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Prospects for Entrepreneurship in urban agriculture in Johannesburg

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A research paper submitted to the Wits School of Governance, University of the Witwatersrand, for the degree of Masters of Management (in the field of Public and Development Management)

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Abstract

The biggest threat to our planet more than global warming is the exponential growth of poverty and unemployment, both of which are present in Johannesburg. Farming methods that use less water and are not susceptible to too many diseases are the potential answer to the limitation of arable land in Johannesburg. The research question of the paper is about whether urban agriculture can increase food security in ways that aid in job creation and stimulate entrepreneurship among urban dwellers. The paper proposes the implementation of an innovative financing approach called Social Impact Bonds. The knowledge contribution of this research is the potential to stimulate government policies that allow for a more effective way to support urban agriculture in Johannesburg. The researcher hopes that this research will add to the body of knowledge and stimulate further research in urban agriculture.

Declaration

I declare that this report is my own, unaided work. It is submitted in partial fulfillment of the requirements of the degree of Masters of Management (in the field of Public Policy) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university. Parts of the literature review chapter were previously submitted as an assignment for the directed reading course of this degree. The research used the directed reading course to generate a literature review for this study.



Thendo Ratshitanga
31 March 2017

Dedication

This research report is dedicated to both my paternal and maternal grandparents, who as subsistence farmers in a rural village in Limpopo, taught me the value of hard work and the reward of growing one's food. Their children, my mother and father, continued this tradition and I am eternally grateful to have been raised by them.

I further dedicate it to my children, Mufhenyi and Ngugi Ratshitanga so that they too may be inspired by the lessons of their father and be part of a growing movement to farm in the City.

Last, but not least, to my Wife, Zandi. I thank her for her patience and support.

Acknowledgement

I would like to acknowledge my supervisor, Dr Ivor Sarakinsky for all the guidance he provided. To my brothers and comrades, Tshilidzi Ratshitanga, Sihle Mzoneli and Mothupi Modiba for their encouragement for me to take up the studies when I hesitated. My uncle, Dr Taki Madima played a crucial role of regularly checking up on my progress and encouraging me to finish.

I would also like to thank all the people who generously gave their knowledge and sometimes commercial secrets to provide me with a lot of information about urban agriculture. I wish to single out Lana Lovasic and Alana Bond together with their team of Trustees at Simanye Trust for allowing me space to experience an urban farm in practice. Much thanks go to my colleagues at the Entrepreneurs Organisation, Forum 2, who not only encouraged me but gave a lot of feedback along the way.

I owe gratitude to Dr Veerle Dieltiens for agreeing to read the report and for offering valuable comments on the structure and flow of the paper.

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1 Chapter One

1.1 Introduction

Johannesburg is not usually associated with agriculture. Its urban sprawl is a concrete jungle, crisscrossed with highways and a grid of tarmac. Yet, here, Kate Humbulani (not her real name) and her team have been cultivating vegetables on a rooftop farm in Braamfontein. She sells her vegetables to local consumers and street traders.

To understand whether Kate's case has lessons that can be shared and replicated, this research investigated whether urban farming has the potential to grow and serve the population of jobless residents within the City of Johannesburg.

The purpose of this research, therefore, was to investigate whether urban agriculture can foster entrepreneurship in poor urban areas of Johannesburg, South Africa. These areas are froth with poverty and unemployment.

Urban agriculture has been identified to have a huge potential to increase job creation in cities around the world.

From a global perspective, there is an increasing move for food security to be addressed through urban agriculture. This is becoming a huge potential for most big cities in the light of urban sprawl. Growing food near or in the city reduces transport costs and "therefore results in lower food costs. Urban agriculture is also said to contribute to income generation and poverty alleviation in cities" (Vagneron, 2007).

Urban agriculture is not only relevant for providing food needs for urban dwellers, it is also an environmental issue. It can make the city and urban spaces beautiful and assist in recycling waste. For example, in an urban agriculture setting there is a co-existence between poor people alongside

wealthy residents. The rich avail their property for use by the poor and the poor grow food for both poor and rich (Ranasinghe, 2005).

This chapter lays the foundation to the study. It provides the background to the study and a rationale for it. It avails the problem statement as well as the research questions and objectives that guided the study. It presents the overall trajectory taken for the study.

1.2 Background to the study

This study was prompted as a response to high levels of unemployment in Johannesburg and high levels of food insecurity. Forty-one and half people in the South African Development Community (SADC) are said to be food insecure and South Africa' share of that number is a four million people (SADC, 2014).

Although once a magnet for migrant labour, the mining and industrial hub of Gauteng, Johannesburg, has seen a significant change in its demography since the down of democracy.

Many cities in the world have high rise buildings which generally have nothing on top providing suitable space for urban agriculture. In Post-Apartheid South Africa, major cities of South Africa, except perhaps for Cape Town, have seen their demographics change from middle income whites to majority black residents who mostly come from the rural areas and the neighbouring countries. Many of these people grew up in rural areas where subsistence farming is popular and therefore their potential to benefit from urban agriculture using the buildings they live in is significant. This will require skilling them in new urban farming technologies augmented by the indigenous knowledge of farming they already possess (Ranasinghe, 2005).

The commercial history of Johannesburg which is the bulk area of the City of Johannesburg starts with the discovery of gold in 1886 leading to it being the commercial hub of Southern Africa and ultimately attracting a vast number of

migrant labourers to work in the mines and the supporting industries (Bremner, 2000). The decrease in the role of mining and the increase in the financial and professional services sector has had a negative impact on the people who came to the city in search of opportunities and only to find that those are no longer there. They came here because their fathers and forefathers before them would have come to the city as cheap labourers to the mines and other industries. Exploitative as the system of cheap labour was, those who did offer their labour earned some income as compared to their rural counterparts whom they left behind in the villages.

The changed demography of the City manifest from an increase in the number of foreign migrants who came in when South Africa became increasingly attractive to neighbouring countries whose economies are extremely weak. With the high influx of people to the City and the lack of opportunities as well as amenities to accommodate these numbers, the city's most urban areas are characterized by a high number of informal settlements which are similar to most slums in other parts of the world where crime, poverty, unemployment and many social ills are prevalent (Mahajan, 2014). The City of Johannesburg's informal and township areas are therefore not unique to the features of other similar areas in urban South Africa characterized by the fact that "38 percent of the country's working-age population resides there and they are home to almost 60 percent of its unemployed" (Ibid).

Attendant to increasing population numbers and prospects of no jobs is the problem of how to feed the urban poor. Cities are by their very nature densely populated which means that land availability for agriculture is limited. It is for this reason that this research is attempting to look at alternative ways of generating food opportunities in the cities where the majority of the population are poor and unemployed. The researcher's personal motivation for this study stems from his growing up experience in the rural village of Ngulumbi in Limpopo where his parents and grandparents grew their own food. This led the researcher to ponder about whether it would be possible to do the same in an urban setting.

The research attempts to look into aspects of livelihood as well as entrepreneurship as a linkage to sustainability. It is argued later in the research paper that entrepreneurship is a potential solution to job creation and food security in an urban setting. Poverty and unemployment are difficult if not impossible to eradicate in today's macroeconomic environment where the global economy is facing high levels of stress. Even when people are not able to find jobs, they still need to eat. The challenge of food security is one that this research is concerned with and in particular the need to find alternative ways of food generation that are sustainable and result in creating opportunities for self-sufficiency for urban dwellers.

The limitation of space in urban areas and the fact that poor urban dwellers do not have land tenure together with the health risks in terms of crop contamination with urban waste (Whittinghill & Rowe, 2012), makes it necessary for innovative solutions for urban farming.

Urban agriculture is contributing to enhancing the livelihood of many poor people in urban areas through farming activities within homes, along rivers and also in private and public land (Van Veenhuizen, 2006).

Van Veenhuizen (2006) found that "research undertaken in the last two decades indicates that urban agriculture has multiple roles and functions and plays an important role in enhancing urban food security, nutrition and health; creating urban job opportunities and generation of income especially for urban poverty groups and provision of a social safety net for these groups; contributing to increased recycling of nutrients (turning urban organic waste into a resource); facilitating social inclusion of disadvantaged groups and community development; and, urban greening and maintenance of green open spaces."

Technological innovation is critical to the success of green economies given the increasing nature of competition within the global economy for natural resources as well as the realisation by capitalist market forces to move towards more sustainable means of production because of the increase in the

limitlessness of natural resources, the need to reduce waste and preserve nature (Barbiroli, 2011).

The study is located under the rubric of the green economy. Urban agriculture fits in well with the green economy because it has a huge potential for food security, social cohesion as well as job creation. Through urban agriculture, it is possible to meet the green economy's focus on achieving "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (Victor & Jackson, 2012a).

Green economy contributes to food security in a way that reuses urban waste leading to the reduction in carbon emissions and positive social and economic outcomes. Explored in this research paper in more details in the next chapter , it is shown that for South Africa and other developing countries of the world, the green economy offers huge opportunities. These countries pollute less than their developed counterparts who still have to meet their carbon footprint reduction goals. Green economy offers not just a corrective approach (i.e., reducing carbon footprint) but a forward-looking opportunity driven approach of reducing costs and fuel for the transportation of food as well as providing food organically by utilising organic waste. Urban agriculture is one such an opportunity for cities across the world, especially the developing world. The opportunity under the green economy is important because of the growing needs of the sprawling urban population.

This study looks at the potential benefit of urban agriculture in the City of Johannesburg and seeks to motivate the introduction of innovative approaches to support urban agriculture which is already a programme implemented by the City. The study proposes that the City should approach its resource use in a way that sees urban management as a resource and a source of energy as well as a catalyst for job creation and entrepreneurial development. There are many ways in which communities in urban areas have engaged in urban agriculture such as by creating community gardens in public spaces like schools, hospitals, prisons, and even planting in alleys. This study, however,

looks at specifically aquaponics and hydroponics, with a view to assessing whether such technologies can be applied within the City of Johannesburg.

1.3 Problem statement

The City of Johannesburg experiences high levels of unemployment, low entrepreneurship amongst the poor and lack of food security. Statssa (2015) reports that the absorption rate for employment lags behind the growing rate of the working population. People flee or migrate from the rural areas, and neighbouring countries into cities in search of opportunities and most of them end up in the City of Johannesburg. The City of Johannesburg is seen as a land of opportunity but as soon as people arrive and settle they realise the harsh realities of a City engrossed in all manner of social ills which may make them more destitute than the situation prevailing in their places of origin. The lack of food sources is one of the biggest challenges they face.

Given the lack of agricultural land in the City of Johannesburg, as is the case with more mega cities around the world, little or no alternative initiatives are in place to ensure food security for poor people in ways that also tackle the need for income generation and sustainable livelihood for poor urban dwellers. It is necessary therefore to address the practical concerns of feeding people in ways that are not limited to social grants but which also create opportunities for entrepreneurship and self-income generation so that city dwellers can create their own food and their own employment and hopefully run prosperous business ventures.

1.4 Research question

The overall research question that is in line with the purpose of this research is: how can urban agriculture increase food security in ways that aid in job creation and stimulate entrepreneurship among urban dwellers in the City of Johannesburg?

This overall research question is supported by the following sub-questions:

- What lessons exist in other countries that can assist the City of Johannesburg to start a programme of urban agriculture more successfully?
- What are retailers of fresh produce willing to do to support the emergence of urban farmers?
- What urban agriculture initiatives are currently in place within the City of Johannesburg and how viable are they? and
- What are the current government programmes aimed at supporting urban farmers?

1.5 Purpose statement

The purpose of this research is to investigate the prospect and potential role that urban agriculture approaches (which have proven successful in other cities of the world) can contribute to increasing food security and at the same time create jobs and stimulate entrepreneurship among poor urban dwellers of Johannesburg.

This research aims to assess the extent to which urban agriculture and relevant technologies for urban agriculture such as vertical gardens, rooftop gardens, aquaponics and hydroponics can help communities within the City of Johannesburg to provide food for themselves as well as create their own jobs. Most poor urban dwellers in the City of Johannesburg need assistance, and this research seeks to explore the extent to which such support can be achieved through a programme of entrepreneurship driven by urban agriculture.

Poverty alleviation strategies need to go beyond social welfare grants and short term job creation schemes (those that give people short term jobs through, for example the Expanded Public Works Programme (EPWP) projects of government) and look to urban agriculture as a poverty alleviation initiative. Urban Agriculture (UA) can “mitigate the effects of poverty and

enable social inclusion" by ensuring a "food secure and inclusive city" (Van Veenhuizen, 2006).

1.6 Report lay out

This report is composed of seven chapters. The first chapter gives a general perspective, definition, and problem statement of Urban Agriculture and formulates the research questions as well the objectives guiding the study. Chapter Two is a broad literature review on UA and issues related to food security and entrepreneurship as well as how its elements can address food insecurity. This chapter highlights experiences on UA in other countries and establishes a framework for the study. Chapter Three outlines the methodology applied for the analysis in this study. Chapter four provides the findings and Chapter five offers an analysis of the findings, whilst chapter six discusses recommendations of the study and the last chapter is the conclusion of the paper.

2 Chapter Two

2.1 Literature review

The purpose of Chapter 2 of this research paper is to review literature written on urban agriculture (UA). Urban agriculture is sometimes called urban farming (UF) and this paper uses both interchangeably. The review of such literature was done using academic articles from peer reviewed journals which were sourced electronically. Additionally, the purpose extends to assessing existing best practice with respect to areas where this has been implemented successfully and then assess lessons learnt to ensure that City of Johannesburg can implement urban agriculture initiatives without reinventing the wheel.

Located within the field of study of the green economy, urban agriculture is reviewed to see how it can contribute to stimulating entrepreneurship and job creation whist at the same time facilitating for the eradication of food insecurity. Governments today face a big challenge of working out strategies to feed their populations with the global population estimated to grow to 9 billion people by 2050 (Tomlinson, 2013). This challenge is compounded by the urban nature of the global population which is nearly half of the total world's population (Carpenter, 2008).

This research paper, therefore, looks at the way that urban agriculture can contribute to feeding the poor while growing the economy and creating jobs. The United Nations Environmental Programme (UNEP) defines green economy as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (Green economy policies in Canada, Wikipedia, n.d.).

Before delving into the subject of urban agriculture, its benefits, technologies and entrepreneurial potential as well as finding mechanisms for urban agriculture, the next section discusses the dichotomy between sustainable

development and green economy in order to suitably locate urban agriculture within an appropriate paradigm.

2.1.1 Green economy vs. sustainable development

Green economy is a new phenomenon of this current millennium which arose from the collapse of the global financial markets in and around 2008 from what is seen as the failure of the financial markets (Brand, 2012). Before the emergence of the concept of the green economy or rather its rise into prominence, sustainable development was the flavour of the time around the world. Sustainable development, itself defined as the implementation of development policies and strategies by governments and the private sector in ways that did not compromise the ability of future generations to survive and prosper sustainably, was seen to be different from the green economy. Sustainable development was seen as the need to use natural resources of the planet, which are becoming increasingly finite, consciously with the aim to ensure they are renewable.

There is no doubt that Sustainable Development introduced a new level of consciousness about the need to preserve our planet and its resources by especially imposing the burden on large corporations. However, what it hasn't achieved is the changing of behaviour by ordinary people as consumers. By focusing on big corporates and the big producers, the lack of emphasis on consumers means that the demands of goods produced in unsustainable ways continue to be consumed.

Several years post the adoption of sustainable development goals, many countries have fallen short of achieving their set targets. The difference with the green economy was found through literature that, whilst sustainable development' indicators of success were based on states or countries signing commitments to meet them within set timeframes, green economy does not rely on such global agreements. Green economy is based on the concept of people themselves, not states, setting their own goals and implementing their own initiatives provided such initiatives generate economic value for the

players (Taxation, Innovation and the Environment, n.d.). Green economy advocates for the engagement in economic activities that contribute to reducing climate change, protecting the environment, ensuring food security for the most vulnerable as well as facilitating the creation of sustainable employment. Other authors even write about green jobs as part of the green economy, where such jobs are based on ensuring equality especially in countries with histories of segregation (Bowen, A. 2012).

Green economy is about the transition from “a carbon-driven economy to a green-driven economy” (Gouvea & Montoya, 2014) because this transition cannot succeed in the presence of practices that continue to support carbon intensive means of production, distribution and consumption.

Green economy contributes to food security in a way that reuses waste leading to the reduction in carbon emissions and positive social and economic outcomes. All these positive outcomes will be explored in this research paper in the context of urban agriculture. It is argued in this paper that for South Africa and other developing countries of the world, green economy offers huge opportunities. These countries pollute less than their developed counterparts who still have to meet their carbon footprint reduction goals. Green economy offers not just a corrective approach (reducing carbon footprint after it was generated by polluters) but a forward-looking opportunity driven approach and urban agriculture is one such an opportunity for cities across the world, especially the developing world. Important is the opportunity under the green economy because of the growing needs of the sprawling urban population.

Urban agriculture fits in well with the green economy because it has a huge potential for food security, social cohesion as well as job creation. The limitation of space in urban areas and the fact that poor urban dwellers do not have land tenure together with the health risks in terms of crop contamination resulting from urban waste (Whittinghill & Rowe, 2012), makes it necessary for innovative solutions to urban farming. Through urban agriculture, it is possible to meet the green economy’s focus on achieving an improvement in the well-

being of people and at the same time contribute to significant environmental benefits (Green economy policies in Canada – Wikipedia, n.d.).

2.1.2 Urban Agriculture

Definition of urban agriculture

Urban agriculture (UA) was defined by the United Nations Development Programme as:

> *"[A]n industry that produces, processes, and markets food and fuel, largely in response to the daily demand of consumers within a town, city, or metropolis, on land and water dispersed throughout the urban and peri-urban area, applying intensive production methods, using and reusing natural resources and urban wastes, to yield a diversity of crops and livestock"* (How Urban Farming Can Transform Our Cities, n.d.).

It is an activity that "produces, processes and markets crops, livestock and other products in urban and peri-urban areas… where farmers apply intensive, innovative, profitable, mobile, and adaptive production to generate specialised (for example, perishables and high-value products), high-yielding (non-) food products" (Hovorka, 2004).

Benefits of urban agriculture (UA)

Urban agriculture is contributing to enhancing the livelihood of many poor people in urban areas through farming activities within homes, along rivers and also in private and public land (Van Veenhuizen, 2006).

Van Veenhuizen (2006) found that "research undertaken in the last two decades indicates that urban agriculture has multiple roles and functions and plays an important role in enhancing urban food security, nutrition and health; creating urban job opportunities and generation of income especially for urban

poverty groups and provision of a social safety net for these groups; contributing to increased recycling of nutrients (turning urban organic waste into a resource); facilitating social inclusion of disadvantaged groups and community development; and, urban greening and maintenance of green open spaces" (Ibid)

Potential negatives of urban agriculture

In contrast, great as may be the benefits of urban agriculture to food security and job creation, there are some pitfalls that policy makers should take into account when developing policies to facilitate urban agriculture. Such pitfalls are the potential health risks associated with the irrigation of food crops using urban wastewater and the potential negative impact on the environment due to the pollution of underground water by agro-chemicals (Van Veenhuizen, 2006).

