proximity to transport networks and job opportunities in Johannesburg's city centre. Subsequently, 'Berea…experienced much of its development in the 1960s and 1970s [where it] retained a more residential character [compared to Hillbrow] with fewer shops and entertainment venues but with more parks, religious buildings and schools.' (Silverman and Zack, 2008:16).

In the late 1970s, as the Group Areas Act was no longer effective in controlling and managing the urbanisation of poor black populations into Johannesburg's inner city (Bethlehem, 2013), the population dynamics in Berea started to shift from an exclusively white population to a mixed population as coloured and Indian groups moved from peripheral townships to the city in search of better accommodation options (Silverman and Zack, 2008). Parallel to this in-migration was white and capital flight from the Johannesburg CBD, and in the 1980s, black African migrants moved to Berea in search of new economic opportunities (*ibid*). The influx of black populations, as well as foreign migrants into the inner city, continued from the 1990s and during the post-apartheid period (Bethlehem, 2013). Presently, Region F in which the inner city is located accounts for 23% of the city's total population (CoJ, 2020). Population and dwelling densities are also significantly higher in the inner city than in other regions of Johannesburg. Specifically, "Hillbrow-Berea is one of the highest density areas internationally, with 135 000 people living [in an area] just under 2km² (67500 per square metre).' (Setplan Dludla Development, 2004, cited in Silverman and Zack, 2008:22). The challenges associated with high-population densities, occupation densities and building densities in Berea are exacerbated by limited social and recreational sites in the area. For example, adequate state provision for public open spaces, parks, schools and creches has not occurred at appropriate scales to residents' demands (Silverman and Zack, 2008).

Housing in Berea is dominated by rental housing tenure, provided and managed through both informal and formal systems (Silverman and Zack, 2008). Berea is comparable to the rest of the inner city, in that increasing affordable rental housing demand is presently unmatched by current levels of supply (*ibid*). Box 3.1. outlines Berea's demographic and settlement features. To provide context, Johannesburg's inner city population was estimated to be 957 441 with over 300 000 households (Statistics South Africa (StatsSA), 2011)[7]. According to Box 3.1, Berea residents have an average monthly income of R2500, therefore, many residents may

[7] There is limited up-to-date information on Johannesburg's inner-city population. While I've noted an estimated population drawn from the 2011 Census, I acknowledge both population and household counts have likely increased quite rapidly since 2011.

fall below the threshold to qualify for state-subsidised housing. Moreover, some residents of Berea might be excluded from qualifying for state-subsided housing due to other factors, namely having previously qualified for state-subsidised housing, their foreign immigration status, being single or living without dependents.

Box 3.1: *Berea: settlement and demographic features*
(Source: StatsSA, 2011, cited in Frith, undated)

Area: 1.01 square km²

Population: 42,801

Population density: 42.22 persons per km²)

Gender profile: Male (51%); Female (49%)

Migration: 55% born in South Africa, 43% from outside South Africa

Total number of households: 14, 618

Household density: 14. 42 per km²

Dominant Population: 97% Black African

Dominant Age group: 25-29 years

Rental tenure provides benefits to tenants in the form of flexibility and relative affordability and is more suited to household mobility than formal homeownership (UN-HABITAT, 2011). Rental tenure options in Berea are matched with the neighbourhood's demographic features outlined above. Given Berea's large youthful and migrant population, one can infer that rental housing provides a foothold for new urban residents entering Johannesburg. Despite the locational benefits of living in Berea, Silverman and Zack (2008) note Berea's transient population as many households are quite mobile, moving between different accommodations based on their life choices, livelihoods and personal preferences. Thus, it seems much of Berea's population may not be heavily invested in the area (*ibid*). Within Berea, social housing investment has

been limited compared to private sector-led housing redevelopment under the Better Buildings Programme. Particularly, Jozi Housing has played a dominant role in large housing redevelopments in Berea, with a total investment of over R30 million (CoJ, undated(b)). Jozi Housing currently manages 8 private rental high-rise buildings in Berea and the company benefits from also having its headquarters located within the neighbourhood. Jozi Housing is responsible for driving housing-led regeneration across the inner city, aiming to achieve safe, decent and affordable accommodation for residents (https://www.jozihousing.co.za). In general, large-scale private sector investment across the inner city, incentivised by the UDZ and the BBP, may have provided favourable conditions in supporting a socio-economic agricultural enterprise such as the UAI that could build on existing inner-city growth and development. The next section describes the UAI in more depth.

3.4. Background of the UAI: Purpose, objectives, and current operations

The UAI was established in 2017 as a collaborative social agricultural enterprise. This idea to promote and support urban agricultural production in the inner city was first incubated by the JICP. At the time, the JICP was investigating how to use innovative thinking to reshape urban spaces in the Johannesburg inner city. The UAI's central purpose is to 'develop sustainable entrepreneurial ventures spread across the agricultural value chain, through the establishment of a plethora of diverse urban farming operations throughout the Johannesburg inner city' (https://www.urbanagriculture.co.za). Moreover, the UAI aims to adopt innovation, technology and financial sustainability into its business model to achieve what is referred to as the triple bottom line in sustainability: economic empowerment, social empowerment and financial sustainability. The company recognises the additional benefits of local food production, which include job creation, local economic development and potential improvements to inner-city neighbourhoods and spaces. Therefore, the outcomes of the UAI can be viewed as multidimensional. The timeline of the project is outlined below in Fig 3.4:

2016: JICP secured funding from the Minerals Council. Shortly thereafter, established a pilot farming site where one local entrepreneur was farming crops.
Proof of concept was established to grow high value crops

2017: UAI approached the Department of Small Business Development for funding to upscale the project

JICP through its networks connected the UAI to the Johannesburg Property Owners Management Authority (JPOMA) to identify appropriate rooftop sites on which farms could be established. Certain property owners agreed to give the UAI rooftop space at no cost as part of their commitment to revitalizing the inner city.

2018: UAI identified land within the National School of the Arts (NSA) set up a seedling farm
Established relationship with AFGRI – a leading agriculture services company offering a wide range of technical and financial support processing facility
Distribution of crops to local networks

2020: UAI, during the peak of COVID-19, secured funding from Rotary International, an International a global community-based organisation that fosters networks between various stakeholders to create lasting change in local communities, to introduce a sustainable food programme (Seedling Farm and resultant seed-sharing programme to support backyard farming and local food production)

2021: UAI forged connections with the Makers Valley Partnership (the creative partner-based community of Bezuidenhout Valley) in the inner city. 6 community kitchens and 50 households were supplied seedlings in support of establishing backyard gardens. Additionally, each kitchen was provided with an agri-influencer who would walk the journey with them and provide technical support

Figure 3.4: *UAI project timeline*

(Source: Compiled by Author, from interviews with UAI project partners, 2021).

The UAI strives to 'develop sustainable entrepreneurial ventures spread across the agricultural value chain, through the establishment of a plethora of diverse urban farming operations throughout the Johannesburg inner city.' (https://www.urbanagriculture.co.za). Moreover, the UAI aims to adopt innovation, technology and financial sustainability into its business model to achieve what is referred to as the triple bottom line in sustainability: economic empowerment, social empowerment and financial sustainability. For an example of the UAI's scale, in 2020, the UAI produced roughly 7340kgs of fresh produce cultivated on rooftops across ten building sites in the Johannesburg inner city (*ibid*).



Figure 3.5, 3.6 and 3.7 (Top and bottom (left to right)): *Views of the inner city from a UAI rooftop farm in New Doornfontein; Celery is grown on the Outreach Building roof in Hillbrow; and the UAI seedling farm at NSA, Braamfontein (Source: Author's Photographs, 18 April 2021)*

In reflecting on the UAI as a positive and inspiring South African case study, as part of the SACN's Good Hood Stories project, Fataar and Brown (2021) note how the project was made successful through bold leadership, strategic partnerships, coordination, and the power of networks. These components, when combined, created a nurturing environment for the UAI to move from an incubation and pilot phase to a formal non-profit organisation. Moreover, the UAI demonstrates how one visionary idea of rooftop farming was able to grow around stakeholders who believed in a common cause – to uplift communities and improve neighbourhoods and living environments in Johannesburg's inner city. Figure 3.8 provides a visual representation of the various project stakeholders of the UAI.



***Figure 3.8**: The UAI and its partnership with key role-players (Source: Our Future Cities, 2021)*

Figure 3.8 shows the broad range of role players in the UAI, starting from the organisation that derived the project concept (Wouldn't It Be Cool), and moving to UAI project funders and donors (for example, the Minerals Council, the Department of Small Business Development, and Rotary International), to property managers and land owners (Johannesburg Housing Company, Johannesburg Land Company and the Outreach Foundation). Figure 3.8 and Figure 3.9 below also highlight farmers' critical role in as key stakeholders within the UAI.