On the African continent, Kaunda's government in Zambia during the 1960s and '70s implemented a policy of urban agriculture which did not succeed for various reasons such as lack of funding, support, marketing, accessing of markets by producers and water scarcity. The failure of the Zambian urban agriculture initiative is also the result of the unintended consequences that were not anticipated previously. Zambia being malaria infested region in sub-Saharan Africa saw the growing incidents of malaria cases in urban areas as urban agriculture provided a breeding ground for mosquitoes (Thornton, Nel, & Hampwaye, 2010).

The detrimental effects of UA agriculture to the environment despite its potential to provide jobs and incomes to the city's poor is further supported by Vagneron (2007) who argues that when waste water or solid waste are used when they have not been properly treated, this poses a grave danger to consumers and producers through food produce contamination. There is also the challenge that most poor people engaged in urban agriculture do not own the land on which they farm and as such their ventures are always threatened or they have no security of tenure to plan their farming activities on a long term

basis including in terms of implementing infrastructure improvements to the land or buildings they work on (Vagneron, 2007).

2.1.3 Food security and urban agriculture

Those who have argued or who position urban agriculture as a panacea to the food security needs of the City's poor argue that food grown in the proximity of the city reduces transport costs and therefore results in low cost of food and that urban agriculture contributes to income generation and poverty alleviation (Vagneron, 2007). These optimists have neglected the fact that there are "growth-limiting and growth-reducing factors that affect actual production in UA among which are issues of water availability, nutrient supply, soil degradation, pests and soil pollution; financing and policy support" (Eriksen-Hamel & Danso, 2010) to make it successful. These and many factors make urban agriculture not a guaranteed reliable source of total food requirements for city dwellers.

Other constraints relate to issues of solar radiation, temperature, quality of air and soil, and climate changes resulting in changes in weather patterns. Additionally, the problem of soil pollution also results from the use of urban wastes (Ibid).

The discussion above is not to suggest that urban agriculture is impossible to make a success of. Major cities in Africa, "including Accra, Kumasi, Nairobi, Dar es Salaam and Dakar show that up to 80 per cent of vegetable requirements in these cities are met by urban agriculture" (Ibid). This suggests that for urban agriculture to succeed, it is important for there to be coordination and working together with relevant stakeholders such as farmers, planners, and policy makers. This value chain is critical to urban agriculture success because farmers must be assisted to produce, and policy makers must be assisted to "manage the supporting systems such as markets, inputs and land use" (Eriksen-Hamel & Danso, 2010). Other proponents of urban agriculture downplay these negative constraints of urban agriculture by arguing that

actually, UA helps to reduce the occurrence of “hazards such as floods, soil contamination, air pollution and green space loss within metropolitan and periurban areas” (Ranasinghe, 2005).

There are other important roles that urban agriculture plays. That is the role of community development in the form of education, training and ensuring that future generations do not lose their touch with direct access to food production. Community food gardens play this role of allowing young and old people to have a direct experience of how food is grown and that they don’t only see as merely a consumable product. Food is part of a full value chain of life. Community food gardens facilitate justice by allowing people to have access to food that they have grown for themselves thereby reducing impoverishment.

From the discussion on the definition, the pros and cons of urban agriculture, it is evident that the positives far outweigh the negatives. Why? The answer is simple. Exponential growth in the world’s population increases waste generation and reduces land space for conventional agriculture. Urban agriculture addresses these problems, first by reusing waste and second by using innovative approaches to agriculture and food production without the use of ground soil and exorbitant fresh water. As such a review of the existing techniques or ways in which UA is implemented follows in the next section.

2.1.4 Techniques for Urban Agriculture

Technological innovation is critical to the success of green economies given the increasing nature of competition within the global economy for natural resources. Capitalist market forces are also realising the need to move towards more sustainable means of production as a result of the limits of natural resources, the need to reduce waste and preserve nature (Barbiroli, 2011).

Some of these technologies are explained below.

Green roof technology

Green roof technology is a potential solution to the problems associated with urban land use as it has the potential to limit the use of land that is contaminated with urban waste as well as ground level water (Whittinghill & Rowe, 2012). Green roof technology refers to “a technology enabling growth of vegetation on rooftops... Conventional green roofs generally consist of a number of layers including a root barrier to prevent damage to the underlying structure; a drainage layer to facilitate the removal of excess water; a filter fabric to prevent the drainage layer from clogging; growing media; and vegetation” (Whittinghill & Rowe, 2012). The growing media of green roofs is usually divided into two categories, namely extensive media because they are greater than 15 cm in depth and those termed as intensive media because they are less than 15 cm (Ibid).

The benefits of green roof technology include “reduced air and noise pollution, carbon sequestration, increased habitat and biodiversity, increased roof lifespan, storm water retention, energy savings and mitigation of the urban heat” (Ibid). The limited availability of arable land in urban areas is solved by this technique. Some of the potential pitfalls for the poor in urban areas may include high installation and maintenance costs and the potential limitations of the weight on the roofs.

Vertical Gardens

Another form of technology in urban agriculture is vertical gardens or living walls or green walls.

Green walls comprise mainly of two types, which are “green façades and living walls”. “Green façades are trellis systems or trailing structures installed for climbing plants to grow vertically without attaching to the surface of the building (Sustainable Design Materials: Green Walls - asla.org, n.d.). Living walls are a building envelope system where plants are actually planted, irrigated and grown in a modular system secured and integrated to a wall” (Carpenter, 2008)

The benefits of green walls are that they reduce solar heating on walls that get direct sunlight (by up to 10%) and also act as pollutants and dust trappers providing health benefits to buildings installed with such (Carpenter, 2008). The benefits or use of vertical gardens or green walls in South Africa for agricultural purposes has not been studied sufficiently, and this offers an opportunity for further research in respect of the potential for this technology in urban agriculture for food production purposes.

Recycling of urban organic waste for urban agriculture

Urban agriculture has the potential to squash the traditional modus operandi of cities - where the general practice is for importing resources into the cities for consumption and exporting of waste out of the city- by recycling waste into food and fuel (Ranasinghe, 2005). City municipalities generate a huge amount of solid waste which can provide high quantity organic compost (Sotamenou & Parrot, 2013).

Although chemical fertilizers are a quick way to increase crop yields for farmers, they increase the risk of depleting soil nutrients, land degradation as well as pose a health risk to consumers (Ibid). Organic compost, therefore, poses an alternative to chemical fertiliser which can be beneficial to urban agriculture, including in terms of job creation due to the fact that compost generates high labour and transport costs due to its weight (Ibid).

There is a general tendency to focus on the negative and hazards of urban waste. However urban waste can be used as a resource and a successful input to urban agriculture. Urban waste is described as water, and solid waste derived mainly from the growing population of urban dwellers. The challenge in most cities is the lack of effective means to dispose of urban waste (Running, Ligon, & Miskioglu, 1999). This suggests the need to view waste as a potential resource and not just a problem to dispose of.

Given many restaurants in Johannesburg and the food waste they generate, harvesting them for fertilizing vegetable crops can add substantially to the success of urban agriculture in the city.

Water waste

The type of waste with the potential to add to the benefit alluded to above is what is called organic waste comprising of water and solid waste. Nutrient rich water waste has the potential to provide rich input for urban farming (Running et al., 1999).

The problem with this approach is that waste water tends to contain harmful pathogens and vectors which require monitoring and management as well as the contamination of industrial chemicals in heavily industrialised areas (Running et al., 1999). The extent of the effect on crops vary. Potential solutions include the fact that pathogens and vectors can be removed from waste water using methods such as sunlight, waiting time before use as well as planting certain crops which are able to absorb them. The other challenge to the use of waste water is cultural as in the Muslim communities where the use of effluent is viewed negatively (Running et al., 1999).

Water waste is abundant in urban areas. This means that urban agriculture can benefit greatly from its use especially in water limited areas such as Johannesburg which does not have its own source of fresh water. Johannesburg currently draws the bulk of its fresh water from the Mountain Kingdom of Lesotho.

Coupled with the use of water waste could be the potential benefit of water harvesting from rain fall. A lot of water could be captured during the rainy season as it falls into buildings by trapping it and using it in urban agriculture.

Solid waste

Solid waste is categorized as organic and inorganic waste. Inorganic waste types are such things as chemical by-products from manufacturing; construction debris which in urban agriculture can be used to create planting beds; and plastic and wooden containers that can be used to plant crops in them (Running et al., 1999). Organic waste on the other hand result from food waste such as vegetables from households; restaurants and places with a large number of people such as hospitals, universities, prisons and conferences. Another example of organic waste is the by-products of grass cutting and tree felling as well as some by-products of manufacturing such as paper manufacturing. Organic waste is very useful to enhance soil nutrients in agriculture and certainly urban agriculture where large volumes are created (Running et al., 1999).

Unlike water waste where there are cultural reasons not to use effluent for food production, organic waste is seen as more acceptable given the wide use of composts in much of the world. The challenge with organic solid waste is its management. Benefiting from the use of this waste requires the sorting of the waste primarily from source to prevent contamination with other harmful waste, and this needs an urban management process to assist households as well as industry to adhere to a system of separating waste so that waste is transformed into food by generating fertile soil and ultimately green plants (Running et al., 1999).

Green economy ultimately requires the development of sustainable urban cities and urban agriculture can play a significant role in this as the majority of the world's population is estimated to soon reside in urban areas.

Urban waste that includes sewage has to be managed carefully. Sewage is good for fertilizing food crops when processed well, however, if something goes wrong with the processing and its heavy metal composition goes into food, this can lead to catastrophic results. Processing sewage includes taking out pathogens and other harmful chemicals by letting sewage sits in the sun

until those chemicals are killed or by planting trees that can absorb the chemicals without harm to themselves. This does call for the development of an effective sewage infrastructure to minimise the threat of disease (Gouvea & Montoya, 2014). Additionally, the success of utilising solid waste, sometimes referred to as urban solid residue, depends on huge investments by government (especially municipalities) in developing recycling systems and reducing urban landfills as seen in Brazil which in 2011 needed to invest "close to US$ 35 billion to replace its aging and not sustainable 3 thousand landfills" (Gouvea & Montoya, 2014).

Aquaponics and Hydroponics

Aquaponics and hydroponics are another technique of urban agriculture which use water instead of soil to grow food. They can be utilised in vertical farming and rooftops as discussed above as well as on the ground. These techniques are worthy of exploring for urban agriculture given their increasing prominence. Aquaponics comprises Hydroponics and aquaculture. Hydroponics is a form of agriculture which is soil less and uses only water and chemical fertilisers. The farming of fish in holding ponds is referred to as aquaculture. Aquaponics is a good alternative to the use of synthetic chemical fertilisers found in most hydroponics. (Childress, 2002).

Aquaponics "produces a valuable fish protein with minimal pollution of fresh water resources, while at the same time producing horticultural (usually vegetable) crops" (Nichols, M & Savidov, N, 2011).

The researcher has selected to focus on aquaponics and hydroponics as a form of urban farming to explore for the City of Johannesburg. More discussion on these systems is explored in subsequent chapter of this paper.

The next section looks at how the opportunities presented by various urban farming technologies can help to create jobs.

2.1.5 Urban agriculture can stimulate employment

Unemployment, together with socio-politico-economic, and psychological issues continues be a big problem in developing countries. More than 195 million people are unemployed globally as at 2007 (Ashford, 1990).

Williams, Round, & Rodgers, (2009) observed that start-up informal enterprises, forced into trading or conducting business as a way to survive do eventually establish themselves as businesses in the formal economy. Entrepreneurship is therefore a potential solution to Joburg's unemployment problem.

However, the unemployed need assistance to start their own enterprises. "Success in SMEs' development in transition economies requires appropriate macroeconomic conditions providing incentives, effective development and training of entrepreneurs, and financial support and infrastructure" (Hubner, 2000).

> *"The most important policy for socially equitable development is full employment. The employed are not just a statistic or an underutilized resource that could have increased GDP. They are people, and no numbers can convey the degree of disruption that unemployment brings to their lives, their livelihoods, and the wellbeing of their families. Although safety nets and targeted assistance may mitigate some of the consequences of unemployment, from an economic, political, or psychological perspective, nothing is better than a job. Jobs are how people participate in the productive economy and feel productive themselves. It is one of the most important sources of inclusion into the national economy (Stiglitz, 1998, in Responding to economic crises: Policy alternatives for …, n.d.)*

Stiglitz wrote his views about jobs before the global economic meltdown of 2008. Since then, millions of jobs have been shed in the global economy

rather than created. Targeted assistance and safety nets by governments are not sufficient to mitigate the effects of the harsh and cruel consequences of being unemployed. Therefore, something else needs to be considered. Recently, many nations, including South Africa have been embracing the idea of entrepreneurship as a potential significant contributor to assist in addressing the consequences of low levels of employment. Urban agriculture has a huge potential to be the catalyst for urban entrepreneurs involved in food production.

The problem of unemployment

Statistics South Africa (Stats SA) defines its "official unemployment rate in line with the International Labour Organisation's (ILO) definition" (Statistics South Africa, 1999), which is used by many developed and less developed countries. In terms of this definition, "the *unemployed* are those people within the economically active population who: (a) did not work during the seven days prior to the interview, (b) want to work and are available to start work within a week of the interview, and (c) have taken active steps to look for work or to start some form of self-employment in the four weeks prior to the interview. The *economically active population* consists of both those who are employed and those who are unemployed" (Statistics South Africa, 1999, in Statistics South Africa, n.d.).

Sustainable Development Goals have one of their first goal being to end poverty by 2030. The achievement of this goal is made impossible because of high unemployment globally and in South Africa, where in 2015, "the number of unemployed globally was 197,1 million and this is expected to increase to 199,4 million in 2016" (Statistics South Africa, 2015).

Unemployment affects mainly poor people, the youth and women. South Africa's records from Statssa shows that 5,3 million people in 2015 were unemployed giving rise to an unemployment rate of 25,3% for that year. Not much is expected to have changed to date. "Over the period 2009 to 2015, absorption rates declined in six of the nine provinces, most notably in Gauteng (2,2 percentage points)" (Statssa, 2015). The absorption rate measures the

rate at which employment increases as the population of the working age increases. In terms of the City of Johannesburg, the biggest area of the Gauteng Province, the absorption rate lags behind the working population growth. Statssa further reports that “regardless of race, unemployment rates are higher amongst black African women… Young people continue to face higher unemployment rates and lower absorption and participation rates relative to adults. (Ibid).

Given the fact that the employability of people is linked to both work experience as well as education, many of the poor, young and women who face the brunt of poverty have neither work experiences nor good educational backgrounds. It is for this reason therefore, that alternative innovative solutions need to be explored to end poverty. Entrepreneurship is proving, in major cities or the world, to contribute significantly towards the eradication of poverty. Increased food production in cities is expected to rise, especially in an environment where today, per the UN, out of 7 billion people in the world, 4 billion currently live in cities and this number is projected to increase to 9 billion by 2050. Seventy percent of them will live in cities. This suggests that 100% more food will be required and most of it will make sense to be grown closest to where people live. This therefore bodes well for a programme of entrepreneurship development around food production, distribution and processing within the City.

This paper proposes that such a programme be driven by the City of Johannesburg to end poverty as well as stimulate entrepreneurship. It goes without saying that the more people generate their own food, funds currently used for social welfare grants can be redirected to other pressing social issues. It is estimated that the South African government spends R10 billion per months (that is R120 billion per year) on social grants benefiting roughly 17 million people (Beneficiaries, 2016). At some point the financial tap that supports this social grant programme will run dry and when it does, not only will there be more hardship, there is also likely to be an increase in instability and revolts.

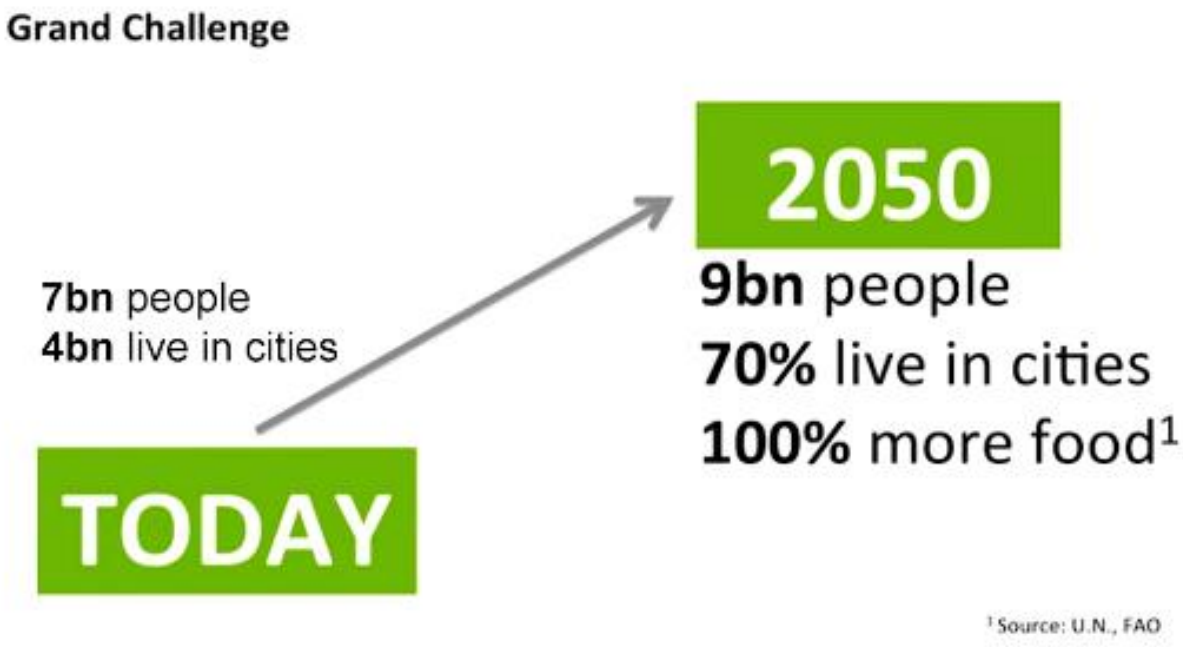


Figure 1: Current and projected global population

Source: (Gaus, 2011)

2.1.6 The potential of entrepreneurship in urban farming

This section looks at assessing the entrepreneurial potential of Urban Agriculture as opposed to merely seeing it as a subsistence farming activity for household survival (Hovorka, 2004). The section assesses the extent of people's engagement in urban agriculture deliberately as an economic activity for profit generation which in turn creates jobs and alleviates poverty via agricultural production. Studies are starting to reveal that urban agriculture is undertaken in many countries in ways that display innovation and dynamic approaches such as discussed above in terms of green roofs, vertical gardens and aquaponics.

It is important to challenge the general view that urban dwellers, especially in Africa, are driven to engage in urban agriculture purely as a desperate measure of responding to economic or market failures of cities (Hovorka, 2004). African cities are becoming urbanised with some studies suggesting that more than 50% of the population of the world resides in urban areas today (Carpenter, 2008).

The importance of entrepreneurship

The importance of assisting micro enterprises, including nurturing them so that they can make a meaningful contribution to job creation and poverty alleviation is never overemphasized, especially in an environment where big firms are shedding jobs at alarming rates. The Small Micro and Medium Enterprises (SMME) sector has a greater potential to increase the entire economic base of urban areas and reduce poverty as it can support people to generate their own income through agricultural businesses aimed at sustaining their families. Experience elsewhere in the world shows that the informal sector, as well as small businesses in most developing countries, contribute a significant proportion of employment generation, income and productivity (Tambunan, 2008).

SMEs (Small Medium Enterprises) in LDCs (Less Developed Countries) “can survive, and even grow in the long-run, for three main reasons: (a) they create a niche market for themselves, (b) they are a necessity as they act as a “last resort” for the poor, and (c) they will grow along with large enterprises (LEs) because of their increasingly important production linkages with LEs in the form of subcontracting” (Tambunan, 2008)

2.1.7 The role of government to stimulate entrepreneurship in urban agriculture

Countries such as Botswana, forced by "ineffective local food production" (Hovorka, 2004) have found ways of promoting urban agriculture within their "local economic development and agricultural diversification" policies (Hovorka, 2004). These promotional activities include financial assistance programmes which have been a "significant catalyst for the emergence of entrepreneurial urban agriculture in Greater Gaborone" (Hovorka, 2004).

Diversification of agriculture in urban agriculture for meeting the sophisticated needs of urban dwellers such as horticulture and the high demand of herbs

has further stimulated the demand to move towards entrepreneurial urban agricultural activities (Hovorka, 2004).

Government at a local and provincial level has to put in place a system where small urban farmers are insulated from the predatory practices of large farmers by creating markets for their produce within an environment that fosters retail shops to buy from small urban farmers. Such insulated practices could be in addition to the procurement benefits under the BBBEE regulations and include training and skills development for these new farmers (Morrison, Murray, & Ngidang, 2006)

A direct intervention by policy makers would be to initiate contract farming where buyers of farming produce sign contracts with urban farmers, and in these contracts, they stipulate their requirements and assist farmers, through training, to produce in accordance with such. In return, farmers offer their labour to produce the required produce assisted by the buyers. This has worked successfully for example in the state of Sarawak in Malaysia (Morrison et al., 2006).

In Sarawak, "by employing contract farmers, agribusiness has sought out cheaper labour, cheaper natural resource provision, reduced transaction costs and transfers of risk." (Morrison et al., 2006)

The obvious benefits of this system of contract farming are that costs are reduced and managed predictably, and there is guaranteed business for the farmers as well as a guarantee of supply for the buyers (Morrison et al., 2006). It is also another mechanism of financing which otherwise would be difficult to come by for the new small urban farmers as the guarantee of buyers means that financial institutions are easily persuaded to lend farmers money to buy implements and farming inputs (Morrison et al., 2006).

The challenge to manage is that small farmers generally lack information and skills to negotiate better contracts with large corporations. This is seen as a one-sided relationship in which most contracts are in favour of the buying firms.

However as a way to stimulate entrepreneurship, this is a good place to start (Morrison et al., 2006).

The role of the state in making contract farming work is critical from the point of view of taking this beyond contracts purely between private firms and farmers to institutional contracts with government marketing agencies such as the City of Johannesburg's Joburg Market (Morrison et al., 2006).

2.1.8 Financing urban agriculture

Financial support to poor urban families especially those who are micro-entrepreneurs, involved in urban farming is critical to ensure that they can have access to working capital. However many of these types of micro-entrepreneurs "have limited access to credit and investment schemes" (Van Veenhuizen, 2006). Financial support will assist in addressing several social outcomes in cities for the poor dwellers because "by growing food in the city, the urban poor can reduce household food expenses and generate additional income, thereby enhancing food security and reducing poverty. UA can also help recycle urban wastes, create green space in cities, and maintain existing green spaces in both urban and peri-urban areas" (Ibid).

It is widely known that "most urban producers lack access to credit and investment schemes as well as information about such schemes" (Ibid).

There are different types of urban agriculture which mean that financing options and needs ought to be addressed according to the types of urban agriculture targeted. These different types are: "a) agriculture practices for meeting subsistence needs; b) market-oriented activities; c) farming for recreation; d) or a combination of these" (Ibid). This research paper is concerned with the type of agriculture that is a combination of group or community subsistence farming schemes as well as market-oriented activity farming for profit generation. Farmers who group themselves into cooperatives

or a single farmer whose farming activity is large enough to generate profit will benefit from financial support in the form of credit (Ibid).

Urban agricultural can also enhance income generation and jobs for the urban poor and as such contribute significantly to local economic development by achieving “a *productive* city, one in which produce brought from outside the city is substituted with locally-grown produce” (Van Veenhuizen, 2006). Although this is not a direct way of funding urban farmers, it is nonetheless an important way of looking at food funding for the city at a macro level.

The challenge of addressing specific funding needs of urban farmers is that research conducted in several developing countries show that financing institutions do not often have schemes targeting funding for micro entrepreneurs involved in urban farming. Where funding is allocated for urban farming producers, often it is done under the auspices of rural agricultural support programmes, “as is the case in Gaborone, Texcoco, Camilo Aldao and Addis Ababa, or as part of urban community development programmes (Philippines)” (Ibid). This limits the potential for urban agriculture as most of the time the UA micro-entrepreneurs have no collateral required by formal financing institutions.

Types of financing

Financing urban agriculture can be categorised into financing derived from savings by the farmers themselves, or subsidies from government and other donor organisation as well as credit (Van Veenhuizen, 2006). Savings is about self-funding when the individual farmer or group of farmers involved in subsistence farming save from their produce to conduct further farming. Subsidies, on the other hand, take various forms which include grants from private individuals or organisations given directly to the farmer to buy tools and agricultural input as well as provide training.

Subsidies can also be granted to governments or banks with the aim to facilitate an environment for effective farming by farmers such as creating a

good platform for the marketing and selling of farm produce as well as creating dedicated credit lines. Such grants typically come from donors interested in meeting macro goals such as reducing poverty or creating employment. The third form of financing is credit financing based on a full cost recovery and profit generation by the funder. “Most existing credit and investment schemes, however, are not accessible to the poor or other vulnerable groups. Poor urban farmers usually cannot afford the requested collateral or the high interest rates, while they often lack access to marketing or management experience” (Ibid).

2.1.9 Practical lessons of Urban agriculture from other parts of the world

Up until about the 1980s, the concept of urban agriculture was a contradiction in terms. It was ridiculous to speak of ‘urban’ and ‘agriculture’ in the same sentence. However, “with the evolution of environmental sciences, urban planners began to emphasize the importance of interrelationships between human beings and nature” (Madaleno, 2015). In the 21st century, this has become not only an issue of creating green spaces in cities for beautification purposes, but a dire need, as urban city dwellers look for convenience, reduction of carbon emissions resulting from the transportation of fresh produce into the City, as well as the benefit of fresh and organic food grown closest to where they live. This section highlights some examples of urban farms in several cities of the world. It does so briefly with a short narrative and a few images.

Green in the City

Another example of an urban farming initiative is *Green in the City,* which is a successful rooftop urban farm in Tel Aviv, Israel. Every month, all year round, it produces 10,000 heads of leafy greens using organic and hydroponic methods of farming (Wang, n.d.). This urban agriculture initiative serves many purposes such as raising awareness about global food crisis, adding to the provision of organic produce to the local city residence of Tel Aviv, and to empower locals with the skills and tools to grow their own food organically

using hydroponics, which is a system of growing vegetables using water and nutrients without soils. This is explained in details in other sections of this paper.



Figure 2: Green in the City Farm

Source: (Wang, n.d.)

Gotham Greens

Gotham Greens is a large rooftop greenhouse farm in the middle of New York City in the United States of America. The farm produces vegetables that are sold to a large fruit and vegetable store located below their farm. This assures the retail store of instant fresh produce that is delivered to them on a need basis allowing their customers freshness and peace of mind of knowing where their food comes from. The farm also uses its facility as an educational platform where people can undertake pre-planned tours of their facility. The figure below shows the big greenhouse structure located in the middle of the New York City (Gotham, n.d.) .



Figure 3: Gotham Far in New York

Source: (Gotham, n.d.)

The company believes that their "greenhouse's proximity to large urban populations sharply reduce transportation, fuel consumption and associated air emissions, while ensuring [our] customers receive a fresher, more nutritious produce" (ibid)

Other urban farms in Europe, Russia, Africa and Latin America

Madaleno (2015) produced a report on urban agriculture initiatives in several countries across various continents. Below is a summary conducted by Madaleno (2015) on urban farming initiatives in a few countries in Europe, Asia, Africa, Latin America and the Caribbean.

Europe and Asia	
France	10% percent of Île de France constitute intensive farming and 35 % is used for peri-urban agriculture producing vegetables, flowers and fruit." (Madaleno, 2015)

Britain	London has about 30 000 active allotment gardens constituting 831 ha of land. 1 000 beekeepers are located throughout greater London generating 27 000 kg of honey each year.
Russia	Over 50 percent of the population of St Petersburg in 1999 (4.73 million) was engaged in urban farming.
Africa	
Mali	Bamako, Mali's capital city, produces enough vegetables to feed the entire city population of 1 million people. This is done by the 1780 city farmers.
Mozambique	About 6 200 women in the peri-urban outskirts of Maputo, the capital city of Mozambique, grow food and small livestock. These women are part of the General Cooperatives Union (GCU).
Latin America and the Caribbean	
Cuba	Cuba has: • “316 company farms (supplying state entities); • 178 basic cooperative production units; • 48 loans and services cooperatives; • groups of small farmers and gardeners cultivating more than 20 000 orchards and small parcels of land with an average area not

	exceeding 1 200 m2" (Madeleno, (2015)

Table 1: Examples of urban farms in Europe, Asia, Africa and Latin America

Source: Madaleno (2015)

2.1.10 Conclusion

The survey of literature in this chapter has revealed a number of relevant themes in the field of urban agriculture, locating it within the green economy, starting with addressing the dichotomy between sustainable development and the newly emerging field of green economy. Other themes explored are the role of urban agriculture in food security, job creation and poverty alleviation including potential negative effects of urban agriculture as experienced in various jurisdictions. Techniques utilised in urban agriculture such as the use of urban waste, both liquid and solid waste, green roofs, vertical gardens, aquaponics and hydroponics were explored as well as the financing of urban agriculture. Lastly, a portion of the literature review focused on the potential for entrepreneurial activities in urban agriculture as well as job creation.

On the subject of sustainable development vs. green economy, the literature revealed that the concept of a green economy is a new phenomenon of this current millennium which arose from the collapse of the global financial markets in and around 2008 from what is seen as the failure of the financial markets. Before the emergence of the concept of the green economy or rather its emergence into prominence, sustainable development was the flavour of the day around the world. Sustainable development, itself defined as the implementation of development policies and strategies by governments and the private sector in ways that did not compromise the ability of future generations to survive and prosper sustainably was seen to be different from the green economy. The difference with the new concept of a green economy is that whilst sustainable development' indicators of success were based on states or countries signing commitments to meet them within set timeframes, the green economy does not rely on such global agreements. The green economy is based on the concept of people themselves, not states, setting

their own goals and implementing their own initiatives. Such initiatives generate economic value for the players “while preventing environmental degradation, biodiversity loss and unsustainable natural resource use” (Bowen, A. 2012).

With regard to urban agriculture’s contribution towards food security, job creation and poverty alleviation, the literature surveyed supports the use of urban agriculture for these objectives stating its significant contribution to enhancing nutrition and health among urban dwellers and supporting them to create their own jobs and also creating a platform for social cohesion and community development as well as making the living environment in urban cities better living spaces (Van Veenhuizen, 2006).

The benefits, as well as potential threats of urban agriculture techniques such as green roofs, vertical gardens, aquaponics, hydroponics as well as usage of urban waste, revealed that there is room for innovation in urban agriculture where problems of land tenure and lack of arable land and water sources are prevalent. The literature evaluating these benefits also pointed towards some of the dangers of these techniques especially in terms of the potential health hazards of waste utilisation in food production.

Since the problem statement of this research is about assessing the potential for urban agriculture to contribute to addressing both food security and unemployment in the City of Johannesburg, the literature above points to the huge potential that urban agriculture has. The City of Johannesburg can learn from lessons in other countries where this has been implemented successfully as well as local initiatives which will be discussed later in this paper. It is also expected that the new technologies for urban agriculture discussed in the literature review will provide learning potential for the City of Johannesburg and more research will need to be undertaken in terms of the most relevant of these technologies. Another knowledge contribution of this research is the potential stimulation of policy changes to allow a more effective way of harvesting waste and facilitate for its use in urban agriculture.

Summary of literature review

The literature review for this research paper was drawn from the overall research question, the sub-questions and key themes. Below is a table that captures the key themes, the questions being asked in each theme linking them to the core purpose of the research. This is done to support how the data collected makes meaning of the research purpose and answer the research questions.

Theme	**Author**	**Question being asked**	**How does it relate to the purpose?**	**Data: Where is the data derived from?**	**Method**
Green Economy	Victor & Jackson	How does Urban agriculture fit in with the green economy?	The research aims not just to address food security but to create an economic benefit for the poor in urban areas	Literature specifically from jurisdictions which have looked at this issue	Desktop research
Benefits of urban agriculture	Van Veenhuizen	What are the socio-economic benefits of urban agriculture?	Urban agriculture serves a purpose beyond the provision of food. So, the research highlights this added benefits in order to create a convincing argument for the City to adopt an urban agriculture programme	Literature; interviews with identified participants; retailers	Interviews and focus groups

Food security and urban agriculture	Eriksen-Hamel & Danso; Ranasinghe	How can urban agriculture serve to ensure food security?	This is the core of the purpose of the research. A direct link is assumed and is justified in the paper.	Literature reviewed and from participants of food production and distribution	Desktop research, interviews and focus groups
Technologies for Urban agriculture	Barbiroli	Are there specific technologies for urban agriculture which can meet green economy objectives?	Sustainable livelihood needs for the production of food to reduce impact on natural resources and to reduce waste especially in the context of urban environments	The literature reviewed and from other cities that are implementing successful programmes in this field such as Ethekwini Metro.	Desktop research and interviews
The importance of entrepreneurship	Tambunan	Is there a potential for urban agriculture to stimulate entrepreneurship in urban areas?	Food security is unlikely to be solved by handing out food parcels to people, so this research looks at how through urban agriculture people can feed themselves and at the same time sell their produce profitably.	Literature and interviews	Desktop research and interviews

Urban agriculture and job creation	Williams, Round, & Rodgers	How far can urban agriculture create jobs	Like entrepreneurship, urban agriculture which produces ongoing needed resources has a huge potential to create jobs in cities.	Literature and interviews with the target group as well as retailers.	Desktop research and interviews
The role of government	Hovorka; Morrison, Murray, & Ngidang	What role should government play to facilitate an environment in which urban agriculture can thrive in cities	Poor people on their own have no resources and sometimes knowledge to make a success of urban agriculture initiatives as there is a need for policy changes as well as financial support	Interviews with government officials Review of the Gauteng Urban Agriculture strategy policy	Interviews and reviewing existing government support initiatives
Financing urban agriculture	Van Veenhuizen	Who would fund urban agriculture initiatives?	Funds are necessary for an effective initiative of urban agriculture to take place.	Interviews with government officials	Interviews and reviewing existing government financial support initiatives

Table 2: Summary of Literature review

3 Chapter Three

3.1 Methodology

3.1.1 Research paradigm: Quantitative vs qualitative

An issue such as the one identified for this research is best examined using the qualitative research paradigm because the researcher makes no hypothesis at the onset but plans to develop and make meaning of participants experiences as well as written research on the effectiveness or otherwise of urban agriculture in terms of food security, job creation and entrepreneurship. Although some quantitative data was gained in the course of the research, it was not the primary source of information to guide the findings of the research. Descriptions of experiences and opinions from participants in the form of words and pictures was more relevant to the results of the research. This approach allowed findings to be analysed by deducing meanings from various inputs and developing them into coherent theories or conclusions. The research will aid in the stimulation of policy changes to allow for a more effective way of growing vegetables in small spaces as well as facilitate innovation in urban agriculture (Wagner, Kawulich & Garner, 2012).

A quantitative study on the other hand which first sets out a hypothesis upfront would have required the researcher to develop a set of measures based on numbers and data derived from probability sampling. This approach would have required that the causes of food insecurity and unemployment needed to be tested and proven by analysing variables aimed at proving or disproving the hypothesis in a deductive way. The researcher believes that inductive research where information is gathered and used to develop a theory or conclusion and not the other way around is best suited to this study as it allowed participants the freedom to share their views freely and at their own pace (ibid).

3.1.2 Research Approach

This research was conducted from a critical social science research approach since this allowed for a practical way of looking at the issue in a manner that was intended to empower participants as opposed to merely observing them and their situations. The aim of the research was to end up with some form of proposals that could be acted upon resulting from the findings. The research reviewed instances where urban agriculture was implemented successfully, in ways that support entrepreneurship and job creation, as well as reviewed current thinking within the City of Johannesburg on the subject. This was done with a view to proposing the implementation of urban agriculture strategies within the City. From this perspective, it was observed that there is an activist intention to this research and this is what critical social science paradigm is understood to be. The approach is different from the positivist approach which focuses on natural laws or natural science. If the positivist approach was used here, this approach would have limited the researcher to analyse the natural laws leading to food insecurity and unemployment without employing the researcher's value-judgement when in fact, the researcher had desired outcomes in mind, such as developing proposal for implementation by the City of Johannesburg. The other approach of interpretive social science would also have fallen short as it would have led to a simple understanding and description of the situation and not empower people to change their behaviour as was the intention of critical social science (Neuman, 2006).

It is acknowledged upfront that during research the researcher got involved in running an urban farm on a rooftop. As such, there might exist a degree of bias in terms of the recommendations and preferred methods of urban farming discussed in this report.

3.1.3 Research design

Research design defined the overall strategy of this research to ensure that the research problem was addressed. It touched on sampling strategy, data collection strategy, and data analysis approach.

Phenomenology as a research design is most relevant to the issue identified for this research because phenomenology aims “to determine what an experience means for the person who has had the experience and is able to provide a comprehensive description of it. From the individual descriptions, general or universal meanings are derived, in other words, the essences of structures of the experience” Wagner, Kawulich & Garner (2012). This research approach ties in well with critical social science approach because what the research report sought to do was to review how participants in urban farming in the City of Johannesburg and government officials, perceived the potential effectiveness of urban agriculture to ending unemployment, poverty and stimulate entrepreneurship whilst at the same time providing food security. The research also sought to empower participants, mainly the urban poor to take actions through entrepreneurship to feed themselves and their families.