***Figure 3.9**: The UAI as a people-centred business (Source: Our Future Cities and SACN, 2021, cited by Fataar and Brown, 2021, unpaginated)*

Fataar and Brown (2021) refer to an ‘an invisible layer of parts holding the project together… the network of key role players including the JICP, the UAI farmers, Jozi Housing and ultimately the markets and end-users where the produce from UAI rooftop farms ends up.’ The willingness and participation of each stakeholder in the UAI project from its earliest iterations up until its present operations is a testament to the commitment of each UAI project partner, every farmer who has gone through the pipeline, acquiring valuable skills and knowledge, and every kilogram of fresh produce that has been harvested from UAI rooftop farms. The following section provides more detail about the specific UAI farm chosen for this study located at Coronia Gardens in Berea.

3.5. Coronia Gardens – the building and its rooftop farm

Coronia Gardens is located at 45 O’Reilly Road in Berea, a suburb that has been characterised as unsafe for many years. The 13-storey residential property comprises 324 rental units (157 bachelor units and 167 one-bedroom units) and is currently managed by Jozi Housing. Fig. 3.10. shows the location of Coronia Gardens in Berea, indicating the neighbouring suburb of Hillbrow to the West, Yeoville to the East and Doornfontein to the South. Coronia Gardens was built as a hotel in the 1970s serving as an attractive venue within the inner city for many years (CoJ, undated(a)). From the 1990s, however, Berea and its surrounding areas became undesirable due to high levels of crime, white and capital flight, and the rapid influx of black migrants. Following this period of economic and physical decline, Coronia Gardens, along with many other neglected inner-city buildings, was taken over by criminals, leading to the building being hijacked (*ibid*). Jozi Housing acquired the Coronia Gardens building through the BBP programme in 2010 and thereafter redeveloped the property, spending roughly R30 million in construction costs (CoJ, undated(a)) The newly refurbished Coronia Gardens was completed in 2013.

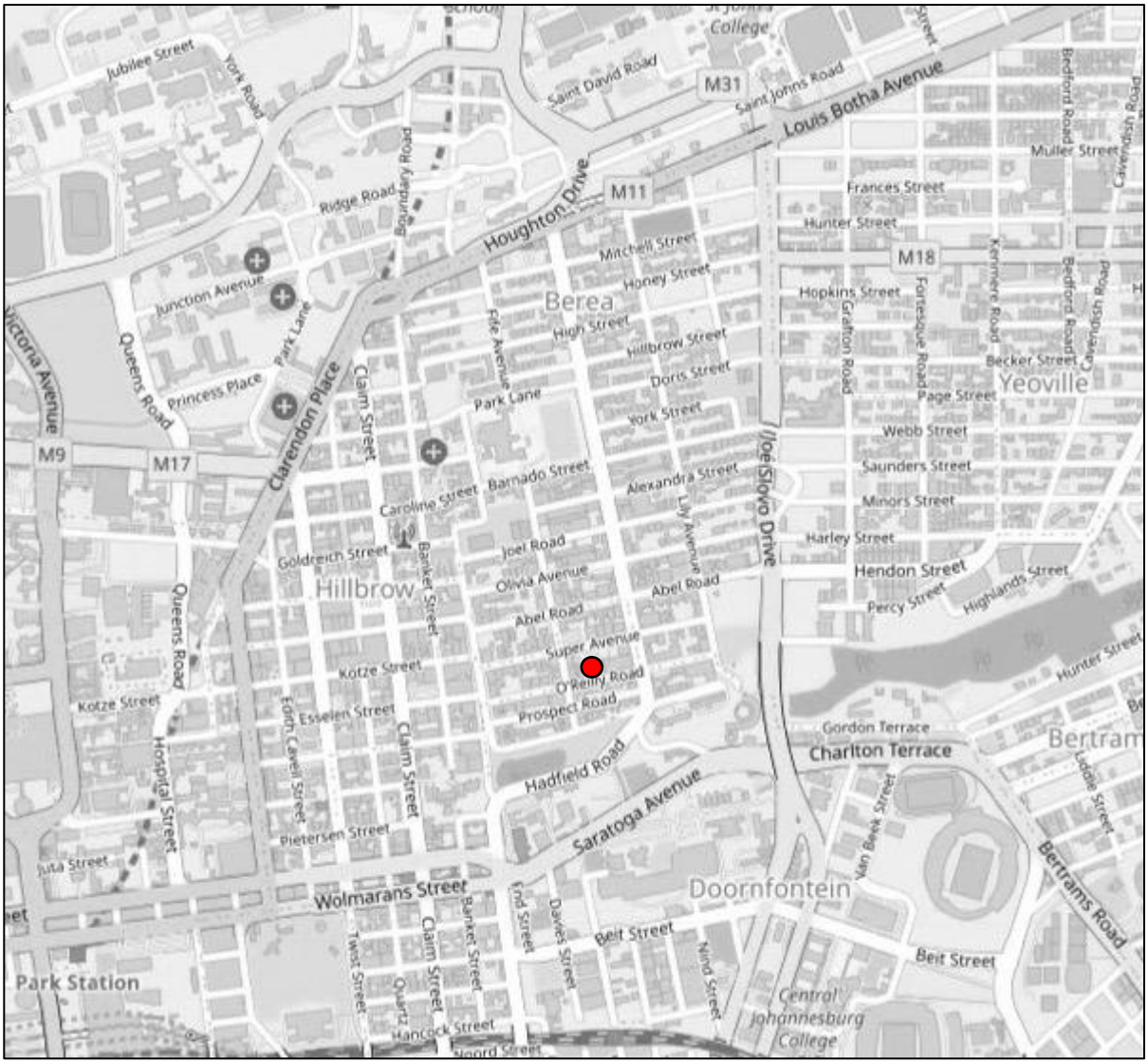


Figure 3.10: *Location of Coronia Gardens in Berea*
(Source: Open Street Map, 2021, adapted by Author)

Currently, Coronia Gardens caters to lower and middle-income populations residing within the inner city. Coronia Gardens has 24-hour security, biometric access control, closed-circuit televisions, secure parking, WIFI, a library, a gym and a crèche. Additionally, there are 3 retail spaces on the ground floor and a local SPAR retail store is located about 500 metres across the road (https://www.jozihousing.co.za). Figure 3.11 provides a snapshot of Coronia Gardens as seen from the ground, illustrating its building footprint and high dwelling density.



Figure 3.11: *Coronia Gardens' façade (Source: Jozi Housing, 2018)*



Figure 3.12: *Street view of Coronia Gardens (Source: Resident D's photograph, 17 December 2021)*

From my (remote) observation, it seems that Coronia Gardens is generally well-kept by Jozi Housing. Fig 3.12 indicates a clean environment, at least at the entrance to the building. An underground parking entrance can also be seen in the above photograph.

The Coronia Gardens rooftop farm opened in 2019 and was designed as an intensive *rooftop greenhouse* with crops being grown using hydroponics, planted in six A-frames. Produce is grown in tunnels where water and nutrients are recycled through the system. The UAI routinely checks the water quality to ensure that no contamination occurs in the growing of their produce. The UAI has in the past experimented with growing various vegetable crops such as basil, celery, strawberries, spinach, lemongrass and several varieties of lettuce (UAI Project Partner 3, interview, 9 November 2021). The UAI recently specialised its food crop to focus on spring onion largely based on economic viability and continued demand for spring onion amongst inner-city retailers, restaurants and ultimately inner-city consumers. Fig. 3.13 and Fig. 3.14 show the rooftop greenhouse structure of the rooftop farm as well as a close-up view of the spring onion and lettuce that is currently growing on the farm.