3.1.4 Data Collection Strategy

The researcher gathered data using a combination of primary and secondary data which was done in an observational setting. Data was collected about people, processes and cultures (Wagner, Kawulich & Garner, 2012).

Primary data was collected from interviews with a category of participants from practitioners in the field of urban agriculture.

Secondary data of research conducted in other jurisdictions where urban agriculture was implemented was collated.

3.1.5 Primary data

Interviews

Interviews are an effective way to obtain in-depth and comprehensive information because the researcher has control over who responds and can clear misunderstandings of issues during an interview (Wagner, et.al, 2012). This was critical for this research as the researcher interviewed practitioners in the field of urban agriculture and social development within the City of Johannesburg and the Gauteng province. This allowed for an opportunity to observe the body language and listen to what they said (or did not say) to make a meaningful interpretation of their inputs. This was found to be different from the limiting nature of questionnaires which are used in other types of research.

The interviews were unstructured to allow participants to take their time in determining the pace and content of the answers they give, albeit facilitated by the interviewer.

Section 3.1.7 ahead provides a list of all interviewees.

3.1.6 Secondary Data

Another data collection method utilised for the study was the use of secondary data where the researcher looked at research already conducted by other people or institutions.

One such study is by the World Bank titled: *Economics of South African Townships, Special focus on Diepsloot*, which sought “to develop a systematic understanding of the structure of the township economy, yielding a rich information base on the migration patterns of townships and informal settlements, changes in demographic profiles, labour market characteristics, and access to

public and financial services" (Mahajan, 2014). This was an important study as it informed the writer about entrepreneurship issues on the ground where Diepsloot acts as a microcosm of the landscape of Johannesburg.

Other studies were reviewed as part of secondary data collection such as a report of the Global Entrepreneurship Monitor (GEM) on the performance of South Africa on entrepreneurship. Official reports from Statistics South Africa several government departments' annual reports where reviewed. The list below is of the relevant documents the studies reviewed:

- Department of Water Affairs Annual Report 2011
- Gauteng Department of Agriculture and Rural Development' 20Year Food Security Plan
- Gauteng Department of Agriculture and Rural Development Annual Report 2015
- Statistics SA Census in Brief report 1999
- Statistics South Africa: Unemployment and Employment in South Africa Report 1998

A desktop study of existing urban farms in other countries globally was conducted and lessons from these are documented to serve as lessons that might be adopted by the City of Johannesburg in its urban farming programme.

Involvement of the researcher in urban farming

After interviewing one of the respondents, the researcher and them realised that there were many synergies between them. The respondent's company needed a project manager and an entrepreneur to take the project to fully operational level, and the researcher's goal post this research report, was to start an urban farming project.

It is possible that this involvement, which was not envisaged at the start of the research, might have shaped the researcher's own choices in terms of recommendations. This however, is mitigated by the substantive findings from literature review as well as the examples from existing urban farms both locally and globally.

3.1.7 Data Sampling

Where will Data come from? (probability vs. nonprobability sampling)

This research utilised qualitative non-probability sampling and purposive sampling as opposed to quantitative probability sampling. There was a bias in the decision-making process and purposeful selection of people, data and instruments in order to gain the knowledge and experiences of experts. The researcher used his own contacts and judgement to identify and select participants (Wagner, Kawulich & Garner (Eds.) 2012). This approach is different from quantitative probability sampling where those chosen to participate in a research are chosen randomly. Non-probability sampling was found to be useful for the purpose of this research because the researcher wanted to reach experts and practitioners who are involved in urban agriculture and employment creation initiatives, especially in government. The researcher targeted specific people and purposefully those he already knew to be experts in the relevant fields. Some of those identified were the people below divided according to interviews and focus groups as discussed in the previous section. As mentioned earlier, although not an experiment forming part of the research, the researcher implemented a specific urban farming technology which is discussed and this does increase the level of bias from a purposive sampling perspective.

Interview participants

Two government officials who were interviewed were officials from City of Johannesburg involved in the allocation of funds to programmes aimed at urban agriculture and job creation. Respondents from the City of Johannesburg were from the Social Development Department as well as one service provider implement urban agriculture on their behalf. Regarding the Department of Agriculture in Gauteng, the researcher interviewed two officials.

The researcher also interviewed a practitioner an urban farmer in another part of the country, Cape Town, who has implemented a successful urban agriculture programme as well as an urban farmer in the United States of America.

Interviews were conducted with three retailers who buy and sell food products, especially vegetables to gain their impressions of the potential for such an initiative and specifically to assess their willingness to partner with new urban farmers were this to be a successful initiative. These interviews also assessed the prospects for retailers in terms of their willingness to sign supplier agreements where a link and commitment is developed with large and even small-scale corner spaza shops and hawkers.

Interviewees

Name	Organisation
Appna. (2016, March).	Food Lovers
Argrys, L. (2016, July 15)	News Cafe
Frankental, R. (2016, September).	Urban Farmer, Vicinity
JT, J. (2016, December 6)	Main Events Caterers
Lovasic, L. (2016, February 2)	Urban Farmer, Simanye
Maluleke, A. (2016, July 15)	Urban Farmer, Bambanani
Mathews, L. (2016, February 2)	City of JHB

Motsusi, S. (2016, July 2016)	City of JHB
Mudau. (2016, February 25)	Urban farmer, Soweto
Phakwago, D. (2016, July 15)	City of Johannesburg
Phalane, S. (2016, January 19	Urban Farmer, Rustenburg
Quiding, L. (2016, January).	Urban Farmer, JHB
Rehann	Rooftop urban farmer, JHB
Smith, B. (2016, August).	Urban Farming consultant

3.1.8 Data analysis and presentation

Data analysis started with the capturing of interviews and was followed by a process of analysis of the captured notes on the interviews to extract the themes that emerged from the various interviews. This included noting the things that people did not actually say but revealed by their body language and other physical expressions. Observation of these non-verbal feedback was key to analysing the data. The researcher kept a record or audit of the interviews so that they could be referred back to, to see if trends emerged during the analysis.

Themes identified in the literature review as well as the stated research questions were used to organise and present new findings during the field research stage. This process of analysis led to the emergence of the following key themes, which themselves are reported as findings in chapter 4:

- Challenges and lessons experienced with urban agriculture from a global perspective
- Urban agriculture initiatives within South African and in City of Johannesburg;
- Commercial retailers of fresh produce and their willingness to support emerging urban farmers?
- Government support; and
- Unemployment and entrepreneurship

3.1.9 Validity and reliability of the data to be gathered

To ensure the triangulation of data, the researcher interviewed and gathered data from research reports already written on the topic by experts and interviewed urban farming entrepreneurs. Triangulation, referred to as the process of "checking the validity of an interpretation based on a single source of data by recourse to at least one further source" (Hammersley, 2008) was utilised. To ensure validity, the strategy was to collect data from practitioners in government (the City of Johannesburg and Gauteng province) who are also policy makers and crosscheck the findings from external research conducted as well as analysing the perspectives of the affected target population of urban farming.

Another important aspect of ensuring the validity of the research findings was to go back to respondents and have them comment on whether the findings echo their experiences and perceptions or not. The researcher took the findings and presented to at least two of the key people interviewed for their reflections. The feedback from this enhanced and refined the research outcome, but more importantly, helped test the validity and reliability of the findings.

Reliability in social science research is a difficult thing because unlike natural science research, social science research measures intangible constructs which are things that one is not able to physically see or touch (Wagner et al.). This research measured the opinions and attitudes of people towards the potential effectiveness or otherwise of urban agriculture initiatives towards addressing food security, poverty and unemployment. To this extent, the researcher acknowledges the difficulty of gaining consistency and reliability since respondents' views and moods often change. Once again triangulation assisted the researcher to be comfortable that the research findings were reliable because the findings corresponded with an existing body of knowledge.

3.1.10 Limitations

Due to the limitations of time and the fact that the researcher conducted this research alongside fulltime employment, it was not possible to interview everyone who could potentially add value to the research. Access to participants was not always easy and even some who had agreed to be interviewed became unavailable. Access to urban farmers proved easiest to reach.

3.1.11 Ethical considerations

In order to deal with possible misconduct or manipulation of research respondents, the research made certain ethical considerations. These include the following:

- Scientific validity: The researcher avoided plagiarism and fabrication of findings to ensure academic integrity. The researcher relied on the information given by respondents and checked some of the observations they made against documentation and writings by others to determine their validity.

- Participation: Participants were assured of confidentiality and anonymity. One such respondent who requested to remain anonymous is reported as such in the findings.

- A letter was drafted and informed participants that they had the right to contact the University to confirm the authenticity of the researcher as a student conducting this research as part of his studies.

The above ethical considerations ensured that respondents did not perceive that their data would be compromised. As such, an environment of confidentiality was ensured by the researcher.

The researcher gave respondents the option to sign informed consent forms before participating in the research survey. This consent form was to indicate that interviewees understood what the interview was all about, indicating that the interview was on a voluntary basis, and that they had a right to withdraw at any time and that there was a possibility of the interview to have emotional effects upon them (Wagner et al., 2012)

4 Chapter Four

4.1 Research Findings

The overall research question which is in line with the purpose of the research is: How can urban agriculture increase food security in ways that aid in job creation and stimulate entrepreneurship among urban dwellers in the City of Johannesburg? This overall research question is supported by the following sub-questions:

- What lessons exist in other countries that can assist the City of Johannesburg to start a programme of urban agriculture more successfully?
- What are retailers of fresh produce willing to do to support small-scale urban farmers?
- What urban agriculture initiatives are currently in place within the City of Johannesburg and how viable are they? and
- What are the current government programmes aimed at supporting urban farmers?

This chapter responds to these research questions by covering the following themes which will be the bases of making recommendations in chapter6:

- Challenges and lessons experienced with urban agriculture from a global perspective
- Urban agriculture initiatives within South African and in City of Johannesburg;
- Commercial retailers of fresh produce and their willingness to support emerging urban farmers?
- Government support; and

- Unemployment and entrepreneurship

4.1.1 Challenges and lessons experienced with urban agriculture from a global perspective

Apart from one example of an urban farmer interviewed by the researcher, the rest of this section is the result of desktop research conducted via the internet. It was found useful since most of the farms profiled were existing farms as represented by the way they report about themselves online. The researcher cannot confirm the real existence of these farms. However, the last part of this section is of a conference in which panelists spoke of their knowledge of some of the farms covered in the report.

Main Event Caterers

Main Event Caterers is a catering and event management company. In 2012 the company announced it would use the aquaponic farming methodology at their office premises in Arlington, Virginia in America (Main event caterers, n.d.)

The researcher of this paper, while visiting the US, Washington DC, contacted the owner of Main Event Caterers and visited their premises to interview its founder, herein referred to as JT. JT has experience in running an urban farm.

First of all, even in America, presumed to be an advanced nation, the government of Washington DC has not caught up to the growing interest of growing food on rooftops, let alone using aquaponics (Main event caterers, n.d.). When Main Event Caterers applied for a permit to set up the farm on their rooftop, the local government administration had no idea as to how to handle their application and as a result, when they applied for a permit, they were only given permission to set up a farm on the ground floor whilst the government figured out what kinds of permits would be relevant for this urban farm (JT,(2016). Personal interview).

After setting up their system, JT learnt several lessons, namely, the mixing of fish species such as Tilapia, Catfish and Carp was found to be a bad idea as some of the fish were too territorial and fought all the time and the babies were often eaten by adults.

Their system was capital intensive and took a while to pay for itself since their only client was their own catering company which used the fresh produce for client events. It was too much of a technical operation requiring someone with knowledge of nutrient mix, temperature needs for fish and balancing Potential of Hydrogen (PH) on an ongoing basis.

JT believes that if they were to do it again, they would use such a system to grow high value crops such as micro-greens, and they would use aeroponics and not aquaponics because micro-greens grow much faster using aeroponics. Aeroponics "is the process of growing plants in air or misty environment without the use of soil or an aggregate medium (known as geoponics) …Unlike hydroponics, which uses a liquid nutrient solution as a growing medium and essential minerals to sustain plant growth; or aquaponics which uses water and fish waste, aeroponics is conducted without a growing medium" (Aeroponics, n.d.)

Key findings: *Main event's experience points to the need for policy and regulations regarding the use of rooftop spaces for agricultural purposes. The City of Johannesburg could develop such a policy.*

4.1.2 General challenges found with urban farming globally

Agritecture, an urban farming commentator blog, hosted a conference of more than 200 urban farmers in February 2017 in Atlanta, Georgia called the Aglanta Conference. At this conference, a panel of experts discussed the most common failures, their causes and possible solutions to urban farming (Michael, 2017).

Below is a brief discussion of some of the relevant issues covered during this conference, mainly about challenges affecting urban farmers.

Insurance Location

Securing one's investment is seen as a key part of most business ventures. However, unlike commercial conventional farming where big farmers have huge scale and means to withstand challenges such as disasters by insuring their farms, small urban farmers face difficulties in insuring their facilities due to the insurance industry's lack of relevant insurance products for this unknown farming method as well as lack of scale which prohibits them from taking the necessary risk appetite. As such, small urban farmers are unable to find ways to mitigate disastrous forces such as unexpected weather issues and a range of other farming challenges.

Location and distribution

Location is key from the perspective of the need for growing food closest to where people live. Urban farmers need to sell their produce to local residents in cities or the local restaurants closest to their farming operations. Where growing might be the easiest part of an urban farmer given the advancement of urban farming technologies such as hydroponics, aquaponics and vertical farming, the problems of distribution and getting their produce to the end user are critical for many of urban farmers. Many are not necessarily sales and marketing experts nor do they have enough time to develop efficient distribution channels. These farmers also face challenges of competing with fresh produce from conventional farmers which often land in the local municipal fresh produce markets where restaurants and fruit and vegetable retailers buy from them through established distributors.

Distribution and/or location is so important to the performance of any farm. If a farmer chooses to sell direct to consumers, for example, it makes sense for their farm to be located closest to consumers. If on the other hand, they choose to sell to restaurants, their farm should be located closest to the restaurants they wish to sell to. However, if they choose not to compete with distribution companies and want to use established distribution channels to distribute to either restaurants and retail stores, then their farm should be located not closest to consumers or restaurants but closest to the warehouse and processing factory of the distribution company. Many urban farmers fail for not recognising the importance of location in relation to the distribution of their produce.

Cost of running an urban farm

Another issue affecting urban farmers is that of the cost of running an urban farm. Some Urban farms are indoor and require energy in the form of artificial lighting. Some are on Rooftops requiring cost to manage weather forces and other natural forces related to farming on higher buildings including the cost of managing equipment and fresh produce up and down the roof. These are important factors urban farmers must contend with which often, if not anticipated in advance, thwarts their success.

Pricing

Another major challenge facing urban farmers is that of the pricing of their produce. The panellists talked about how often a lot of urban farmers set their prices based on the going price at retail vegetable shops or the daily prices of the local municipal fresh produce market. This, they argued is a recipe for disaster. Consumers today are most interested in knowing where their food is grown, how it was grown as well as knowing that they are consuming the freshest produce that has not been cut and refrigerated or processed using genetically modification to ensure that it has a longer shelf life.

Urban farmers have the advantage that they can grow their food without the need for genetic modification to ensure long shelf life because their produce does not need to be kept in the fridge and it does not need to travel long distances to reach consumers. As such, for the fact of its freshness and mostly organic, urban farmers should demand a premium on their produce. The good news is that some consumers of urban produce are educated about this and the urban farmer should know that they are in an industry which is a perception driven industry. With the current hype for fresh organic produce and the high levels of education that many consumers possess, urban farmers should capitalise on this fact and charge a fair bit more than conventional farmers.

Education

The process of planting, harvesting, packaging and even processing in an urban farm which uses some degree of technology requires that the staff in an urban farm have some form of education to be able to read instructions and technical manuals. For example, in a hydroponic or aquaponic system, the daily tasks involves the management and reading of PH (potential of hydrogen) which measures the acidity or alkalinity of water as well as EC (electrical conductivity) to know the strength of nutrients that are given to the plants on a daily basis. At higher or lower PH most plants do not consume the nutrients that are given to them. At a low or too high an electrical conductivity measure, most plants show strain or even die. The training level of an urban farm worker may need to be slightly advanced than that of a conventional farm worker. This adds to the cost of running an urban farm.

The discussion above highlighted some of the challenges experienced globally by existing or ‘shuttered’ urban farms. It serves to inform any local urban farming initiative such as the ones proposed in this paper for implementation within the City of Johannesburg.

***Key findings**: Since location impact the profitability of urban farms, it is therefore a critical decision-making point for urban farmers. It makes sense for these farms to be located closer to consumers if the aim is to sell direct to them or to locate closer to distributers' warehouses if the strategy is to sell through them.*

The next section looks at the experiences of local South African and urban farming initiatives and discusses their successes and challenges as reflected upon by the farmers or practitioners interviewed.

4.1.3 Urban agriculture initiatives within South Africa and in the City of Johannesburg

This section discusses seven existing urban farming initiatives in South Africa and highlights the challenges some of the face. The researcher also shares his own experiences with an urban farming project and the lessons he has learnt.

Farms supported by the City of Johannesburg

The City of Johannesburg has established and supported several urban farms around Johannesburg in the areas of Braamfontein (3 Kotze farm), Orange Farm, Betrams (Bambanani), and more.

The City's Social Development department runs a Food Resilient Programme which saw the setting up of a hydroponic rooftop farm on one of its buildings at number 3 Kotze Street in Braamfontein. The Unit Manager for the Food Resilience Unit which established the Kotze street rooftop farm said that their urban farming initiatives are aimed at reducing poverty, unemployment as well as creating opportunities for entrepreneurship (Motsusi, 2016. Personal interview). The Kotze street farm is located on the roof of a building that serves as a shelter for the homeless and it produces about 40 kg of various types of vegetables such as spinach, cabbage and lettuce.

The Kotze street rooftop farm was installed by a consulting firm, the name of which is not mentioned for reason of anonymity. The firm contributed in setting up two similar urban farming systems at another rooftop farm discussed later in this section. They also helped to the project manager of the Kotze Street rooftop farm, together with her team.

A consultant of the above-mentioned firm believes that anyone with an entrepreneurial drive and willing to work hard and who receives training such as the team at Kotze street rooftop farm can make it as a hydroponic farmer. The hydroponic system is designed with very low technical specs which means it can be operated by people with little educational background (The consultant, 2016. Personal interview).



Figure 4: Kotze Rooftop farm

Source: Researcher

The Food Resilience unit manager's colleague in the City of Johannesburg says that the City buys R2 million worth of vegetables from the Johannesburg Fresh Produce Market every month and that they wish to see this money spent with local urban farmers within the City. It is for this reason that they support many urban

farmers including emerging rooftop gardens (Unit manager's colleague, 2016. Personal interview).