Figure 3.13: *Exterior view of the Coronia Gardens rooftop farm*
(Source: UAI farmer Y, 22 November 2021)



Figure 3.14: *Lettuce and spring onion grow at the rooftop farm, using hydroponics (Source: Resident D's Photograph, 17 December 2021)*

3.6. Conclusion

Johannesburg has undergone a series of iterations regarding UR in the post-apartheid period. Inner-city investment has been driven by both the public and private sectors, with the private sector capitalising on incentives such as the UDZ. In comparison with private rental housing delivery, state-delivered inner-city rental housing, in the form of social housing units and community residential units, is severely limited. This chapter contextualised the neighbourhood of Berea and its settlement and demographic characteristics within the ambit of the inner city. Further, I outlined the UAI's role and function in the inner city context, a space that is constantly evolving. The UAI relies on commitment, active collaboration and strategic partnerships among key stakeholders. The JICP in particular, as the UAI project incubator, capitalised on existing networks of influence within the inner city to obtain private-sector buy-in, thereby sustaining interest and investment in the initiative. This chapter then described

Coronia Gardens and specifically the Coronia Gardens rooftop farm. The produce grown here is facilitated by hydroponic farming, a highly-intensive farming method focussing on speciality crops resulting in relatively high yields. Coronia Gardens is an example of private sector-led UR and housing development in Berea, a neighbourhood that has experienced a history of physical and economic decline and resultant neglect in the post-apartheid period. A major challenge in Berea is a widespread lack of public and social infrastructure, particularly parks, schools, and other recreational spaces, leading to a scarcity of such valuable resources in an already highly populated and dwelling-dense neighbourhood (Silverman and Zack, 2008). In the absence of adequate green space provision in Berea, how could rooftop farms potentially address this challenge in a neighbourhood like Berea? The next chapter unpacks the relationship between the Coronia Gardens rooftop farm, its existence and function tied to the Coronia Gardens building, and its current influence on Coronia Gardens residents.

4. CHAPTER FOUR: 'VIEWS' FROM THE TOP – ACCOUNTING FOR DIFFERENT PERSPECTIVES AND EXPERIENCES OF THE CORONIA GARDENS ROOFTOP FARM

4.1. Introduction

This chapter presents and analyses key findings from my fieldwork by weaving three different perspectives of inner-city rooftop farming in the case of the UAI rooftop farm at Coronia Gardens in Berea. Aligned with my research question, my research methods sought to analyse insights from three different respondent categories, These three respondent categories are 1) UAI project partners; 2) UAI farmers and 3) Coronia Gardens residents, each reflecting unique perspectives relating to the UAI Coronia Gardens Rooftop Farm in Berea. Firstly, UAI partners' insights are presented and discussed to explore the UAI's role and function, alongside the Coronia Garden's rooftop farm's existing social and environmental outcomes. Secondly, I provide and reflect on the experience of UAI farmers' who are immersed in rooftop farming within the inner city and who are deriving livelihood and social capital benefits. Thirdly, I analyse Coronia Gardens residents' perspectives and experiences in relation to the UAI, including an analysis of their perceptions, awareness, and attitudes towards rooftop farming, and if, at all, the rooftop farm at their residence is influencing their housing experience or living circumstances. I conclude this chapter by identifying the interrelationships between rooftop farming, UR goals and initiatives in the CoJ and reflect on the implications for sustainable housing.

4.2. Research design and methods

Due to the exploratory nature of my research question, I chose to conduct interviews with the three different respondent groups outlined in the previous section. At the time of my fieldwork phase, we were in the third wave of COVID-19, thus significantly restricting my access to the

Coronia Gardens site. Doing research in the context of Berea, an impoverished and highly dense area, also brought unique challenges for me as a young Indian urban planner and researcher. For example, I tried to bring an open and friendly approach to each interview, especially with UAI farmers and Coronia Gardens residents. Overall, I approached all interviews with sensitivity, care, and consideration. I took my time in explaining the nature and purpose of my research and encouraged participation through positive body language and allowing respondents to speak, without interruption. My cumulative professional work experience as a social researcher and urban planner gave me confidence based on my critical thinking skills and analytical rigour. However, due to challenges of carrying out research virtually as opposed to in person forced me to be flexible. In this way, I was able to approach my research report incrementally and iteratively and I believe this steady process facilitated my learning and engagement with my research topic.

Having gained professional experience as a social Researcher, I feel I was well-equipped in handling planning, designing and conducting qualitative interviews remotely. Although I was unable to visit the building site and farm at Coronia Gardens, I obtained permission from one of the UAI farmers and the UAI to capture photographs that are used in this Research Report. Although I initially hoped to get a larger sample, I settled on a total of ten respondents based on the above-mentioned challenge, including time and labour constraints. The starting point for me to explore my research topic was the UAI as an organisation itself. After reaching out to the UAI and obtaining permission to conduct research at Coronia Gardens, I was put in touch with key people that could identify UAI farmer respondents and Coronia Gardens residents respectively and that could thereafter invite these individuals for an interview on my behalf. This type of small-scale snowball sampling technique based on word-of-mouth and sharing information via networks assisted me during the latter stages of my fieldwork, particularly with Coronia Gardens residents.

The three perspectives outlined in the sections below are those of UAI project partners, UAI farmers, and residents of Coronia Gardens themselves. UAI project partners refer to individuals who are directly involved in the institutional and operational components of the UAI. In contrast, UAI farmers are employees of the organisation and are involved in farming activities, and are generally responsible for the day-to-day management of respective rooftop farms across Johannesburg's inner city. Lastly, residents are those living at Coronia Gardens in Berea. These residents are not involved directly or indirectly in the operations or management of UAI. Based on these three perspectives, I aim to draw out recurring themes, potential relationships or indeed conflicts between key respondents, whilst also reflecting on the significance, credibility and reliability of the data itself.

4.3. The UAI is more than just an agriculture business

At its core, the UAI is a social and economic enterprise that promotes urban agriculture as a sustainable economic activity within Johannesburg. Although being a relatively young organisation, having formally been established in 2017, the UAI has effectively demonstrated a promising business case for UA, specifically, rooftop farming in dense inner-city neighbourhoods. According to UAI project partner 3, the UAI's primary aim is:

> "to grow a value-chain… by establishing primary growers within the urban context and to establish linkages to market to service urban consumers. So we see the UAI as a coordinating body…our primary role within our immediate ecosystem is to coordinate production and coordinate input, so making sure the value-chain is working efficiently and effectively."
>
> UAI project partner 3, interview, 9 November 2021

I uncovered several other indirect benefits throughout my interviews with the key respondents. As noted by UAI project partner 3

"[t]he original concept [of the UAI] was a small business development concept. This wasn't aligned to food security, it wasn't aligned to UR. It wasn't aligned to job creation. It was about how do we create a useful business. And obviously, there are positive outcomes that work, but if you create food security, if you do this in the inner city, you are helping to create more sustainable settlement types. That was not the primary driver. The primary driver was how do we create a useful business."

UAI project partner 3, interview, 9 November 2021

4.3.1. Supporting employment creation and small business development

The UAI's business model involves training local individuals to become successful farmers and entrepreneurs who can run and manage their own UA enterprises. Through job creation, skills development and mentorship, the UAI is playing a role in supporting new types of enterprise development in the agricultural industry, revealing important benefits to tackle many of South Africa's challenges related to high levels of employment and poverty.

"[F]rom an enterprise development, from a small business point of view, what you're doing is you're creating jobs. So you're taking people that have no special training or anything…they're no requirements for the participants, in fact, they could be someone off the street basically. So the access barriers are very low – anybody can participate. And then, what you're doing is actually creating small businesses…So, those are all huge benefits…"

UAI project partner 1, interview, 8 November 2021

UAI project partner 3 provides a similar perspective on rooftop farming's role in employment creation but explains the additional social benefits he has seen in certain rooftop farming sites.

"So, where we work, we often have residents, for example of Coronia or Jozi Housing residents that would come in on a part-time basis and help us with harvesting and planting and they would get paid for that work. So that's money that they can take

> back and they spend it in the inner city, or they use some of it to pay their levies…and that's money that would've normally just [gone out of the city]. So, at a micro-level, that's sort of where we see UA playing a role when you consider social issues…"
>
> UAI project partner 3, interview, 9 November 2021

From my interviews with UAI project partners, all the respondents acknowledge the significant role of people, networks, partnerships, vision, dedication and political will. Furthermore, the skills transfer component in the UAI business model provides an opportunity for sustained employment growth in the UA sector more broadly. In South Africa's context of high levels of youth unemployment, disengagement and disillusionment, this bodes well to inspire and empower the youth to serve as changemakers, leaders and environmental stewards.

4.3.2. Rooftop farms as green assets in urban regeneration?

The research findings confirm that UAI's rooftop farms make efficient use of underutilised areas within the inner city. Many of Johannesburg's roofscapes were not being utilised optimally. Many were being neglected or not used at all. The participation and active collaboration of private property companies like Jozi Housing was a crucial component in getting the UAI project off the ground. Improving living quality takes more than physical and economic investment in areas. Progress is not only determined by development, but also by positive social impacts, the small intangible things. The way residents, communities, and project participants feel and perceive their environments.

When analysing the role of UA in UR, several responses were elicited:

> "I think it definitely does play a role. It can play a role. I think ultimately, it's about the efficient use of space…and creating opportunities for people to live, work and play in urban spaces. So for me, urban farming, at the core of it, is about creating additional economic opportunity and ensuring that there is no leakage of funds or money out of it – the ecosystem."

UAI project partner 3, interview, 9 November 2021

"The principles of regeneration are to use what you already have and to use it better. My point of view is that rooftops are not being utilised. That doesn't make sense…It's about proper utilisation of an inner-city resource, which in this particular case is rooftops."

UAI project partner 1, interview, 8 November 2021

"I think rooftop farming plays a huge part in the inner city…moving away from the concept that you can only do your farming on land. You cannot use any space. But it shows with the rooftop farms, it shows that [you can farm] anywhere, anytime… You can eat from it, so it's something that's doable!"

UAI farmer Y, interview, 16 November 2021

These perspectives echo the arguments made by Gasperi *et al.* (2016), highlighting the benefits of requalifying vacant areas in cities. Land in the Johannesburg inner city is already a constrained asset. There are many competing demands for land within this context, most notably an immense demand for housing, particularly affordable rental housing. Respondents' views reiterate how rooftop farms serve as multifunctional and multidimensional land uses, where farming is embedded into an existing high-rise building yet has the flexibility to adapt its operations over time. Planning for greater land-use efficiency today will ensure that our cities are more environmentally-conscious and friendly, and more aligned with principles such as liveability, walkability and accessibility (UN-HABITAT, 2012).

4.3.3. Advocacy, education and awareness-raising

Through my interviews with respondents, there is consensus about the need to continue to advocate for rooftop farming and UA more broadly in Johannesburg and other South African cities. The UAI continues to play an advocacy role and frequently engages multiple stakeholders ranging from government officials, and universities, to banks and small

businesses. At the micro-level or neighbourhood scale, the UAI urban farmers have noted the knowledge gaps that exist between farmers and residents concerning hydroponic farming. Due to a lack of knowledge and understanding of these new farming techniques, residents may not be willing to engage or buy the farm's produce if given the opportunity. A lack of residents' buy-in needs to be tackled through greater engagement with residents while also encouraging more participation and involvement of residents in the rooftop farm – either through volunteer work or custodian roles.

To ensure the sustainability and longevity of the UAI programme, more landlords need to agree to host new rooftop farms. The goal of the UAI is to continue expanding its rooftop farm footprint by creating as many rooftop farms as possible with its funding streams. There are still many untapped and underutilised roofscapes in Johannesburg that meet the requirements to establish rooftop farms. It comes down to the willingness of private property companies and arguably, also the CoJ to come to the party and play their respective roles. Current ambiguous zoning laws represent threats to fast-tracking rooftop farming implementation, simultaneously creating grey areas that are deterring some developers from pursuing potential projects.

> "The CoJ has now changed their zoning definitions to also incorporate urban farming. But, it is understood that that is in the context of ground-level, pulling soil within the urban space, right? So there's a need for Environmental Impact Assessments, soil analyses and all of these sorts of things… But that's not applicable in the context of a rooftop urban farm. So there were disagreements around some town planners as to whether rooftop farms, using hydroponic technology, actually needed to be zoned at all. Whether even if it's considered 'urban farming' in terms of the zoning law. So… a very important step would be for the CoJ to be very clear around when we talk urban farming, what does that mean? And where does rooftop farming fall into that?"
>
> UAI project partner 3, interview, 9 November 2021

Similar reflections were raised by UAI project partner 2 who suggested how the CoJ could actively support the growth of the rooftop farming sector in the City:

> "If the City [of Johannesburg] knows you are involved with a particular building, you have a rooftop, I think they must try to get more people involved. To say 'ok, we see that you are participating in this green initiative. Let's see how we can assist you in terms of rates.' I would like to see that.
>
> UAI project partner 2, interview, 2 November 2021

If the CoJ could provide tax incentives for establishing rooftop farms in inner-city areas, this could allow more rooftop farms to be 'built' into planned high-rise developments. If these incentives were further linked to specific inclusionary housing or affordable rental housing projects, it could provide an injection of jobs into the inner city, potentially supporting new and transient urban households.

4.3.4. Environmental impacts of rooftop farms

Growing food on rooftops across Johannesburg's inner city has added to the green infrastructure of the city. As argued by Ansell (2017), rooftop gardens, including rooftop farms, should be facilitated by urban planning legislation and policies. Ansell (2017) proposes greater support of rooftop gardens across Johannesburg, alongside the integration of rooftop gardens into green infrastructure planning and management. The trajectory of rooftop farming will likely see a growth in the spatial footprint of rooftop farms. Some of the environmental benefits identified by respondents include improving urban biodiversity, reducing food miles and localising food production. These benefits are consistent with the global literature on RA (see Orsini *et al*. 2013, 2020; Appolloni, *et al*. 2021).

> "We all know that Joburg [and its] CBD is a concrete jungle. So, you need a bit of that greenery. [Rooftop farms] play a role in the ecosystem at large. We really are in need of greenery. Not seeing this concrete jungle, but also the greenery has played even a major role in that. It [is] also the beautification but also the serious sort of element, cos [sic] you know photosynthesis, all those things."
>
> UAI project partner 2, interview, 2 November 2021

> "The more green [a city is] the better because rooftop farms also affect the ecosystem by improving biodiversity"
>
> UAI farmer X, interview, 14 December 2021

As discussed in Chapter two, rooftop farming is one component along a *spectrum* of possible UA activities in Johannesburg, ranging from farming taking place in informal settlements, in formal backyards across townships and suburbs, on inner-city farming plots, and atop high-rise buildings in the CBD and across other parts of the city. Collectively, these different farming activities can complement one another, creating a sustainable farming ecosystem. One of the limitations of the UAI rooftop farms is that they are, for the most part, inaccessible to residents and the public. Residents are only granted access through permission from the Farming Manager, or the Building Manager and visits are always supervised. Any other visits by outside guests must be facilitated by the UAI. This is partly due to safety concerns, but also to limit unwarranted interference or disturbance to the farming activities on the building's roof. Therefore, the potential of roofscapes to also serve as sites of socialisation and relaxation for residents is currently not realised. However, some residents have occasionally been involved in the harvesting of vegetables from the Coronia Gardens rooftop farm on an ad-hoc basis, including children and young adults.

4.4. Empowered urban farmers: Sowing seeds of hope

Both UAI farmer Y and UAI farmer X (aged in their 20s) have had some exposure to UA while growing up. In their adult lives, UAI farmer Y was skilled in different types of farming, including organic farming, aquaponics and hydroponics and formally joined the UAI programme in 2018. Farmer X, on the other hand, has a tertiary degree in horticulture, as well as over 5 years of technical farming experience. Both urban farmers currently stay in the inner city, showing a dedication to working towards a new, more socially and environmentally equitable future.

> "[Rooftop farms] are a really, really good concept. If you look around Johannesburg, we only have flats. We only have space that they don't really do anything with [referring to underutilized vacant spaces]…[the UAI's rooftop farms] increase the [food] production in some sort of way, especially in the inner city where people think that agriculture cannot really be implemented. But it can be done."
>
> UAI farmer Y, interview, 14 December 2021

From both my interactions with urban farmer respondents, I observed a deep appreciation attached to UA and their work as UAI farmers. UAI farmer X has been with the UAI since 2017 and notes the positive feedback he has received and the enthusiasm shown for rooftop farming endeavours in the CBD. He adds that many visitors take pictures and ask several questions. He senses that the visitors feel empowered by what they witness and that they benefit from the exposure to new farming methods and associated possibilities, explaining "[t]here is so much amazement and excitement that something of this nature [growing food on top of high buildings] can be done on a rooftop!" (UAI Farmer X, interview, 14 December 2021).

UAI farmer X is thankful for the experience this job has provided, saying "there are not many rooftop programmes in the country I feel grateful and privileged to be involved with the UAI. The experience I have gained is vital. I am learning a lot and I am inspired for the future." (UAI farmer X, interview, 14 November 2021). UAI farmer X and UAI farmer Y agree that farming is very therapeutic. It grounds them and connects them to nature. In comparison to Coronia Gardens residents, both urban farmers have derived more social value from the rooftop farm. Through their work and engagements with residents and site visitors, the farmers have gained social capital through enhanced social networks. This entails daily interactions with residents, farm visitors and UAI partners and staff. UAI farmer X often meets with students and residents, most of whom are young, who have shown the most interest in UA and rooftop farming,

explaining that “[t]here is a positive social impact between farmers and residents [in the form of] knowledge exchange, learning, awareness building.” (interview, 14 December 2021).