The City supports another initiative called Bambanani. A cooperative of 8 members, run by AM (not his real name), Bambanani Food & Herb Cooperative was inspired by AM's upbringing of growing up in a rural village in Limpopo where he grew food as a subsistence way of living. AM says he grew tired seeing the old bowling club next to Ellis Park Stadium lie idle and thought to himself, "there lies an opportunity to grow food in the city" (AM, 2016. Personal interview).

Although not certified as such, the Bambanani farm produces its vegetables organically and supplies nearby supermarkets, and sets up stalls at local markets such as Sylvia Market, Neighbourhood Goods and BluBird Market. They tried to supply to the Johannesburg Market and soon realised the challenges faced by small farmers.

AM says the Johannesburg Fresh Produce market allows only a minimum truck load of 2 tons to enter and supply the market, thereby prohibiting urban farmers. At first, they would club together with other urban producers outside the gate of the Market to combine their produce until they reached 2 tons and unfortunately for them, the commotion this caused at the gate prompted a big producer to protest and they were left with no options but to look for other markets (Ibid).



Figure 5: Bambanani farm

Source: Author

Supporting the view that even poorly educated people can learn and grow vegetables when driven by passion, AM registered to attend classes at the Gordon School of Business Science (Gibs) to deepen his knowledge about the role and contribution of small businesses to the green economy.

Other urban farms within the City are established under the banner of the Johannesburg Property Company and the Johannesburg Social Housing Company.



Figure 6: Urban farm by Johannesburg Housing Company

Source: researcher

The aim of the various urban initiatives within the City is to reduce levels of food insecurity as well as provide income to the city residents that participate in these initiatives, many of which are run by Cooperatives.

Key findings: *The lack of a sustainable mechanism to support the Kortze farm as well as poor management f the cooperative which led to its failure points to the*

need to revisit the approach of supporting urban farming from the perspective of groups (cooperatives) vs supporting highly motivated entrepreneurs willing to take ownership of their ventures.

Oranjezicht City Farm

Managed by a retired sustainability consultant, herein referred to as “SO”. Oranjezicht City Farm Market in Cape Town. It started as a small volunteer community project and now boosts four years generating a substantia contribution to the local Cape Town economy. The farm has created 200 jobs by working with and supporting 15 small scale farmers, 60 traders and making a turnover of R3 million a year. At their Cape Town market, which they run once a week, they receive 2500 people at the market each week.

Their farm, located in the bottom part of Table Mountain, produces fresh vegetables and combines their produce with that of other small-scale farmers to trade at their Market day on Saturdays in the city. On their plot of land which is about 500sqm, they can generate R3000 a month. SO says that she believes that government can support the poor by giving them access to land. “If the government can make land available, especially unused government land, and have 1000 poor people take these up and grow on 500sqm each generating R3000 per month, then you start to impact positively on poverty” (SO,2015. Personal interview).

Believing food is a human right, SO wants politicians to take this as seriously as they do all other human rights policies, by creating a legal framework to ensure no one ever sleeps hungry. She says most human rights policies are supported by specific policies and institutions, but this is not the case with food. It is for this reason that she found a piece of unused ground, an old unused bowling club established in the 1950s, which had become a haven for criminals. She decided to turn the old bowling club into something productive. Her other motivation was

as a result of being a victim of crime of criminals who used to hide away in this piece of ground. She decided she was not going to move out of the area and understood the conditions that led to people behaving as did those criminals. She felt the need to clear the land and to engage those people in something positive. The achievement of her vision is truly amazing.

SO is concerned that many poor people eat mostly unhealthy food resulting in them becoming fat and sick because the food is not grown for nutrition but for longevity on the shelf.

The farm also serves as an education centre for 1500 learners from over 20 schools who frequently visit and learn about growing food in small spaces, nutrition, plants, climate change, etc. They are working with the Department of Education to make a formal curriculum on these issues.

She has started an initiative where families or clients pay in advance to have what they consume planted for them. They pay in advance to ensure that the fruits of their labour do not go to waste as is the case with many farming initiatives, where the produce is thrown away because the journey to go to market is difficult and often jeopardized by big farmers colluding with retail conglomerates (Ibid). When asked about the prospects of her initiative and the farmers she works with to supply to retailers, she had this to say, “we don’t want retail shops. Here we stand by what we say. It is authenticity here and many retailers don’t always do as they say. They want crops to be uniform in size and looks and that you cannot get if you are growing organically” (ibid).

The first and most challenging aspect of this farm was the initial investment to get it going. SO invested her own money to pay workers, purchase a bakkie (pickup truck) and pay for many other expenses. This was done in addition to the many hours she spent on the farm without being paid a salary. She also started the farm

with volunteers who were not paid. She now funds the farm from the sale of produce at the market once a week.

She does not have enough supply for the once a week market day from her own farm and from the 15 other small scale farmers that she works with. She also finds that transport is a problem since she has to fetch fresh produce from the other farmers who have no transport of their own. This has led her to start thinking about establishing food hubs throughout Cape Town so that the small-scale farmers can sell to the public directly.

Another challenge she has encountered is to put systems and processes in place to ensure her dream of feeding the poor and teaching people how to grow their own food is not thwarted. “People are excited in the beginning and later get burn out or lose interest. Social entrepreneurs start initiatives like this but because it is done without venture capital funding they lose steam without funding. The kinds of people we employ also need psycho-social support, they are homeless, drug addicts and face other social challenges. You end up having to help them and sympathise with them, and this takes a tall on you” (ibid).

The farming method they use is a drip irrigation on the ground using soil beds. For composting they have a worm farm and an organic composting process where the community brings their food waste to make compost. They also use companion plants as well as make their own organic pesticides sprays for pest management. They don’t dig the ground to avoid disturbing existing microbes already in their growing beds. Each time they prepare a new bed they just add composts on top. Forty-five varieties of fruits and vegetable crops are grown in the farm. Fruit trees also help as wind breakers.

SO’s advice to anyone who wants to start an urban farm is that they need to ensure that they have a formal contract from their landlord. They must seek water for free and must work with the community capturing their imagination and have

them fired up to want to get involved. This are lessons she had to learn along the way. She also believes strongly that the City needs to get involved, and the one way to do so is to pay for the market infrastructure and establish a management company that run local community markets as well as build local community hubs because small urban farmers will never be able to compete with large commercial farmers who sell their produce at the established local fresh produce market.

Key findings:

- *Laws such as Human Rights laws need to be enforced to ensure no one sleeps hungry by forcing institutions of government to develop innovative solutions to stop hunger.*
- *Food production of agriculture should be made part of the school curriculum from an early stage of education.*
- *Small scale farmers should have formal supply contract supported by legislation as well as formal tenancy contracts to farm in the land that mostly does not belong to them.*
- *Municipal government should pay for small farmers' market infrastructure and establish a management company that run local community markets as well as build local community hubs because small urban farmers will never be able to compete with large commercial farmers*

Soweto urban farmer

An urban farmer from Soweto managed to negotiate a piece of ground in a school yard which he has been planting for the past few years. He previously used to work at the Country Club Johannesburg as a restaurant manager and managed to convince some of the patrons to donate a greenhouse tunnel for the propagation and protection of his crops. He used to sell produce to the club's patrons and now sells to his surrounding community in Soweto (Soweto urban farmer, 2016. Personal interview).



Figure 7: Mudau Farm, Soweto

Source: Author

Integrated Aquaculture

Run by an entrepreneur, here in referred to as “Mr L”, Integrated Aquaculture is an urban fish farm which focuses on “the production of Tilapia Fish for human consumption making use of shipping containers and greenhouse tunnels.” They support the Tilapia growing industry by collaborating knowledge and experiences as well as selling equipment to the industry (Quiding, in, n.d.)

Mr L is passionate about what he does. He started his fish farming business after selling his security company three years ago, driven by the need to tap into what he saw as a growing global opportunity. He managed to get a small grant from the Department of Trade and Industry (DTI) to help with the infrastructure set up. He is a self-taught farmer with no historical background in farming. He watched online videos and read anything he came across related to aquaculture and aquaponics. Aquaculture is the farming of fish in tanks as opposed to their natural environment. He farms freshwater fish as opposed to salt water fish which many fish farmers do.

Given the amount of fish waste generated, he set up an aquaponics module which he markets and sells to small scale farmers in greenhouse tunnels. After setting up a greenhouse of a Cooperative client and observing the lack of group maturity that most Cooperative have, Mr L believes there is no accountability and no

ownership amongst Cooperative members. This, according to him, is due to the fact that such structures are an amalgamation of people brought together not by a common purpose but as an escape from poverty and as such they do not see the long-term value of their ventures. He feels desponded to sell to cooperatives as he feels success will come from self-start entrepreneurs (Mr L, 2016. Personal interview).

There are many challenges that Mr L has experienced with his fish farming enterprise. He has perfected the technical side of the farm set up, and everything runs well as he has about 50 000 Tilapia fish at any given time. However, he is not able to compete with retailers who import the same type of fish and can sell frozen Tilapia cheaper than his production costs. His alternative is to establish a market within communities where people can come with small bakkies and buy fish to sell in the township. At the time of the interview, Mr L was still busy establishing these links but not yet successful.

Because of the technical nature of the farming systems which has too much technology such as complicated pumps, monitoring probes, meters, and automatic feeders, labour is the main concern for Mr L. He believes that there is limited education among the typical people who are farm workers. He has found it difficult to find young black people interested in farming who possess a bit of general knowledge to manage some of the readings necessary for the farm.

Key findings: *Selling produce as an emerging farmer requires establishing an alternative approach from the establishment by establishing a fresh produce market within communities where people can come with small bakkies and buy sell in the township.*

Vicinity

“RF” is an entrepreneur who sells vertical garden platforms for urban farming through his company, Vicinity. He started this business after realising the potential for vertical urban farming. He is “involved in creating opportunities for a new generation of farmers that want to grow food in cities. The world needs new methods for growing food sustainably. Vertical farming uses less water, is more space efficient, easier to control than open field farming, and is closer to the customer with less carbon impact due to reduced distance for transportation. The urban farming revolution is under way, and RF aims to be a contributor to this new industry (Frankental, in, n.d.)



Figure 8: Vicinity vertical farming system

Source: Vicinity

RF is adamant that his system is better than most urban farming systems. He uses soil as a grow medium. He says, “I think that urban farming has huge

advantages in water efficiencies and proximity to the market" (RF,2016. Personal interview). His system comprises readymade hardware material for an easy do-it-yourself (DIY) assembly for a vertical garden with an irrigation system that allows for easy and reliable irrigation. This is accompanied by an electronic smart sensor-technology to monitor the system functionality always, by detecting irrigation failures, alerting the farmer of any malfunctions including lack of water feed (Ibid).

As part of the research, the researcher bought one of RF's system and placed it at his home for testing. The results were amazing. With an automated timer for watering intervals, a float to fill water into the tanks once the water drops to a low level, this proved to be a hasslefree farming method geared for people with limited spaces. What the researcher also found attractive from this system was the lack of complications found in both hydroponic and aquaponic systems relating to the balance of PH and nutrients. In this system, if the soil medium used is pre-composted, there is little to no need to add nutrients. See picture below of a system installed at the researcher's home balcony.



Figure 9: Home Balcony System from Vicinity

Source: author

Key Findings: *Soil based mediums on vertically placed planting pots could serve less educated people since they do not require technical instruments and know-how for monitoring various things that hydroponic systems require.*

Greenbuds

"SM" is a young entrepreneur who started his agri-produce hub in the city of Rustenburg after quitting a professional job at Telkom. Greenbuds is an enterprise aimed at the "upliftment of small scale farmers up to a level where they are capable of farming on a commercial scale, thus becoming meaningful players in the development of their local economies" (Greenbuds, n.d.)

SP was attracted by an entrepreneurial mindset which saw an opportunity from the economic growth of the Rustenburg area stimulated by mining activities. He says he realised that a lot of fresh produce feeding the mine workers and other mining staff was brought in from as far afield as Johannesburg - from the Johannesbburg Fresh Produce Market. He saw that a lot of farmers in the North West produced for the Joburg market only for their fresh produce to come back to Rustenburg and sold at a higher price. He cites an example that shows that the Joburg fresh produce market makes R21 million from 05h00 to 10h00 in the morning daily and the Tshwane market also makes over R10 million during the same time. "This means there is no doubt about the potential for this kind of business in Rustenburg if it is run well" (SP,2016. Personal interview).

A major challenge that turned into an opportunity was the difficulties experience by small scale farmers who supply big retailers but can only meet their service commitment for only one season. The trouble being that, due to their limited farming and business skills, they cannot plan their growing times and synchronize with the time of harvest by ensuring that when they harvest, the next crops are ready for their next harvest. "Many small-scale farmers are seen as unreliable by suppliers because of their limited capacity (knowledge and equipment). After

harvesting, they must wait several months before the next harvest, and this makes them lose their contracts. Through Greenbuds, SP is able to assist them to collaborate and increase the collective capacities of several farmers and negotiating contracts with retailers and mining houses. He can service these contracts by buying produce from several farmers.

Greenbuds also has the additional benefit of adding value to their fresh produce by providing food processing services. For instance, they chop vegetables for functions such as weddings and parties as well as for local restaurants.

They have a data base of all the farmers in the North-West province, and their goal is to facilitate for a situation in which, through Greenbuds, farmers could be assured that their produce will be bought given the fact that they do not need to engage in marketing these themselves. The way they achieve this is by advising farmers to grow different things so that not all farmers grow the same crops at the same time thereby reducing prices by flooding the market. Because Greenbuds negotiates deals with clients, they can select the various crops which farmers can grow to meet the demand. This forms part of their business's advisory services in a programme called, grow the grower programme. The programme is run through pre-negotiated prices resulting in little to no effect on price fluctuations which is different to what is conducted in the more established markets.

Transport costs from farms to their warehouse or clients are paid by Greenbuds and not by the farmer. They collect from farmers, and this is built into the agreed prices with the farmers. They fix prices since their clients want to have steady prices. For example, "we have a tender with a mining company for their hostel food supply, and we have an agreed price with them. We fix prices with the buyers on the one hand and the farmers on the other hand" (Ibid). Other customers they have are hospitals, Bed and Breakfast (B&B) facilities as well as some chain restaurants.

The warehouse they operate from is an old industrial building which they had to refurbish and repurpose. They approached government institutions like Invest North West, but were disappointed. SP believes these government institutions are not interested in supporting small businesses despite their constant claims that they support small businesses. Unfortunately, the focus of government support in agriculture is through cooperatives. “The problem with cooperatives is that not all members of cooperatives are entrepreneurs and many a time a lot of fights and bickering starts as soon as the first pay cheque is received” (ibid). “When budgets are made for supporting small businesses, officials scramble for the loot and no progress is made. In fact, we know of R35 million that has been rolled back into Treasury as unspent budget due to bureaucratic incapacity to execute. I have avoided diluting my progress and took the risk, and hopefully, they will come on board soon” (ibid).

They fund their business through negotiating good payment deals such as payment within seven days of supplying to their corporate clients. This, in turn, means that their farmers are also guaranteed speedy and constant cashflow.

Dealing successfully with corporate clients including retailers requires quality control and certification. Greenbuds is processing to gain a GAP (Good Agricultural Practice) certificate which is a critical control point to ensure management of processed food and compliance with health requirements. The certificate is also needed for acceptance by the municipality to ensure that the operations are supported, and the clients can also differentiate Greenbuds from “micky mouse” cooperatives. “By looking and presenting ourselves as a professional organisation, we are able to attract clients and banks or funding institutions chasing us for business. These include clients such as Famous Brands and Nedbank” (Ibid).

Advise to emerging urban agriculture entrepreneurs

SP says that the government should create an end-to-end system where, when they have trained apprentices, there are real opportunities for them. He helps a few young people to start farming by buying them seeds and facilitating access for them to a farm, and these in turn supply Greenbuds with fresh produce. “So when you hear people saying that young people are not interested in farming, this is false” (ibid).

Greenbuds makes a turnover of R800k per month and SP believes they have the potential to do R2 million per months. They aim to be present in every district municipality to open similar hubs or facilities such as their existing one. He sees this prospect as a good prospect because he says if each municipality were to have 100 farmers participating and supplying to a facility such as Greenbuds, suddenly they would be an increase in the number of young black farmers participating in mainstream agriculture. They have a client base, such as Famous Brands, a few restaurants chain stores and several mining companies.

Greenbuds employs 45 direct employees and their farmers and the cooperatives whom they work with have employed 95 people through the entire farming value chain. They project that if they implement their business plan fully covering all the four districts in North West, they would be able to create 900 jobs per district.

Key findings: *There is a need for farmer training to ensure that farmers can synchronise their growing processes and not all grow the same items at the same time and also that when they grow, they can grow and harvest all the time thereby ensuring a constant supply to their customers.*

Simanye Trust

One of the directors of Simanye Trust, an enterprise development Trust based in Johannesburg interviewd by the researcher is “LL”. Simanye started off as a BEE enterprise and economic development consultancy specialising in how to use

business to drive economic change. Together with her partners they experienced frustrations when recommending social impact initiatives to their corporate clients who were not too willing to implement their recommendations. This led the two social entrepreneurs to found Simanye Economic Empowerment Development Trust (SEED) which is an NPO (Not for Profit Organisation). The Trust can receive both enterprise development funding from corporates as well as grant funding for social impact initiatives. One such initiative is a rooftop farm established in downtown Johannesburg. The Trust allows Simanye Consulting to entice its small to medium clients who do not have the capacity to implement Enterprise Development (ED) initiatives to donate money to the Trust to do some "cool social impact stuff" according to LL (LL,2016. Personal interview).

Because the funders that invest in Simanye Trust are investing their money to finance social enterprises, they do not necessarily need their money back with huge amounts of returns. As such, Simanye Trust can invest in high risk initiatives, unlike the more established venture capital funds which typically look for high returns on their investments. "Our focus is not to make too much money out of our investment, but we are more interested in unlocking potential," LL said (ibid).

The Trust's first initiative was a farming venture in the North-West province where Simanye Trust had two project managers over a short period of time. This did not work well since, based in Johannesburg, the Trust could not effectively manage something that was too far from them. Eager to pursue their social impact goals, a new project was conceived – a rooftop farm.

It all started with a pilot on small farming systems at a few urban spaces such as a school in Jeppestown, Johannesburg. Later, Simanye Trust partnered with another social impact organisation to establish an urban farming initiative on the rooftop of a residential building in Jeppestown. This partnership resulted in the completion of a feasibility study in 2014 followed by the establishment of a commercial pilot in 2015 on the rooftop.

The main environmental and socio-economic benefits of this urban farming initiative was to include:

- Improving local food and nutritional security for poor people who currently pay hefty prices for nutritional food because they often buy stuff from local vendors who themselves buy the fresh produce from retailers;
- Skills development, job creation and enterprise development. The intention is for their urban farms to employ local people and develop them into social entrepreneurs who will run their own urban farms;
- Education and training are the other objectives. Currently, the rooftop farm at Bjala Squire is used for this purpose. Kids from a school on the ground floor of the building are taught about food production, nutrition and health by Malibongwe (farm operator) two afternoons a week; and
- Resource-use efficiency (water, nutrients, fuel, land) – they are also interested in using water conserving technologies, hence the choice to use aquaponics which has proven to use 90% less water than conventional ground farming (Ibid).



Figure 10: Rooftop Roots, A farmer teaching kids about growing vegetables

Source: Author

The rooftop farm was initially operated by a local resident of Jeppestown who showed an interest but lacked the entrepreneurial skills needed to make the farm grow and become self-sustainable. It is for this reason that Simanye wanted to partner with an entrepreneur who could invest their skills and time to take it further.

The rooftop farm is an innovative urban eco-farming business. The current farming initiative uses aquaponics and hydroponic farming systems, “which are both 100% water based methods of growing healthy and tasty produce without the conventional use of soil. The aquaponics system is a closed loop system comprising of fish tanks and plant grow beds which create an efficient approach

to water-based farming. The fish provide nutrients to the plants, and through a circulation process, the plants clean the water by absorbing nutrients which otherwise are not good for the fish but are necessary for plants, after which the water returns to the fish tanks. Rooftop roots grow a variety of leafy vegetables and herbs along with tilapia fish" (Ibid).

The company managing the rooftop farm is a social enterprise company. Social and environmental impact are as critical as much as profits and business growth. The farm is located in a low-income area and this facilitates for it to sell its produce locally to low income consumers affordably and yet offering high levels of freshness and organic vegetables. LL said: "we commenced our initiative by conducting a feasibility study in 2014 which was followed by the installation and management of 2 pilot aquaponics systems on the rooftop of a building in Jeppestown. The success of the pilot resulted in us scaling up to a further 4 systems. During both the feasibility study and pilot phase, our team has developed knowledge of the value chain of farming and food production in the city. We have created good networks with suppliers and clients" (Ibid).

There are three systems currently in place at the rooftop farm, namely a vertical hydroponics system, a horizontal one and a Deep-Water Culture (DWC) aquaponics system. The roof space allocated for the farm is approximately 1000 sqm on a 3000sqm rooftop.

The first system installed in 2015 is an aquaponics system comprising of two deep water culture grow baths and two large fish tanks taking about 50sqm of space, comprising of: two 1500-liter fish tanks; two radial flow filters; two Bio-filters; two 2500-liter deep water culture grow beds; low pressure plumbing fittings; water and air pumps; solar geysers to warm water during winter; a generator for an alternate energy source. The system is power dependent to run the water and air pumps, and it is necessary to ensure that there is a backup power generation equipment.

In terms of weight, the system without water is approximately 300 kg. The weight of the water is the most significant contributor to weight, as the total water is approximately 10000 litres at one time. This means that structurally this kind of system needs to ensure that the roof can support the weight. To address this concern, the system was installed in such a way that the bulk of the weight of the water tanks rests on building's supporting beams/pillars.

The production capacity of the above system is approximately 1200 vegetable plants.

The second system on the farm is a hydroponic system which uses a nutrient film technic (NFT). The specifications of this system are as follows: including the water/nutrients tanks the system is approximately 5600mm in length, 1340mm wide and 2030mm tall; it has two water tanks and can accommodate approximately 1000 plants. The entire system weighs approximately 2600 kg, which includes fully grown plants in the system at the end of the plant growth cycle as well as the water tanks.

The last farm system on the roof comprises of two horizontal tunnels measuring 2m wide X 5m long X 1.6m in height with a weight 250kg each (inclusive of water and plants), covered in 40% grey agricultural shade cloth. This system also uses NFT. In addition, a third smaller tunnel measuring 3m x 2m with a weight of less than 100kg is in place for seedling propagation. This last system was a donation from the City of Johannesburg and is like the one located at Kotze Street rooftop farm in Braamfontein.

Later involvement of the researcher in the Rooftop farm

After interviewing LL, the researcher and LL immediately realised that there were many synergies between them. LL's company needed a project manager and an entrepreneur to take the project to fully operational level, and the researcher's

goal post with this research report, was to start an urban farming project. This would be implemented as part of the researcher using the research report to encourage the City of Johannesburg to support such urban farming initiatives. As such, it was decided that the researcher had the exact profile of an entrepreneur that LL's company was looking for – with his social enterprise experience, formal business experience, growing businesses from start-up to medium sized enterprises, and he was working towards a Master's degree focused on urban farming. The parties agreed to come together to try to fully operationalise the rooftop urban farming project and scale it into a large scale social impact business.

The parties immediately entered into an agreement which came into effect on April 1, 2016, and which would last for 3 months, and with the potential for further extension to the end of October 2016. This was to allow the parties an opportunity to evaluate the progress and potential for scaling-up the business.

The result of this partnership is documented below.

Key successes

The following keys achievements were recorded during the first 6 months of the partnership:

- Installation of 5 new Hydroponics systems (2 Simanye Trust funded and 3 donated by the City of Johannesburg (CoJ);
- Successful planting (most of the time);
- Commencement of the sales of produce from the farm;
- Completion of Business/ Financial Model;
- Negotiation and acquisition of a second rooftop at a nearby building for purposes of scaling-up the business;
- Potential acquisition of large restaurant client pending sufficient produce is in place; and

- Success at trouble shooting most of the system's technical troubles thus reducing reliance on external consultants, the effect of which is that the researcher has achieved a reasonable to a good grasp of the technicalities of a hydroponics and aquaponics farming method within a short space of time.

Key challenges

Operational management of routine activities was found to be a major challenge given the technical nature of both the Hydroponic and Aquaponic systems. The skills needed are for a person who is familiar with some aspects of plant nutrient needs and the management of diseases affecting plants. Unlike conventional farming, where the soil provides nutrients, water based farming is a complex process involving measurements of nutrients given to plants as well as the PH of the water. Most plants tend to absorb nutrients at a PH of between 5.5 and 6.5. Yet fish in an aquaponic system thrive at a PH of 6.8 and slightly above. The previously appointed farm operator experienced difficulties of reading and understanding PH values as well as identifying nutrient deficiencies in plant leaves. Several other farming challenges were observed. The lack of effective control of water temperatures during winter to keep the fish alive resulted in the loss of some fish. Pest control was a major problem since chemical pesticides could not be used and the farm operator did not adhere to a strict routine of checking plants regularly.

It was found that plants in a controlled water based and nutrient fed system grow much quicker than in conventional farming. This meant that markets to sell produce to needed to be negotiated in advance of planting which was not previously the case. Thus, a lot of produce was given away for free or discarded as waste. Distribution channels for fresh produce is utmost critical going forward and attending more closely to the above challenges will in future yield better results.

Operational Management

The researcher developed an operational management protocol involving taking regular reports of what was happening at the farm on daily, weekly and monthly basis. This report was captured by the farm operator as part of his regular tasks. Below are the tables and the figures that needed to be captured.

PH management report				
	Aqua	Hydro Vertical	Hydro Horizontal	
PH Readings				
Date				

Figure 11: PH Management report

Water Temperature				**Aqua water meter readings**			**Hydro water meter readings**
Date	Degrees		Date	Meter		Date	Meter

Figure 12: Water management report

Aqua Nitrate, Nitrite and Ammonia							
Date			Ammonia		Nitrate		Nitrite

Figure 13: ammonia, nitrite and nitrate measurement report

Nutrient Feed									
		Hydro Vertical		Hydro Horizontal 1		Hydro Horizontal 2		Aquaponics	Comments
Date									

Figure 14: Nutrient feed report

Planting

During the period of six months, the farm produced lettuce; spinach, kale, parsley, spring onion and rocket. The plants did well, but sometimes got infested with the Aphid bug. Unfortunately, these had to be discarded. The second time round the farm managed to get to the harvest stage and to sell the produce within the host building (Bjala Squire) and at local Sunday markets such as Sylvia Market and Brownsense Soweto market.



Figure 15: farm operations. Clockwise from left to right: harvesting; packaged produce; organic pest management; selling of produce

Source: author

At the time of writing, there were approximately 2000 healthy crops on the farm at varying stages of growth.

Challenges and lessons with plants

The aquaponics system was built with estimations of plants planted 100mm apart. This is only suitable for small herbal crops and not leafy vegetables which mostly need 300 mm of space between them. This has implications for the financial model. It means that the farm will have less yield on leafy vegetables. The spacing of leafy vegetable allows for plants to breath and limit transmission of pests. Easy contamination is due to proximity when plants touch each other. Space is also needed for harvesting purposes. The ideal spacing for hydroponics and aquaponics is as follows for these common plants: Basil = 15-20 cm; Lettuce = 18 - 30cm; Peppers = 30 - 60cm; Tomatoes = 40-60cm; and Spinach = 30cm.

Maintaining sufficient fish stock in the system

Sufficient fish is required to provide enough nutrients to plants. Through reading and researching, this researcher found out the following formulae for determining fish to plant ratio. This ratio is a relationship between the fish, the plants and the fish feed. According to Henry Pereira, in his unpublished document: “A little bit of everything-backyard and commercial aquaponics” (Pereira, 2014), Fish density equals 25-30kg of fish to 1000ltrs of water. Fish feed, on the other hand, equals total squire meter (s.q.m) of grow bed (9,6sqm in the case of rooftop) x grams of feed per s.q.m (which is 35g for leafy vegetables). The result for the rooftop farm is therefore 336 g of feed per day is necessary to support the 9,6sqm of grow bed installed.

A simple calculation therefore per the above formula would be:

9,6 s.q.m of grow bed x 35g of feed = 336 grams of daily feed per system
Therefore fish required = Daily feed amount (Kg), i.e., 336g ÷ Average daily consumption (as % of bodyweight). 2% of fish body weight for adult fish is recommended by Pereira (2015).
= 336g ÷ .02
= 16,8 Kg of fish required to consume 336g of food daily
Total volume of water needed in fish tank for 16,8kg of fish is
(Total Kgs of fish required ÷ Average stocking density for aquaponics) x 1000
= (16,8 ÷ 30) x 1000
= 0,56 x 1000
= 560 litters of water in fish tank is required. The current system is 1500ltrs each, meaning there is a lot more scope to add grow beds and scale up on this system without adding too much new infrastructure except for growing beds. There is another implication, which is the increase in water, electricity and fish food consumption. These must be weighed against the prospects of additional revenue.

The researcher's own experiment at home

After interviewing several urban farmers and viewing several online videos, the researcher went ahead to test the difficulties or ease of setting up a home aquaponics farm. The materials used where the following including the cost for each item: 50 litter Tank (R400); Fish Tank (R300); Pump, flow 1000 type (R600); Airpump (R500); Piping and Valves (R300); 10 litter Swirl filter tank (used swimming pool chlorine backet); Timer (R200); Floating polystyrene raft: (R60); LED light globe (R80); Power inverter (R2600); Car battery (used own car battery, new one is R3000) ; Fish stock (R200); Plant seedlings (R50); Initial plant nutrients (R400). The total cost of this set up excluding tools is roughly R9000. Tools used included: Drill machine; hole saw; PVC Glue; and Marine Silicon glue. The result is the system shown below.



Figure 16: Home aquaponics system

Source: Author

The experiment proved relatively easy to set up. No technical training or knowledge is required except some common sense and the ability to follow

manuals and instructions. The cost of materials was slightly higher than expected including the time to look for materials. In hindsight and with some experience post this experiment, most of the tools and hardware could be purchased cheaply. Many of these were purchased at Builders Warehouse which is not a cheap hardware store. There are many direct suppliers especially for irrigation systems that sell many of the above at nearly half the price. Another lesson learnt was that by innovating with gravity water feeding, it was not a major requirement for a home system to include an alternative power source. If this is eliminated, the R9000 price tag comes down to about R4500 and could be even less if materials are sourced properly. It is therefore possible to design a home aquaponics system for just under R4000, and this can give a family of 4 people enough vegetables to consume all year round.

***Key findings**:*

- *If farming on rooftop using deep water culture system it is necessary to ensure that the rooftop of building are structurally capable of carrying heavy water, otherwise a less heavy system of hydroponics is the a good alternative.*
- *The spacing of leafy vegetable allows for plants to breath and limit transmission of pests. Easy contamination is due to proximity when plants touch each other. Space is also needed for harvesting purposes. The ideal spacing for hydroponics and aquaponics is as follows for these common plants: Basil = 15-20 cm; Lettuce = 18 - 30cm; Peppers = 30 - 60cm; Tomatoes = 40-60cm; and Spinach = 30cm.*

4.1.4 Conclusion

This section discussed lessons and experiences from urban farmers starting with an urban farmer who farms using aquaponics. Other examples in this section use other farming methods including pure hydroponics. The object of this section was to highlight the fact that urban farms do exist. Their successes and challenges are

necessary to take into account the implementation of urban farming within the City of Johannesburg.

Each case or project discussed in this chapter pointed to some findings which are summarised here in as follows:

- *There is a need for policy and regulations regarding the use of rooftop spaces for agricultural purposes. The City of Johannesburg could develop such a policy.*

- *Since location impacts the profitability of urban farms, location is a critical decision-making point for urban farmers. It makes sense for urban farms to be located closer to consumers if the aim is to sell direct to them or to be located closer to distributers' warehouses if the strategy is to sell through them.*

- *The lack of a sustainable mechanism to support urban farmers as well as poor management of Cooperative could lead to their failure and points to the need to revisit the approach of supporting urban farming from the perspective of groups (cooperatives) vs supporting highly motivated entrepreneurs willing to take ownership of their ventures.*

- *Laws such as Human Rights laws need to be enforced to ensure no one sleeps hungry by forcing institutions of government to develop innovative solutions to stop hunger.*

- *Food production of agriculture should be made part of the school curriculum from an early stage of education.*

- *Small scale farmers should have formal supply contract supported by legislation as well as formal tenancy contracts to farm in the land or buildings that often do not belong to them.*

- *Municipal governments should pay for small farmers' market infrastructure and establish management companies that run local community markets as well as build local community hubs because small urban farmers will never be able to compete with large commercial farmers*

- *Selling produce as an emerging farmer requires developing an alternative approach from the "establishment" by establishing a fresh produce markets within communities where people can come with small bakkies and buy sell in the township.*

- *Soil based mediums on vertically placed planting pots could serve less educated people since they do not require technical instruments and know-how for monitoring various things that hydroponic systems require.*

- *There is a need for farmer training to ensure that farmers can synchronize their growing processes and not all grow the same items at the same time and also that when they grow, they can grow and harvest all the time thereby ensuring a constant supply to their customers.*

- *The spacing of leafy vegetable allows for plants to breath and limit transmission of pests. Easy contamination is due to proximity when plants touch each other. Space is also needed for harvesting purposes. The ideal spacing for hydroponics and aquaponics is as follows for these common plants: Basil = 15-20 cm; Lettuce = 18 - 30cm; Peppers = 30 - 60cm; Tomatoes = 40-60cm; and Spinach = 30cm.*

- *If farming on rooftop using deep water culture system it is necessary to ensure that the rooftop of building are structurally capable of carrying heavy water, otherwise a less heavy system of hydroponics is the a good alternative.*

Not only is urban agriculture beneficial for the entrepreneur farmer but also for the subsistence farmer and for the urban citizens wishing to grow their own food at home. The upfront infrastructure cost may seem expensive, however, counter balanced with the high cost of vegetables, a family that invests in simple urban farming system like some discussed above can amortise the expense over a 24-months period and find that they can recover the costs as their reduced expenses on vegetables helps to pay for the growing system. Once the system is paid off, a family that invests in a system like this is free to spend the extra money saved on other things. On the other hand, entrepreneurs that invest in using some of the commercial farming systems above can make a reasonable income and even employ others.

4.1.5 Are commercial retailers of fresh produce, including restaurants, willing to support small-scale urban farmers?

For the urban farmer, the challenges of production are immense. The initial input to set up the farm, the intensive nature of growing vegetables on a small area of land or on the concrete roofs of city skyscrapers, the costs of water and equipment, and the time and knowledge required to make a success of urban agriculture – all mitigate against the possibility of success. And for the entrepreneur, the bigger challenge is still to come – the marketing and selling of produce at a profit.

This section reflects on interviews with retailers on their willingness to engage with small-scale urban farmers.

Massmart

Solomon (not his real name as he requested to remain anonymous) is an employee at Massmart in their Supplier Development Unit for the food production sector. His unit supports the following Massmart group of companies: Game, Macro and Fruitspot. The company is a retail and wholesale business with 411 stores in South Africa and Sub-Saharan Africa, generating revenues of over R70 billion and R2 billion in profits in 2014 (Massmart, n.d.)

Solomon's role within the group is to source small holder suppliers; to ensure food safety and farmer training. This affords him an opportunity to work with small holder farmers to spec and produce agricultural fresh produce for the three stores within Massmart, i.e. Game, Macro and Fruitspot (Solomon, 2016. Personal interview). This company, which has 2-2.5% market share of the fresh produce market in South Africa, buys their produce almost entirely from the local municipality fresh produce markets such as Joburg Fresh Produce Market and the Tshwane Market. They previously had a growing programme with small holder farmers which they have abandoned. Despite the 13% commission that these local municipal markets charge and take from growers and the margin opportunity lost by the group, Solomon says, they stopped buying from small holder farmers or growers because these generally do not have capacity nor understanding of their commercial needs (ibid). For example, Massmart will only take fresh produce which meets specific predetermined sizes, colour and packaging requirements, often uniformly. If they buy tomatoes, for example, they all must be of the same size and colour in the package, otherwise they don't take it. The result unfortunately is that farmer must throw away a lot of the healthy produce in selecting the perfect ones that meet this shape and colour requirements. Food dumping is a big problem globally. "Figures from the Institution of Mechanical Engineers show as much as 2bn tonnes of food never makes it on to a plate" (away, 2013). Most of this is because of consumers and retailers insisting on cosmetically pleasing products and not necessarily healthy and nutritious needs.

This report says, “in the UK as much as 30% of vegetable crops are not harvested due to their failure to meet retailers' exacting standards on physical appearance” (ibid).

Solomon’s experience with small holder farmers even in urban areas such as Mabopane in Tshwane is that small holder farmers struggle to raise finance from banks and therefore are also not able to profitably transport their goods to the markets, let alone to the Massmart stores. The trouble with farm to store is that they have central sorting and distribution facilities and do not accept goods straight into the retail stores (Solomon, 2016. Personal interview). He was adamant in his conviction that the development of urban farmers is unlikely to lead to successful commercial farming in urban areas for the reasons he gave above. Other difficulties he sighted negating the potential success of small urban farmers, relate to the burdensomeness of food safety requirements such as record keeping; compliance; consumer protection where consumers are increasingly demanding for the retail stores to be transparent in the history and source of the food they consume.