Additionally, the farmers serve as custodians of UA and are very willing to share their knowledge with other groups. These groups range from tourists who visit nearby landmarks such as Ponte in Hillbrow, university student groups, corporate groups, and school groups. The farmers have also engaged the youth currently living at Coronia Gardens who are keen to learn more about hydroponic farming. UAI farmer Y has used this collective interest as an opportunity to teach young children about the importance of rooftop farming, specifically hydroponic farming, including sharing knowledge about the origins of food. However, UAI farmer Y agrees with UAI farmer X that many inner-city residents have a limited understanding regarding rooftop farms and UA, presenting an ongoing challenge to the UAI programme:

> “[a] lot of people, they still need to be educated. This system [hydroponic farming] is still growing in South Africa. It’s not really a huge [well-known] system that people are aware of or even understand, we still have to work on people’s minds because they are used to the land [traditional farming models]. The thing with growing food with water is still new to them, so, it’s a space we really need to work on.”
>
> UAI Farmer Y, Interview, 16 November 2021

Despite this apparent challenge, UAI Farmer Y acknowledges witnessing slow changes in the way residents perceive the rooftop farm:

> “slowly but surely, people [residents and neighbours] are being keen.. you find that people, ask for my contact. They just want to know more about it [the rooftop farm]. They would like to embrace the experience and to see the environment, how it really works.”
>
> UAI Farmer Y, Interview, 16 November 2021

Overall, urban farmers’ experiences are generally positive and they both agree, consistent with Pillay’s (2017) study, there are more benefits associated with rooftop farming than

limitations. Regarding existing challenges, rooftop farms are more exposed to the elements than UA at the ground level due to the high heights of inner-city buildings (often over 10 storeys). Both farmers identified extreme winds and exposure to harsh sunlight as threats. But these are mitigated by careful maintenance and monitoring of the rooftop greenhouse structures that are designed to protect crops from the natural elements. I uncovered two further unique constraints to hydroponic farming in a South African context: hydroponic farms need a consistent energy source to operate and to support optimal food production. In South Africa, however, particularly in Johannesburg, load shedding has forced the UAI to buy generators that have to be immediately switched on when a power cut occurs. The generators act as backup energy sources. The second constraint is the unreliable water quality that feeds into the nutrient solution in which plants grow. The UAI continuously tests the water quality to ensure they meet its food standards and certification.

In some instances, the UAI found water contamination after testing water samples. Contamination can jeopardize the entire organisation and effectively put them out of business. Thus, the UAI spends a lot of time checking the water quality in all its hydroponic farms, while remaining extremely reliant on municipal service delivery. Ideally, as noted by UAI farmer Y, the electricity for the UAI's rooftop farms should come from solar power (photovoltaic panels). However, due to a lack of solar panels on the rooftops of Jozi Housing residences, the UAI has had to make a trade-off in using generators that use fuel, thereby compromising environmental sustainability goals.

4.5. Resident perspectives of rooftop farms

Residents of Coronia Gardens represent a diverse demographic group. Johannesburg, is South Africa's largest city and economic hub attracting many migrant populations, both from rural areas and from neighbouring countries in Southern Africa. The Johannesburg inner city in particular is a melting pot of cultures and nationalities. Table 4.1 describes the resident sample and their' household characteristics.

The information is contained in Table 4.1. was derived directly from my interviews with the 5 respective Coronia Gardens residents. To protect resident identities, I have labelled the resident sample as Resident A-E in the rest of this chapter.

Table 4.1: *Snapshot of resident sample living at Coronia Gardens, Berea (Source: Author, 2022)*

Resident ID	Birthplace	Gender	Age	Household size	Unit type	No. of years living in inner city	Current Job
Resident A	Bulawayo, Zimbabwe	Male	26	2 (lives with his brother)	Bachelor	5	Uber Driver (All across the city)
Resident B	Malawi	Male	Not disclosed	2 (lives with his wife)	2 bed	13	Security Officer (Berea)
Resident C	Bulawayo, Zimbabwe	Female	24	2 (lives with her husband)	Bachelor	3	Unemployed
Resident D	Johannesburg, South Africa	Female	Not disclosed	1	Bachelor	6	Waitress (Randburg)
Resident E	Johannesburg, South Africa	Female	Not disclosed	4 (lives with husband and 2 kids)	2 bed	12-13	Domestic worker (Bryanston)

4.5.1. Current housing and living circumstances

My interactions with residents revealed that, on the whole, they are satisfied with their current living circumstances. In particular, most of the residents feel that Coronia Gardens offers many benefits such as secure parking, safety (in the form of closed-circuit television cameras and a neighbourhood patrol), and good amenities, such as ground-level shops and nearby supermarkets. When probed about the general inner-city environment, all of the residents agreed that parks and public spaces are not spaces, resulting in them not visiting parks for fear of being attacked or robbed. Despite not making use of parks in their immediate vicinity, the residents acknowledge that parks and other green spaces can and do play a positive role in Johannesburg. According to Resident C, parks “bring oxygen to the people. Joburg is a crowded place. We need more parks.” (Interview, 17 December 2021). Although residents are informed of the benefits linked to urban parks, they cannot fully translate the similar benefits that UA typologies play in Johannesburg.

Despite various safety concerns, all of the residents believed that living in the Johannesburg inner city has more benefits than drawbacks. For example, according to Resident E, “Jozi is good for work, staying in Jozi provides the easiest way to get to work opportunities… staying centrally is beneficial as it is close to taxi routes and it is accessible and affordable to get around.” (Interview, 8 January 2022). I then enquired specifically if the residents noticed any neighbourhood changes in Berea since moving into Coronia Gardens. Residents hold differing viewpoints, somewhat influenced by when they moved to Coronia Gardens. The residents that have lived there for a longer period argue that they have seen steady improvements in Berea. Resident B explains the changes he has witnessed in Berea, saying: [a] lot of changes have occurred... [There have been] a lot of buildings renovated, a lot of different things in different areas [of the Joburg CBD] …. In 2006/2007, Coronia Gardens was a bad, bad, bad building, now it’s a good place!” (Interview, 14 December 2021).

For the residents who have recently moved to Coronia Gardens, their sentiments are different. These residents hold negative views of the inner city related to poor urban management, poor service delivery and the constant threat of crime. Resident C adds that “[i]n 2019, things were better, right now there are so many problems, like the looting in 2021, robberies and poverty.” (Interview, 17 December 2021). The current dire economic circumstances place pressure on an already constrained inner-city housing market. The formal rental housing market in the Johannesburg CBD is currently under strain as many renters cannot meet rental payments due to job losses, alongside the ever-rising costs of living. Food price increases, in particular, are affecting more vulnerable households, including those living or staying in the inner city. The resident participants concur that food prices, both supermarket goods and those sold by informal traders, are unaffordable. What the residents require is cheaper food, an apparent rooftop farming benefit. The following section explores the residents' detailed perspectives of rooftop farms, particularly in Berea.

4.5.2. Degrees of awareness and acceptance of rooftop farms

As noted in section 4.1.3. as well as section 4.2., residents' awareness of the rooftop farm at Coronia Gardens is generally fairly low. This could be explained by the poor performance of the rooftop farm when farming infrastructure was first installed in 2019 Since 2020, however, a new Farming Manager has taken over the rooftop farm and the farm's productivity has drastically improved (UAI project partner 2, interview, 2 November 2021). Jozi Housing has graciously allowed the UAI's Farming Manager to live in a flat at Coronia Gardens for free. The only requirement is that the price of water and utilities be paid. The Farming manager previously used to live in Tembisa, having to commute to the CBD daily. By living and working in the same vicinity, she feels a level of freedom and a better sense of productivity in her duties as an urban farmer.

Regarding existing knowledge around concepts such as UA and rooftop farms, I found a limited understanding of both concepts. Only two residents were able to adequately describe UA, with only one resident who has seen and spent time at the Coronia Gardens rooftop farm. For most of the residents, rooftop farming is a foreign concept, far removed from their everyday lives, and reflects low levels of awareness related to rooftop farming reported by Pillay (2017). It was important to get a sense of residents' perceptions of these concepts. Fig 4.1 provides an overview of all the word associations made by residents in their interviews with me.