He also believes that smallholder farmers will find it difficult to compete with big commercial farmers because they compete on the same variables such as input costs, transportation and labour, yet their economies of scale allow the big farmers to price low and take a knock with the commission charged at the local municipal markets. Through their supplier development programme, he found out that small farmers typically grow multiple crops to mitigate against disasters whereas the big commercial ones typically do monocrop production and can handle losses in the event of disasters. For this reason, the small farmers already make it impossible to sell their produce to retailers because retailers like Massmart cannot buy little bits of fresh produce from multiple suppliers as it is easier to control and manage one supplier for a specific produce. “Retailers want to have efficiency, consistency and time commitment” (Solomon, 2016). It’s a double edge sword, he says. At the market, small holder famers are squeezed on margins, and when they turn to sell

to retailers directly, they cannot offer the required volumes, consistent look and feel of crops at a consistent time. He gives an example where he says, due to the bulk nature of the needs of retailers, it is possible for fresh produce to be farmed in Nelspruit in Mpumalanga, sold at the Joburg fresh produce market, packaged at a central distribution warehouse in Johannesburg and sold back to a store in Nelspruit and the original farmer cannot beat the store price at his farm gate. “This is the power of bulk buying and the ability to determine price by the big retailers” (ibid). He believes that urban farming is a good concept which will help in food security, but it is not going to create farming millionaires.

There is an additional problem of price fixing and collusion by market agents at the big fresh produce markets who sell fruit and vegetables on behalf of big farmers. As recent as March 2017, the Competition Commission of South Africa raided these market agents at the Joburg and Tshwane fresh produce markets. Their allegation against the agents were that they had received a tip from the Department of Agriculture, Forestry and Fisheries which reported possible cartel conduct by the big market agents who are alleged to slash “prices to undercut market entrants, before raising prices when smaller companies run out of stock – aiming to suppress competition – and using identity to discriminate on price… which could limit the development of black farmers and raise prices in the food sector – affecting vulnerable households the most” (Nicolson, 2017)

Key Findings: *Massmart does not consider small scale farmers as their key suppliers due to their internal buying practices which favours the big farmers who can produce their prescribed cultivars in large quantities and the fact that they buy centrally and then distribute to their stores.*

Fruit Lovers

A store manager of Fruit Lovers says that 90% of their produce comes from the Joburg Fresh Produce Market, and 10% is from farmers that drop off their own produce especially herbs (Store manager, 2016. Personal interview).

The likelihood to buy from local farmers is low for them. “We have a store in Mdantsane in the Eastern Cape where we support local urban farmers from that township. Although we do not have any other small scale urban farmers we work with, we are willing to support any one who meets our consistency and quality needs, provided they can deliver to our stores” (ibid). We do not do formal contracts with any farmer as the bulk of our produce is from the Joburg Fresh Produce Market where we buy direct. When buying from any other farmers like the Mdantsane group, they regularly check the price at the local municipal food produce market and benchmark their price to buy from local farmers. The store manager says that their engagement with local farmers shows that the older ones are better and understand their requirements and are willing to supply them on these terms. He believes that the farmers who are younger in age want instant riches and over price their stuff and hence curtail their own chances of succeeding as farmers.

“I believe urban farmers are good with micro greens or small herbs and I don’t think urban farmers can supply huge quantities that we require all the time and are able to get from bigger farmers. I believe urban farming is about building communities and sustaining communities. I have been in the industry for 25 years and have not seen a successful urban farm producing at a high scale enough to consistently supply to bigger stores like ours,” says the store manager (ibid).

Education and encouragement is a very important thing to stimulate young people to get involved in urban farming. Currently, they are not interested only because they are not informed, not because they don’t want to (ibid).

Key finding: *Fruit Lovers also believes that local farmers have little to no chance of supplying to them as they cannot compete with big farmers in terms of vegetable. However, they are willing to encourage them to supply micro greens and herbs which tend to fetch higher prices from higher LSM customers. These crops do not need bigger spaces to grow them and are therefore suitable for smaller spaces.*

Fournews

An executive director at Fournews, the parent company of several popular restaurants such, Brooklyn Brothers, Moyo, Smooch, Krispy Kreme, Cafe Fino, and News Cafe is enthusiastic about supporting local urban farmers. He visited a rooftop farm with the researcher to see whether they could buy produce from the farm.

The executive director, willing as he is about supporting small and emerging urban famers, has some concerns. He says that one of his restaurants which is most likely to buy from local growers is Newscafe, but when they are in their busy seasons they require a full supply from one source, hence they cannot commit to buying from local farmers during peak periods. When in low season he is willing to test it out provided the supply is consistent in quality and quantity (Executive director, 2016. Personal interview).

He believes that to solve the above concerns, there must be a platform created that all farmers can sell to, and then in turn a network of individuals that can do the logistics for their benefit. The executive director thinks this too is still a long way to go.

Key findings: *Small scale urban farmers need to collaborate and establish distribution channels and pull together their fresh produce in order to supply restaurants and retail stores.*

Summary of findings

Findings from this section are summarised as follows:

- *Massmart does not consider small scale farmers as their key suppliers due to their internal buying practices which favours the big farmers who can produce their prescribed cultivars in large quantities and the fact that they buy centrally and then distribute to their stores.*

- *Fruit Lovers also believes that local farmers have little to no chance of supplying to them as they cannot compete with big farmers in terms of vegetable. However, they are willing to encourage them to supply micro greens and herbs which tend to fetch higher prices from higher LSM customers. These crops do not need bigger spaces to grow them and are therefore suitable for smaller spaces.*

- *Small scale urban farmers need to collaborate and establish distribution channels and pull together their fresh produce in order to supply restaurants and retail stores.*

4.1.6 Conclusion

Retailers and restaurants seem to find it difficult to buy from small-scale farmers because of the inconvenience of buying from too many suppliers where they cannot effectively manage quality, size and looks of produce at an acceptable price and in large quantities. Convenience is what drives purchasing decisions, it

would appear. Therefore, urban farming initiatives need to have a deliberate strategy to supply their produce directly to consumer and the street traders who themselves are being ripped off by huge prices at the fresh produce market or when they buy from big retailers as some of them do. By selling to street traders, the farmers will have better prices as well as contribute to improving the profit margins of street traders. The benefit to the street traders is that when they buy and sell food grown in the City, they save on transport costs of travelling to fetch vegetables from the fresh produce market or from farms in the far flung areas of the City.

4.1.7 Government support for urban agriculture

As a writer in the field of economics and social development, Andersen developed a typology of social policy which is based on the notion of the state as having the role to manage and organise the economy, in what he calls the political economic function of the state, more along the lines of welfare capitalism. Welfare capitalism is concerned with “issues of employment, wages and overall macro-economic steering” (Anderson, 1991) as opposed to merely focusing on income transfers and the provision of social services.

Andersen, says that “issues of de-commodification, social stratification, and employment are key” (ibid) to the identity of a modern welfare state, albeit not all modern welfare states are the same. A universalistic welfare states that pursues issues of social rights, income security, equalization and the eradication of poverty is the kind of state that is required in South African and indeed the City of Johannesburg to speed up the process of uplifting people from poverty.

By arguing that the critical role of the welfare state is to achieve the de-commodification of labour, Sampie Terreblanche aligns himself to Andersen’s typology of the social democratic welfare state’s key function as that of the de-commodification of people so that they are not dependent on the market.

Terreblanche however, engages in a study of several welfare states of different kinds (conservative, liberal and social democratic type of states) and comes to the conclusion that many have in fact succeeded only to re-commodify and to re-stratify particularly the workers (Terreblanche, 1998).

The focus that Andersen places on the function of the state as playing an active role in driving society as opposed merely to its allocative function, is shared by many because there is an increasing view that the state has to have a transformative role to steer society along a social rights paths. Joseph Stiglitz also argues that “the heart of the current problem [of the role of the state] in most cases is not that government has done too much, but that it has done too little” (Stiglitz, 1998).

Those who argue for less government spending because of the assertion that when government spends money it crowds out private sector investment and as a such results in low levels of economic growth, miss the point about the failure of markets to perform effective distribution of resources to all citizens. In the long run, it is inequity in the ownership and access to resources that leads to instability as opposed to more government spending. The key issue lies in the need for government to identify developmental objectives so that the use of taxes and borrowing as ways in which government gets money to spend, is done in a way that benefits society as opposed to benefiting politicians and their friends through corruption as has been witnessed in many post-independence African countries.

These developmental objectives include addressing issues of high levels of poverty faced by many urban dwellers within the City of Johannesburg. They include making sure that black people who previously where excluded from the economy, to remain only as laborers, are given opportunities to create and grow their own wealth. These require increased government spending and will indeed lead to a stable and prosperous City where everyone benefits.

The above sets out the context within which the role of the state in supporting income generating initiatives is expected. It is through state policies as well as the character of the state that defines its role in development. This paper recognises that the problems that poor people in urban areas find themselves in are both systematic and structural due to the history of the country in terms of Apartheid, but that these poor people themselves have strengths granted to them by the Constitution of the Republic and the rights and assets that come with that. These are land and mineral rights, availability of programmes such as BBBEE, special programmes targeting poor people and small businesses, etc. The question then is, whether there is any leverage that can be used to ensure that people's constitutional rights are turned into actual entrepreneurial opportunities that can get them out of poverty. This research paper uses this thinking to suggest a way to get the poor and under resourced people to activate their potential. It is also recognised that problems in poor communities can be turned into opportunities as will be argued in the next chapter of this research.

Policy Response

There are many instruments that government has introduced to support the poor. At a national level, the National Development Plan (NDP), South Africa's long-term vision for 2030, was adopted with critical milestones to transform the country including in terms of urban development. In respect of agriculture the government still see it mainly as part of a rural development strategy targeting mostly provinces and municipalities with vast rural and agricultural land. The NDP for example, speaks of the need "to build an inclusive rural economy through increased direct and indirect jobs in the agriculture, agro-processing and related sectors. It calls for action that will activate rural economies through improved infrastructure, services to small and micro farmers and investments in tourism" (South African Government, n.d.)

Another major government policy intervention is the Broad Based Black Economic Empowerment (BBBEE) legislation which has benefited some black people in South Africa at a corporate level. Several but not many enough people have become business people. However, most of the downtrodden and small entrepreneurs who run small individual businesses utilizing local resources have not been positively affected by this legislation. The City of Johannesburg can make a significant impact in the lives of the poor urban dwellers by assisting them with resources as well as knowledge to scale up their micro business so that they are sustainable. The underlying or overall aim for doing this will be to train entrepreneurs to gain self-confidence and give them autonomy in their small enterprises.

City of Johannesburg interventions

As previously discussed under the section on urban farming initiatives, it was pointed out that the City of Johannesburg is directly involved in stimulating urban agriculture within the city. As such, no repeat of that discussion is warranted here. This section therefore discusses what the provincial government of Gauteng is doing to support urban farmers, many whom are found in the City of Johannesburg.

Gauteng 20 Year Food Security Plan

Recognising the human right to food as enshrined in the bill of right of the South African Constitution, where it says that: "*Everyone has the right to have access to sufficient food and water"* (South African Government, n.d.), the Gauteng provincial government developed a 20-year strategy for food security aimed at reducing hunger and ensuring access to food. The 20-year plan identifies 6 pillars as follows:

- "Pillar 1. Increase the amount of land under sustainable agriculture;
- Pillar 2. Intensify establishment of sustainable food gardens: Siyazondla;

- Pillar 3: Intensify skills development and training on sustainable food production;
- Pillar 4: Accelerate facilitation of access to finance and markets for economic livelihood;
- Pillar 5: Mobilise partnerships to distribute nutritious and safe food for relief; and
- Pillar 6: Climate smart agriculture and water management"

(Gauteng Department of Agriculture and Rural Development, n.d.)

A review of the department's 2015/16 Annual Report reflects some progress regarding two pillars relevant for this paper, namely pillar 2 and 3 above.

In terms of pillar 2 of the 20-year plan, the provincial department reported supporting 75 small holder farmers with farming infrastructure to enhance their production. 160 small holder farmers were also supported with agricultural inputs in addition to receiving agricultural advisory services from the department's agricultural extension. 2000 farmers benefited from this programme. The agricultural extension and advisory services is aimed at enabling famers "to improve their practices as well as help them respond to emerging challenges such as climate change and an ever-changing market environment. Agricultural extension provides knowledge, skills and ideas to the farming fraternity" (Gauteng Deprtment of Agriculture and Rural Development, n.d.). Additionally, 10600 food gardens were established and supported during the period.

Regarding pillar 3, during the 2015/16 financial year "a total of 1 600 smallholder farmers received non-accredited training in vegetable production, poultry production, TB testing in cattle, piggery management, bio-security, beef management, handling and transportation of Nguni cattle, mechanisation support, layer management, pest management, fish production, co-operatives, marketing and disease control. Five hundred and thirty-six (536) farmers received accredited training, of whom 36 were commercial farmers" (ibid)

An official from the Gauteng Department of Agriculture in Gauteng, says that their budget is the main and first place which supports many facets of urban food security in Gauteng. The next level of support comes in the form of conditional grants that are offered to small and emerging farmers as reported in the department's annual report (Official, 2016 Personal interview).

Extension and advisory services are the non-financial support mechanism where people employed by the Department of Agriculture go around to farms and provide advisory services to farmers. These officials are qualified in agriculture and are paid by the government to provide these advisory services at no cost to the farmers.

Although the provincial government together with the City of Johannesburg collaborate in supporting rooftop farms, "we have found that the difficulties we have experienced in terms of rooftop farming are that most buildings are not designed with agriculture in mind. For example, drainage is an issue, as well as the weight bearing of the roofs. Most rooftops are not strong enough to hold the weight of most agriculture growing medium such as soil based mediums and a large volume of water. However vertical gardens are growing and showing some successes," (ibid).

Key findings: *Government can make a significant impact in the lives of the poor urban dwellers by assisting them with resources as well as knowledge to scale up their micro business so that they are sustainable.*

5 Chapter Five

5.1 Analysis of Findings

The purpose of this research was to investigate whether urban agriculture can foster entrepreneurship in poor urban areas of Johannesburg, provide jobs opportunities and reduce food insecurity. Most areas in Johannesburg are froth with poverty and unemployment. Urban agriculture was identified to have a huge potential to increase job creation in cities around the world and the research sought to establish successes and challenges experienced in urban agriculture both globally and locally.

Technological innovation is critical to the success of urban agriculture where urban dwellers lack access to land for conventional farming. The paper looked at rooftop gardening, vertical gardens, aquaponics and hydroponics. This with a view to assess whether such technologies can be applied within the City of Johannesburg. For this reason, the first section in this chapter discusses the urban farming technology which the researcher found to be most suitable for use by urban farmers and for reasons of its fit with the green economy as discussed earlier in the research paper.

5.1.1 Technologies in urban farming: Aquaponics and hydroponics farming

There are several technologies in urban farming, some of which were discussed in chapter 3 of this paper. The researcher has found the two most relevant for an urban setting such as the City of Johannesburg to be aquaponics and hydroponics done in a vertical growing platform. Their purported prospect of success stems from the fact that they are farming technologies or methods that use less water than conventional agriculture without the use of soil. These two technologies are discussed in some detail in this section to give sufficient information so that

readers understand their benefits as well as limitations. It is the limitations that need to be addressed if they are to be adopted in the City of Johannesburg.

Aquaponics is a food producing system that has emerged as a popular form of sustainable agriculture over the course of the last few decades. Sustainable agriculture has been defined as an environmentally safe way of producing food which must contain three components: “plant and animal productivity, environmental quality and ecological soundness, and socioeconomic viability” (Neher, 2013). It is a farming system that combines techniques and functions of both hydroponics and aquaculture (Okemwa, 2015).

Hydroponics, is an agricultural system which uses water instead of soil as its growing medium is combined with the ecosystem of a fish tank. Instead of earlier forms of aquaculture, “the growing of aquatic organisms for food” or “fish breeding as a branch or industry” (Goodman, 2011) which typically released polluted water into the environment, aquaponics uses a technique of Recirculating Aquaculture System (RAS) which recycles water from a fish tank into a containment pool whereby crops are grown (hydroponically) instead of adding new clean water to the system (Foskett, 2015).

While just beginning to increase in popularity in modern times, agricultural practices using the combination of fish and crops dates to the times of the Aztecs where they created “Chinampas” or floating gardens which were fertilized with lake water (Goodman 2011). Aquaponics, provides many benefits ranging from positive effects on the environment, the provision of healthy and safe food, energy and resource conserving techniques and a low cost, low labour intensive way of producing food (Belsare, Singh et. al. 2007). The benefits of aquaponics production can play an important role in achieving food security, in that it attempts to respond to many forms of insecurity, including groundwater pollution, climate change, and overfishing of oceans, while providing diversified and healthy food.

Also, as a highly efficient source of localized production it is a direct response to the dependence upon imported food.

Without the need to add nutrients to the plants, such as in conventional or hydroponic systems, farmers using aquaponics rely on plant nutrient deriving from fish effluent which contains 13 of the 16 required nutrients in adequate quantities that plants require to grow. These nutrients are divided into those supplied from the *air* (Carbon (C), Oxygen (O), Hydrogen (H)); *Macro nutrients*: (Magnesium (Mg), Phosphorous (P), Sulphur (S), Nitrogen (N)); and *Micro nutrients*: Boron (B), Chlorine(Cl) Manganese (Mn), Copper (Cu), Molybdenum (Mo), and Zinc(Zn). Only Iron (Fe), Potassium (K) and Calcium (Ca) are the only nutrients that need to be additionally supplemented (Rakocy et al., 2004). The amount nutrients supplied by the fish are directly related to the amount fish eat as it is their waste and thus the fish feeding ratio that determines the amount of plants that can be grown (Rakocy, 2007; Lennard, 2012). In itself aquaponics systems without additional (Ca,K,Fe) supplementation are able to support healthy growth of leafy plants such as lettuce, spinach, and basil as the main requirement for them are nitrogenous (NO3) which are the main supplied nutrient of fish effluent. Fish fed a normal diet will produce a continuous supply of nutrients to supply leafy plants to grow optimally and the plants will prevent any nutrient build up by taking up nutrients for growth and in return this reduces polluting discharge into the environment (Rakocy et al., 2004). Figure 17 below demonstrates the closed loop system in a typical aquaponic system.