***Figure 4.1**: Word cloud generated from resident transcripts, indicating the most recurring keywords and phrases used (Source: www.monkeycloud.com)*

The larger the words in Fig 4.1., the more times they occurred in the resident transcripts. After the obvious terms of UA and rooftop farm, a variety of other words and phrases recurred, revealing the associated benefits and shortcomings of inner-city rooftop farms. Rooftop farming was identified by one respondent as an ideal activity to empower children, especially those living at Coronia Gardens, but also other children living in proximity to the rooftop farming site. Although some residents identify the rooftop farm as a “safe place”, there were two occasions where crime, or the threat of crime, pose challenges to rooftop farming operators in the CBD. Residents made the association between farming and vegetables, annotated as “veggies” in Fig 4.1. yet, two out of the five residents associated rooftop farms with the word “nuisance”. Similarly, phrases such “disease outbreaks” and “attracting mosquitoes and pests” are also used to describe rooftop farming activities in the inner city (Residents C and D, interviews 8 and 9, 17 December 2021 and 7 January 2022). In all these cases, residents noted concerns about the lack of cleanliness and concerns about food contamination. Cheaper food was noted as one benefit of rooftop farms. However, anecdotally, Resident B and Resident E explain that most residents are not aware of the rooftop farm at Coronia Gardens and have limited to no awareness of the farm’s existence or the vegetable crops that it harvests. A limited direct-to-resident market is a current limitation of the UAI’s food supply and value chain.

The majority of the UAI’s harvest from all of its rooftop farms is sent to its agro-processors, Glamour Veg Packhouse, located in Krugersdorp, where the fresh produce is cleaned, sorted and packed, thereafter being distributed to local retailers and restaurants within the inner city. A very small amount of each harvest is sold directly to Coronia Gardens residents (UAI farmer Y, interview, 16 November 2022). Seemingly, this type of distribution model doesn’t favour the food demands of residents. Additionally, due to the highly specialised crops grown based on intensive hydroponic farming requirements, the UAI currently has a lack of crop diversity. The full impact of the UAI’s operations is yet to be seen and indeed felt. Unlike other globally established rooftop farms like Brooklyn Grange in New York or *ComCrop* in Singapore, the

Coronia Gardens rooftop farm cannot currently meet the food security or nutrition security requirements of residents. These findings contrast with Orsini *et al*. 2014 who illustrate a positive correlation between rooftop farms and food and nutrition security in Bologna, Italy. I uncovered another constraint in that some residents don't feel involved or invested in the project. Resident E for example, explains how many residents were not told there was a rooftop farm at Coronia Gardens, they were "just told that someone was selling veggies" (Interview, 8 January 2022). I feel that greater residents' involvement in the rooftop farm may prove beneficial to the residents themselves. My findings are therefore inconsistent with rooftop farming experiences in both Hong Kong and Sydney as reported by Wang and Pryor (2019) and Ghosh *et al*. 2016), and generally positive perceptions of UA noted by Grebitus *et al.* 2017). In future studies, gathering a larger residential sample size in either a quantitative survey-based analysis or through larger resident focus groups may assist in understanding the experiences of Coronia Gardens residents in more detail. For me, I think that education is a key factor because, the more residents learn, the more they will want to engage, and this could encourage residents to connect more with their neighbours but also importantly, could provide important collaborative learning opportunities amongst the UAI, its farmers and Coronia Gardens residents.

4.6. The potential future scenario for rooftop farming in Johannesburg

Local food economies play important roles in cities, existing alongside a variety of UA initiatives at different scales that are growing food within and across Johannesburg. The UAI and its various farming projects have been highly flexible and able to adapt to various changes since its operation in 2016. With insights, iterative learning and considered reflections of UAI project partners, as demonstrated in my qualitative findings, the initiative is now in a phase where it's poised to expand. Its future success and reach as a socio-economic enterprise in Johannesburg are reliant on greater policy and planning alignment alongside the buy-in of a greater share of property owners and managers across the city. I believe that involving the

future residents of buildings earmarked for rooftop farming projects is essential to support, sustain and grow rooftop farms that can accommodate a diverse production of affordable fresh fruit and vegetables. The UAI is a relatively young organisation, a newcomer to the UA sector in Johannesburg and South Africa. According to the UAI's Roadmap, current modelling studies suggest that a total of 35 additional rooftop farms could be established in Johannesburg by 2030, adding an extra 1ha to the UAI's rooftop farming spatial footprint (UAI project partner 3, interview, 9 November 2021). At this point, the UAI believes that its farming operations will reach a level of sustainability. Presently, each farm operates as a sustainable entity but there is more potential to grow the economies of scale associated with food production on inner-city rooftops. My findings reveal a lost opportunity of connecting the UAI's rooftop farms with the ground level. UAI project partner 1 believes that there is currently a disconnect between people on the ground and the inner-city rooftop farms. Limited access to rooftop farms is not the only challenge. In the future, there may be opportunities to establish local fruit and vegetable markets at the ground level that sells produce grown on rooftop farms (UAI project partner 1, interview, 8 November 2021). These markets could take place in nearby parks, underutilised public spaces and streets (*ibid*). In this way, the local economy can be stimulated through job creation, tourism activities, and circulating local money in the inner-city economy.

I also discovered an interesting potential linkage between the UAI's rooftop farms and inner-city development proposals at the ground level. The JICP is in the process of implementing its Walkable Network (WN) Project, aiming to enhance the liveability of the inner city through a network of walkable routes that are safe, clean and activated through street furniture, art, lighting and most importantly local economic activities (see van Niekerk, 2020). The WN project aspires to welcome people back into the inner city while improving the lives and daily experiences of people already living in the inner city. The WN aims to integrate UAI rooftop farms into the planning and implementation of the project.

Rooftop farming's future success is dependent on institutional support from the CoJ. Planning by-laws and zoning schemes and regulations should not be a hindrance to implementing future rooftop farms. Political will is crucial, but this should also be backed up by overt policy support and planning incentives. Alongside this institutional support, is the necessary funding support. The UAI currently relies on donor funding to support its main programme to train individuals to be farming entrepreneurs. Furthermore, there are opportunities to link the UAI programme with relevant University and Technical College departments that could 1) supplement existing funding streams; 2) provide learning and training opportunities to students and 3) create a research pipeline to evaluate rooftop farms over time and to possibly test new farming technologies in residential settings.

> "[t]he Universities have major land-holdings as well which are quite close to the inner city… if you just look around, there's a lot of University rooftops which are probably unused. And I think, what also could be a nice link is…smart cities…almost like a tech incubator kind of thing. You know, just linking that with the UAI could be very interesting as well because now what you're doing is asking how can you improve the farms through technology?"
>
> UAI project partner 1, interview, 8 November 2021

Relating to sustainability and fostering sustainable housing, rooftop farming must ensure efficient and effective uses of resources. Ideally, this would entail clean or green energy systems such as solar power and the recycling of both inputs (water) and outputs (food waste). The whole food value chain has the potential to become hyper-localised. As noted in section 4.3.3., the UAI's agro-processing facility is located far from its inner-city rooftops. The company plans to set up an agro-processing facility in Braamfontein that would allow for a more sustainable and resource-efficient food supply and distribution (UAI project partner 3, interview, 9 November 2021).

Regarding residents, I believe they could benefit from a closer connection to the food grown and harvested on their rooftops. Education and exposure to rooftop farming are very important as impacts could be long-lasting in an area like Berea. The UAI rooftop farms, in their current form and function, produce large quantities of speciality crops that are sold and distributed to inner-city retailers, restaurants and ultimately inner-city consumers. To reach greater sustainability in the inner city, the scale of food production and the diversity of food grown ought to be enhanced and supported. Enabling more UA projects across the inner city requires that landowners, both public and private, offer underutilised or disused spaces to support new farms. As UAI project partner 2 argues:

> "The future is there, the future is bright. But UA will only be sustainable if there are more people who are raising their hands to say "listen I got space". With no space in the inner city, I don't see it surviving."
>
> UAI project partner 2, interview, 2 November 2021

4.7. Conclusion

This chapter has woven three different perspectives of actors involved in the Coronia Gardens rooftop farm. From UAI project partners' insights, my findings illustrate how the UAI has multifunctional outcomes with benefits in the form of employment creation, skills development through agricultural training, establishing a pipeline of entrepreneurial farmers, and enhancing social capital and networks of UAI farmers. The JICP as the project incubator and coordinating partner played a significant role in seeing the vision of inner-city rooftop farms come to fruition. Similarly, Jozi Housing, alongside a small group of private sector inner-city landlords reflect a willingness, commitment and enthusiasm towards rooftop farming. The UAI as a sustainable socio-economic UA agriculture initiative provides lessons on the process and systems associated with initiating rooftop farming projects in once-disused inner-city rooftops. In this chapter, I have argued that the value of the UAI is multidimensional and multi-layered, albeit complex. While the CoJ has not actively been involved in the UAI programme, the municipality

is supportive of the initiative. Going forward, I hope to see a closer partnership between the CoJ and the UAI that could facilitate and upscale rooftop farms, with their growth planned for in strategic spatial planning frameworks and local urban management precinct plans. The UAI farmers' first-hand experiences in UA are overwhelmingly positive, reflective of an optimistic attitude and an inspired outlook of UA's role in the future of South African cities. At the household level, perceptions of rooftop farms are mixed, evidenced by Coronia Gardens residents' attitudes toward and relationship to the rooftop farm. While some acknowledge positive benefits that could be derived from growing food close to where they live, such as cheaper, better quality and more accessible food, some hold more negative perceptions and beliefs in the absence of limited knowledge and education of the UAI's rooftop farms and its associated food safety standards. Greater immersion into rooftop farming activities at Coronia Gardens may provide opportunities for residents to gain insight and renewed perspectives on urban food production.

5. CHAPTER FIVE: CONCLUSION

5.1. Introduction

This chapter summarises and synthesises key findings and reflects on the role of the UAI within Berea and the inner-city housing landscape against broader UR goals and strategies. I discuss the implications of rooftop farms in the inner city – both positive and negative – and unpack how Coronia Gardens residents currently relate to rooftop farming, and broader UA activities in the inner city. I begin by providing reflections on my overall research endeavour. I then reflect on my findings' significance and implications regarding inner-city housing provision and development, providing recommendations for future research.

5.2. Reflections on research aims, processes and outcomes

My research set out to explore the policy, functional, social and spatial relationships between rooftop farms, UR and sustainable housing in Berea, Johannesburg. My research analysed various outcomes and perspectives of rooftop farming in Berea using the Coronia Gardens case study. Upon carrying out my fieldwork and analysing findings, it is apparent that the linkages between rooftop farms, urban regeneration and sustainability in the context of the UAI rooftop farm at Coronia Gardens are neither clearly defined (in tangible, measurable terms) nor one-dimensional. The case of the UAI rooftop farming operations is both multi-layered and multidimensional, driven by a people-centred approach that leverages advocacy for UA a sustainable model for urban growth and development. The role of partnerships, coordination and tenacity of all UAI project stakeholders have been key to sustaining and nurturing this initiative. These aspects of rooftop farming are often underestimated and under-researched in contemporary rooftop farming literature that predominantly explores rooftop farming's role in and linkages to debates on food security, economic development and environmental, sustainability and resilience literature. My findings provide in-depth and nuanced reflections on how rooftop farming could potentially align with certain urban

regeneration and sustainable housing goals, providing benefits including employment creation, skills development, land use efficiency, and social capital for farmers. But resident benefits have not been realised. Challenges include limited involvement and engagement in the rooftop farm, low awareness levels, a lack of food crop diversity, and a disconnect between rooftop farms and ground-level activities. Confirming Pillay's (2017) research in eThekwini, a major constraint to upscaling rooftop farming projects is limited resident awareness of UA. Additionally, I encountered a general scepticism of rooftop farms that use hydroponic techniques, although this was not based on consumer food preferences (as noted by Specht *et al*. 2014) but rather reflects residents' attitudes, perceptions and beliefs regarding the concept of farming in Berea and the inner-city more broadly. To overcome these challenges I believe that going forward, the UAI could benefit from working alongside residents. Community collaboration may potentially involve educational campaigns, awareness and training campaigns, community support and outreach, educational campaigns, and planning and setting up food markets. My research also adds a spatial and land-use management dimension to rooftop farming. Following Lovell (2010) I have argued for the greater integration of sites and scales of UA as a proactive strategy to build on the multifunctionality of UA.

5.3. Reflections on inner-city housing and development in Johannesburg

The current spatial form and resultant settlement patterns in Johannesburg reflect high levels of differentiation between parts of Johannesburg. The inner city remains the historical core of Johannesburg providing access to jobs, both in the formal and informal sectors, transport links and networks and an array of affordable housing options. As discussed in Chapter two, rooftop farms can be beneficial to an inner-city environment based on their multifunctionality, providing benefits that expand beyond food production on roofscapes to include 1) enhancing green spaces within cities 2) improving biodiversity 3) reducing food miles and carbon emissions through localising food systems and shortening food-chains; 4) effective use of resources in farming and 5) community benefits in the form of solidarity, social networks physical and

mental health improvements (Lovell, 2010; Specht *et al*. 2014; Poulsen *et al*. 2017; Wang and Pryor, 2019). My research provided a snapshot of the UAI in its present form and function. Integrating rooftop farms into future inner-city residential buildings should be carefully considered, alongside broader approaches to integrate UA into existing land use systems. Lovell (2010) points to the need for sufficient infrastructure and support services within the entire urban food system that could enhance market connections, transportation systems, resource management and waste disposal systems.

There are however limitations to integrating rooftop farms and UA into the urban human settlements fabric of South African cities. The biggest barriers in the case of Johannesburg are the lack of specific policies on UA at the national, provincial and local levels, and ambiguous land-use mechanisms such as zoning rights that could incentivise the development of rooftop farms on suitable rooftops. I support Lovell's (2010) suggestion of compiling land-use inventories and conducting land suitability analyses to methodologically advocate and support UA planning within urban and spatial planning frameworks. In the CoJ, these largely quantitative studies may support the creation of city-level UA policies and ultimately implementation. Rooftop farming feasibility studies in existing social housing projects would be an important next step to understanding the current opportunities and barriers regarding the future planning of rooftop farms and their possible implementation. The success of rooftop farms in Johannesburg hinges on economies of scale that are brought about by a larger footprint of urban farming across the city, defined by a diversity of farming activities but also strengthened by the integration of functions, services and community networks. Thinking of ways to both include and appreciate diverse residents in future UAI rooftop farms could prove beneficial in supporting responsive and incremental neighbourhood improvements.

5.4. Recommendations for future research on the topic

Considering the UAI's growing profile within the local UA sector, and the organisation's generally positive outcomes, I recommend the following types of studies:

- **Comparative studies:** It may be interesting to present an analysis of the UAI's rooftop farms at different geographical locations within the inner city. Research could focus on the similarities and differences found between UAI rooftop farm sites in areas such as Braamfontein, Marshalltown, New Doornfontein and Berea. Additionally, the case of Johannesburg's rooftop farms can be compared with similar initiatives in other cities in South Africa if and when they emerge.

- **Longitudinal studies of the UAI Case Study:** Considering the potential longevity of the UAI project and its predicted financial sustainability, a longitudinal study on the impacts of rooftop farming projects should yield interesting results. Longitudinal studies can be further strengthened by developing sustainability indicators relevant to resident quality of life in the Johannesburg inner city. Indicators can then be collected quantitatively, and matched with a qualitative analysis measured over time. Sustainability indicators must be carefully devised and be appropriate to the case study context.

- **Modelling studies**: A value-addition to longitudinal studies is the potential of modelling research, for example, urban simulation models, studies based on statical analysis and spatial mapping of present and potential future rooftop farm sites in Johannesburg. Such studies could be framed through the challenges of future urban growth, rising food demands, climate change, and even global pandemics such as COVID-19.

- **Participatory and ethnographic research on rooftop farms alongside other UA projects:** A closer examination of emerging UA projects is needed, especially given the importance of urban farming in supporting local livelihoods as discussed in my literature review. The use of participatory and ethnographic research strategies adds an in-depth

narrative to the existing body of literature and will also be able to identify any challenges, constraints and threats inherent in existing urban farming projects, across different scales, and locations and involving different stakeholders and beneficiaries.

5.5. Summary and conclusion

Rooftop farming offers a viable solution to address both the climate change challenge as well as an inherently fractured food security crisis in South African cities. Following arguments in the Milan Urban Food Policy Pact (2015), planning and accommodating urban food production must take priority, with specific and practical planning mechanisms and incentives to support all types of UA in Johannesburg. My research explored the potential role and function of rooftop farming in inner-city Johannesburg, discussed against contemporary urban regeneration and sustainable housing literature. From studying the UAI Coronia Gardens rooftop farm, I recognise rooftop farming in Johannesburg is *more* than a 'solution' to food insecurity. I argue that greater visibility and local government support of rooftop farming projects will likely trigger enthusiasm for and future application of urban farming projects across all scales and configurations. In spaces within the Johannesburg inner city, this truly could be revolutionary, allowing for greater small-scale UA projects within (or nearby) well-located housing sites that, over time, could support affordable, accessible and fresh food supply to residents. For all the benefits of rooftop farming and potential positive future scenarios of rooftop farming, it is important to acknowledge that rooftop farms cannot be viewed as a panacea for unstainable forms of urban development. Sustainability, including sustainable housing development, intersects various economic, environmental, social and cultural dimensions. Therefore, rooftop farms should be viewed as *one component* in a step towards transitioning to enhanced sustainable urban forms and functions across various settlement types within Johannesburg. The success of rooftop farms in Johannesburg is therefore dependent on a holistic approach that links existing UA projects and that encourages mutual learning and knowledge exchange between various initiatives. Residents of buildings

on which rooftop farms are located should not be excluded from the process. Necessary steps towards greater resident acceptance of rooftop farms include more deliberate education and awareness-raising campaigns. Additionally, the CoJ has the ability and authority to play a central role in upscaling rooftop farming projects through funding, special zoning, planning incentives, partnerships, and by leasing rooftop spaces of buildings, especially residential buildings, held in their ownership. Linking rooftop farms to existing social and other affordable rental housing projects in the inner city, as well as future affordable housing stock, including student housing, might be a smart strategy and a step towards empowerment and greater self-sufficiency in Johannesburg's growing urban food economy.

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ANNEXURES

Annexure A: Ethics clearance letter with protocol number

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG | SCHOOL OF ARCHITECTURE PLANNING

04 October 2021

Faculty of Engineering and the Built Environment:

Ethics clearance letter:

Dear Shapurjee, Yasmin (0707260D) this letter confirms that your ethics application has been cleared.
Your clearance/protocol number is SOAP144/06/2021

Yours sincerely

Lerato Nkosi

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Annexure B: Example of Participant Information Sheet

Participant Information Sheet

Participant category: Key informants

Organisation: Johannesburg Inner City Partnership (JICP)

Good day,

My name is **Yasmin Shapurjee** and I am a Master's **student** in the School of Architecture and Planning at the University of the Witwatersrand, Johannesburg. As part of my studies, I must undertake a research project, and I am investigating the **function of urban agriculture in the Johannesburg Inner City** under the supervision of Dr Brian Boshoff. This research project aims to explore the impact of rooftop farms on inner-city neighbourhoods and households using the **Urban Agriculture Initiative (UAI)** as a case study. My research study is qualitative in its approach and holistic in its scope, aiming to evaluate how rooftop farms are contributing to supporting sustainable housing at a micro (neighbourhood) scale.

I have chosen to select you as a research participant based on your expertise in working on strategic urban regeneration projects and partnership-based projects in Johannesburg's inner city. In particular, I believe your role in managing and connecting project partners in the operationalization of UAI in farms is important to explore and understand for my research.

As part of this project, I would like to invite you to take part in an interview. This activity will involve an online semi-structured questionnaire and will take around 30-40 minutes. With your permission, I would also like to audio record the interview using a digital device. This recording will be stored in a password-protected computer and only the researcher will have access to this recording. Further, I request that relevant photographs that may aid in the reporting of the research findings be shared with me with your consent.

There will be no personal costs to you if you participate in this project. You will not receive any direct benefits from participation but there are no disadvantages or penalties if you do not choose to participate or if you withdraw from the study. You may withdraw at any time or not answer any question if you do not want to. If you experience any distress or discomfort at any point in this process, we will stop the interview or resume another time. Any disclosed confidential information will be kept confidential. The information you give to me will be held securely and not disclosed to anyone else. The name of your organisation may be identified in the research. Anonymity cannot fully be guaranteed in the reporting of findings based on your expertise and position within your organisation. However, I will still ensure the use of pseudonyms in my research report.

If you have any questions during or afterwards about this research, feel free to contact me at the details listed below. This study will be written up as a research report which will be available online through the university library website. If you wish to receive a summary of this report, I will be happy to send it to you. The data collected from this research project will be stored in a password-protected computer and will be kept securely. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

Yours sincerely,
Yasmin Shapurjee

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Annexure C: Example of Informed Consent Form

Informed Consent Form

Participant category: Key informants

Urban Agriculture as a driver for urban regeneration in Johannesburg: Exploring the impact of rooftop farms on inner-city neighbourhoods

I, ……., agree to participate in this research project. The research has been explained to me and I understand what my participation will involve. I agree to the following:

(Please circle the relevant options below):

I agree that my participation will remain anonymous	YES	NO
I agree that the researcher may use anonymous quotes in her research report	YES	NO
I agree that the interview may be audio recorded	YES	NO
I agree that the name of my organisation can be named or identified in the research report (in reporting of the researcher's findings in her Dissertation)	YES	NO
I agree to share relevant photographic materials with the researcher to aid in the reporting of findings	YES.	NO

…… (participant signature) ……..…….. (Date)

……..(researcher signature) …….. (Date)

Annexure D: Examples of interview guides

Interview Guide – Johannesburg Inner City Partnership (Key Informants Participant Group)

1. When was the JICP established and why?
2. JCIP function VS role of Johannesburg (CoJ) – how is JICP differentiated?
3. Please explain the aims and objectives of the JICP
4. What are the specific functions of the JICP?
5. In what areas does the JICP focus their programmes and/or projects?
6. Please explain your role in the UAI
7. How was the UAI conceptualised? Please explain
8. What do you think are the main urban challenges that the UAI address? How?
9. What are some of the benefits of rooftop farming in Johannesburg?
10. Do you perceive any weaknesses, risks or threats regarding rooftop farming in Johannesburg?
11. What are/have been the impacts of rooftop gardens on the inner city?
12. How have inner city neighbourhoods changed, if at all, after the establishment of rooftop farms?
13. What is your understanding of the concept of 'urban regeneration?
14. Can you reflect on urban regeneration programmes/policies and practices in the Johannesburg inner city?
    a. Strengths
    b. Weaknesses
    c. Opportunities
    d. Threats
    e. What lessons were learned
15. What do you think about the relationship between UA and urban regeneration?
16. How do Inner City property holders perceive rooftop farms?
17. How have inner-city residents responded to rooftop farms?
18. What do you see as the future role and scope of urban agriculture, specifically rooftop farms, in Johannesburg and other South African cities more broadly?
19. Are there any institutional or legislative or other challenges that may hinder the upscaling of UA in Johannesburg? Please explain
20. What role do you see the CoJ entities playing in supporting future rooftop farms in Johannesburg? Any specific people within CoJ?

Interview Guide – UAI Farmers (Urban Farmer Participant Group)

1. Where is home?

2. When did you come to Johannesburg and why?

3. Where do you live currently?

4. What do you think of the inner city and Johannesburg?

5. Please can you explain how you came to work for the UAI?

6. What do you think about urban farming and rooftop farming specifically?

- Strengths
- Weaknesses
- Opportunities
- Threats

7. Can you please describe the Coronia Gardens Rooftop Farm?

8. What type of farming does the UAI use? Please explain.

9. How do you feel about being an urban farmer?

10. What are your experiences working as a UAI urban farmer?

11. Can you think of any benefits and challenges of urban farming in the inner city?

12. Has your perception of food changed after working as an urban farmer?

13. How did COVID-19 impact your work as an urban farmer and the UAI as an organisation?

14. Can you explain how rooftop farms can be linked to sustainable development? In which ways?

15. Please describe the relationships you have with Coronia Gardens residents.

16. How do they (the residents) feel about this rooftop farm? And other types of UA in the inner city?

17. What are some of the challenges with regard to residents?

18. What do you hope to see in terms of the future of rooftop farming in Johannesburg and South Africa?

Interview Guide - Coronia Gardens Residents (Households Participant Group)

Background and Environment

1. How long have you lived here in the inner city (in this building)?
2. Are you renting or owning?
3. How do you feel about the inner city?
4. Have you noticed any changes to the inner city since you moved here?
5. Do you think green spaces are important in Johannesburg? Please explain

Knowledge of UA, presence of UAI and perception of UA and UAI

1. Do you know what urban agriculture is?
2. Do you know what rooftop gardening is?
3. Do you know that there is food being grown in the inner city?
4. How do you feel about this type of farming?
5. What do you think are some of the benefits of rooftop farming for the city? And for residents?

Neighbourhood and Household Changes

1. What does urban farming in the inner city mean for you and your family?
2. Have you noticed any changes to your neighbourhood since the UAI has been established these rooftop farms? Please explain
3. Where do you buy food from currently?
4. Is the food you buy currently affordable?
5. Have the farms changed the way you access food in any way? (In terms of the location you buy food, the price of food and food availability and variety?)
6. Has your diet and nutrition changed since the rooftop farms started to grow and sell vegetables?
7. What has changed in your household as a result of rooftop farms? Both positive and negative
8. Has the presence of rooftop farms affected your household income?
9. Has your living experience changed because of rooftop gardens? If so, how?
10. How could rooftop farming better improve your life and the lives of residents?

Annexure E: Plagiarism Declaration

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PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I YASMIN SHAPURJEE (Student number: 0707260D) am a student registered for the degree of MUS (HHS) in the academic year 2022.

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this in not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Signature: _____ Date: 04/11/2022