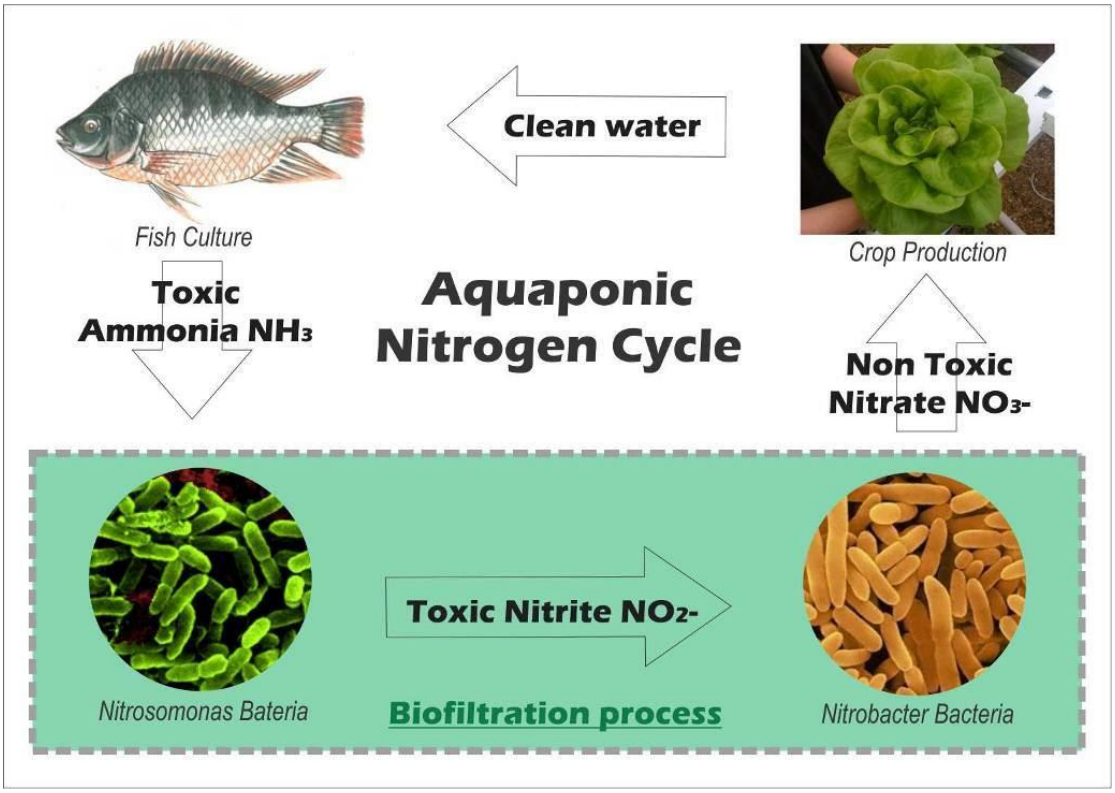


Figure 17: Nitrogen cycle and water filtration in aquaponics

Source: Blidariu & Grozea (2011).

In South Africa, which is a relatively water scarce country, the water use efficiency in the agricultural sector will play a crucial role for sustainability as agriculture consumes 62% of the national allocation of water (Department of Water Affairs, n.d.) Aquaponics can be viewed as a food producing technology which is highly resource efficient to produce high quality nutritious food in areas with water scarcity.

Benefits of Aquaponics

Aquaponics contains all three elements of social, environmental and economic benefits, and therefore fits into this study's working definition of food security when employed on a level for local production and consumption.

This method must be organic in its very nature because if any chemical inputs are added then the fish population would die off. If the fish die off then the plants begin to die as well (Naylor, Goldburg, Primavera, Kautsky, Beveridge, Clay & Troell, 2000). This is what is meant when aquaponics specialists call the system a symbiotic ecosystem or living system (Goodman 2011). Thus, aquaponics is environmentally sustainable in that it cannot use any chemical inputs nor does it release any waste into the outer environment.

Aquaponics can provide a direct social benefit to the community by not only producing food but nutrient dense food that is healthy and safe to consume. Scientific studies done on the vitamin and mineral content in aquaponics food has shown that aquaponics in many instances can produce higher yields in nutrition than traditional agriculture (Rakocy, 2006). The food is also safe because what threats to health that traditional agriculture can have, aquaponics can outright avoid. For example, many threats to consumption can come from soil borne diseases and even organic fertilizers that have not been composted long enough, such that non-beneficial bacteria are still present. As a type of soilless agriculture which uses fish effluent as its main source of fertilizer, aquaponics avoids these threats and becomes a safe and healthy way of producing and consuming food (Belsare, Singh,Yadav & Kunjir, 2007)). Aquaponics food can also be grown in a highly efficient manner as it can produce food 2-3 times faster than traditional agriculture. Thus, aquaponics looks to provide a social benefit of healthy, fresh and safe food to those practicing this method of agriculture, which, as previously mentioned, is a criterion of sustainable agriculture, and contributes to overall food security.

Another social benefit of aquaponics production is a low-cost low-labour way of producing food, because aquaponics systems can be created with materials of varying sorts. Systems can be made from recycled barrels or PVC materials. They can even be constructed by non-industrial methods (Rakocy 2006). This makes aquaponics more attainable for those that may never be able to purchase

tools and machinery such as tractors that are necessary for traditional agriculture. Aquaponics is a low-labour method of producing food in many ways. First, the time that it takes to manage a system is minimal compared to traditional agriculture. Monitoring an aquaponics system once established consists of checking water for proper PH, nitrite and nitrate, dissolved oxygen and ammonia levels, checking for clogs in filters and feeding fish (Rakocy 2006). This level of labour consists of dropping water into a testing kit and mixing it with the proper solutions. There is no weeding or bending over to remove your harvest. Harvesting fish can be accomplished by using nets and the grow beds are often built waist high where harvesting can be done from a standing position.

The ability to use recycled materials and farm with little effort makes aquaponics attractive for those who lack the means and physical ability to perform the duties of traditional agriculture. These benefits reveal social, environmental and economic benefits to those incorporating aquaponics practices, which are necessary to fulfill modern definitions of sustainable agriculture and food security.

Limitations and Vulnerabilities

However, there are several imitations and some consist of dependence on electricity for the movement of water, skepticism about commercial viability and issues concerning health and safety (Klinger and Naylor 2007). Any loss of electricity can result in total death of an aquaponics system. For this reason, anyone using an aquaponics system needs backup procedures to protect from potential death of all fish and plant life. Adaptations have been made to reduce the likelihood of catastrophic failure, including backup power sources such as batteries, generators, and even hand pumps to circulate water.

Concerns over safety consist of the potential of cross-contamination when growing plants next to animals and may result in diseases such as Salmonella and Escherichia coli. There are also consumer concerns about whether the

produce is safe to eat that has been grown by fish feces (Klinger and Naylor 2007). When properly managed, the food can actually be healthier than some traditional crops. This is revealed in some scientific studies which show increased levels of minerals and nutrients in vegetable crops when compared to contemporary methods of agriculture.

This paper therefore contends that there is a case in the City of Johannesburg to adopt an aquaponics biased form of urban agriculture. This is based on the premise that the paper laid for locating urban farming within the scope of the green economy. As previously stated, urban agriculture fits in well with the green economy because it has a huge potential for food security, social cohesion as well as job creation. The limitation of space in urban areas and the fact that poor urban dwellers do not have land tenure together with the health risks in terms of crop contamination with urban waste (Whittinghill & Rowe, 2012), makes it necessary for innovative solutions for urban farming. Through urban agriculture, it is possible to meet the green economy's focus on achieving "improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (Victor & Jackson, 2012).

5.1.2 A response to unemployment in Johannesburg?

Unemployment creates a sense of worthlessness especially among young people. It also leads to a feeling of being redundant, which without a definite occupation leads to crime and sometimes suicide among those affected. Alcoholism is another direct consequence. Unemployment can also be attributed to undermine a positive attitude to life which in a sense affects the ability of people to seek creative ways of removing themselves from poverty and finding ways of creating employment for themselves.

Since "unemployment in South Africa is most acute amongst black Africans, and amongst those with less than a matric, the youth and women" (Statssa, 2015), it

follows that the most innovative solutions need to be aimed at this cohort of the unemployed and vulnerable. This is further motivated by the fact that the absorption rate of the unemployed in Johannesburg is not keeping up with the increase in the working age population.

Urban agriculture is most relevant in Johannesburg since over 96% of the working age population resides in the urban areas of Gauteng, the majority of whom are in Johannesburg. See Figure 18 below.

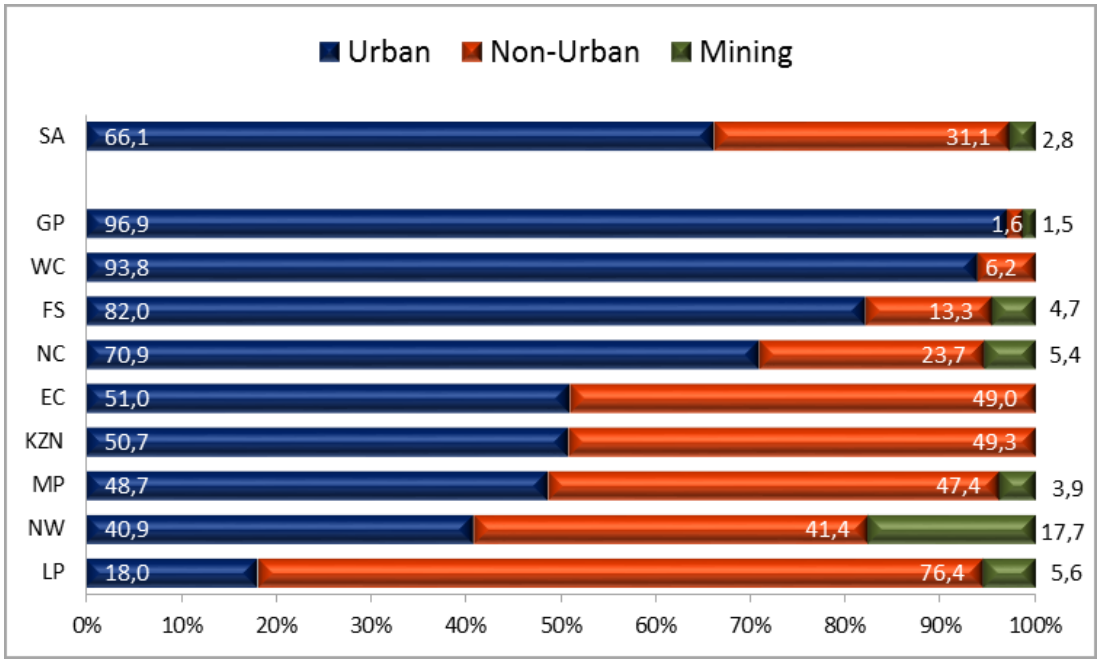


Figure 18: working age population by province and geo-type, 2015

Source: Statssa, 2015

The table below suggests that agriculture contributes the least (0,7%) in terms of employment creation, yet community services and trade account for a higher percentage (20,5% and 20,1% respectively). The relevance of this to urban farming is the high prevalence of informal trading as well as community services which have a direct link to agriculture but are not classified as such. Examples are street vendors who trade fruits and vegetables as well as the buying and selling of animals to slaughter for African religious purposes, weddings and funerals. This papers argues, therefore, that were vegetables to be grown in the city, there would

be no shortage of growers or entrepreneurs as well as consumers due to the fact of the high percentage of people moving into cities and the biggest chunk of unemployed people in the city who are willing and searching for opportunities.

Industry	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
	Percent									
Agriculture	10,1	6,1	11,7	8,8	5,7	5,9	0,7	7,5	10,5	5,6
Mining	0,1	0,1	8,2	4,2	0,3	16,6	1,9	5,0	6,0	2,9
Manufacturing	12,9	9,5	3,6	8,4	13,6	7,7	13,1	9,0	5,6	11,2
Utilities	0,7	0,4	1,2	1,3	0,6	0,5	0,6	2,6	1,0	0,8
Construction	8,7	12,0	9,7	6,9	10,4	6,8	7,5	8,8	11,2	8,9
Trade	19,8	21,2	17,3	21,3	19,7	17,8	20,1	20,4	21,7	20,1
Transport	5,2	4,7	3,1	4,4	6,4	3,7	7,2	5,3	4,3	5,7
Finance	15,8	9,4	6,8	8,0	10,5	10,7	20,4	11,2	7,6	14,0
Services	20,1	28,1	29,9	25,9	24,5	21,6	20,5	21,5	23,2	22,6
Private households	6,7	8,6	8,6	10,6	8,3	8,7	7,9	8,6	9,0	8,2
Total	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**

Note: Total includes 'Other'

Figure 19: Employment shares by industry and province, 2015

Source: Statssa, 2015

5.1.3 Entrepreneurship potential

The question may be asked, how realistic is it that the people who cannot find employment will start and sustain entrepreneurial ventures? The answer may lie in addressing the inhibitors to entrepreneurship. The important recognition stems from an underlying assumption that, increased economic activity, not social handouts like grants, will increase the chances that people will come out of poverty. An organisation called the Global Entrepreneurship Monitor (GEM) collects data from many countries globally, including South Africa. Their 2015 GEM survey which saw South Africa participating in it the 14th time, reveals that South Africa has “persistently low levels of entrepreneurial activity relative to other countries participating in GEM” (Herrington, 2016)

According to the 2015 GEM report, “South Africans aged between 25 and 44 years are the most entrepreneurially active, accounting for between 50% and 60% of all early-stage activity. The percentage of 18 to 24-year-olds in South Africa

involved in early-stage entrepreneurial activity is considerably lower than the average for Africa (which is 2.4 times the South African figure for this age group)" (GEM, 2015). This is incongruent with the fact that the urban dwellers not finding jobs are in fact the 18-25-year olds as shown earlier from the stats from the StatsSa report quoted above.

The GEM report suggests that Total Entrepreneurial Activity (TEA) among black people, who are also much of the affected by low employment levels, is constrained by a number of factors such as government policy and programmes; lack of entrepreneurship education and training at school level as well as cultural and social norms (GEM, 2017). The first of these constraints is particularly worrying since the South African government always talks about supporting small medium micro enterprises.

Practical steps and 'low hanging fruits' initiatives have to be implemented to support this group of the unemployed. Urban agriculture offers a way to facilitate this intervention. Effectively supporting urban farming micro enterprises, will mean that as they make an impact on alleviating poverty and job creation, more public funds could be released to other social service delivery issues such as building and maintaining schools, hospitals, roads, providing housing, providing portable water facilities, and ensuring that everyone has access to good public transport. These and other issues will no doubt help to raise the living standards of the poor. In this way, the City of Johannesburg can lead the way and demonstrate to the rest of the country that it is possible to find solutions to problems of unemployment and poverty without waiting for the 'right' economic environment.

Miriam Altman of the Human Science Research Council observed that, in a situation in which many of the unemployed are "low-skilled and the internationally traded sector has been shedding rather than absorbing unskilled labour" (Altman, 2003), it is necessary to find other means of employment creation. She makes the point that there is an opportunity to tap into "industries that provide basic needs

as these non-traded industries tend to absorb many people” with limited skills (ibid)

Most economic policies seek to raise Gross National Products (GNP) per capita levels by employing measures that can stimulate economic growth. They do this hoping that a higher GNP will reduce poverty. A pattern of broad based economic growth should focus on uplifting the growth of income levels of "target" poverty groups that are the clear majority segments of populations" (Kotler, Jatusripitak, Maesincee. 1997)

Faced with the challenge outlined by Altman, which is that the bulk of the unemployed lack education and skills to be meaningfully employed in the formal trade sector, it is also possible that mainstream entrepreneurial ventures in the service economy – the biggest sector in Johannesburg, may not be an appropriate measure to stimulate thi cohort into highly successful entrepreneurs.

It is not all doom and gloom. A new concept of social entrepreneurs is gaining momentum both globally and in Johannesburg. This paper proposes that social entrepreneurship may prove to offer good results in propelling urban agriculture to be used for the objectives of job creation, food security and entrepreneurship development.

5.1.4 Social entrepreneurship

Social problems are rarely solved by dishing out foreign solutions to target audiences, in this case poor, unemployed urban dwellers, especially if such solutions were developed without their participation. This paper suggests that there is a kind of personality most suited for social entrepreneurship and urban farming entrepreneurship. Such as person is an energetic, persistent, and confident person with the ability to inspire others to join them in their work

(Gardener & Barendsen, 2004). These are people whose mental framework is to see possibilities in the face of adversity or solutions instead of problems.

A social entrepreneur is “an entrepreneur who is driven by the need to create large scale, transformational benefit that accrues either to a significant segment of society or to society at large” (Osberg & Martin, 2007). This paper proposes that there is potential in exploring social entrepreneurship to stimulate job creation, help solve food security needs of urban dwellers and facilitate for these urban dwellers to be micro entrepreneurs. However, a few social entrepreneurs will need to drive such a process.

Osberg and Martin (2007) asserts that the social entrepreneur’s value proposition targets an underserved, neglected, or highly disadvantaged population that lacks the financial means or political clout to achieve transformative benefits on its own.

What is critical to note from the above is that a social entrepreneur is called as such because what they do should be imitated or replicated to create a new transformative equilibrium. Therefore, this paper proposes that a solution to problems of urban poverty and food insecurity has to be tackled in a way that first recognises that it is located in a wider social system and secondly that it has to be led by the actors or affected targeted group (urban dwellers) and thirdly that, through social entrepreneurs, the solution must have the potential for imitation and replication so that it becomes scalable.

Attending a conference at the Gordon Institute of Business Science (GIBS), the researcher had the privilege of listening to Stephan Chambers speaking about social entrepreneurship. Stephan Chambers is the Director of the Marshall Institute at the London School of Economics (LSE) and former chairman of the Skoll Centre for Social Entrepreneurship. He said, at the GIBS conference that his view is that social entrepreneurs are people who do things with or without resources. They are the men and women who address market failures by being

more resourceful without dependence on certain circumstances. They can get things done despite the difficulties they face or are faced with the conditions they wish to change.

He also says that Africa and Southern Africa has so many opportunities due to the human and land demographic dividend. This is since corporations in the first world are worrying continuously about their future as there is increased limitation of human resources to sustain their mega outputs. Social entrepreneurs, therefore, can find innovative solutions to their problems without reliance on big corporations to solve these. The significance of these remarks is to confirm the view that social entrepreneurs, as opposed to NGO or government or big corporations, are the future innovators to address the many challenges of society including food production.

5.1.5 Financing of micro urban farming enterprises

The issue of food production is important not just for consumption but for job creation too. Organically grown food is much healthier than mass produced food. In the advent of HIV/AIDS, these can boost the immune system and help prevent opportunistic infections. As such, encouraging people to grow their own food as well as food for the local market can bring immediate relief on people's hunger while at the same time providing them with income. Many street vendors currently buy vegetables and fruits from the fresh market produce at high prices, including transport costs. Those who start vegetable gardens can sell these to them. The question however is where do they start and how do they finance these initiatives.

The section on existing government initiatives supporting urban agriculture in Gauteng and Joburg, showed several ways in which the provincial government and the City of Johannesburg are aiding farmers. Yet such assistance has not shown that there is a growing number of urban farming entrepreneurs.

The informal sector has great potential to serve as a seed-bed for the development of entrepreneurial skills so desperately needed in the townships of Johannesburg. “Sustainable human development is development that not only generates economic growth but distributes its benefits equitably; that regenerates the environment rather than destroy it; that empowers people rather than marginalize them. It gives priority to the poor, enlarging their choices and opportunities, and provides for their participation in decisions affecting them. It is development that is pro-poor, pro-nature, pro-jobs, pro-women and pro-children” (Taylor and Taylor, 1995).

Adopting this way of thinking can result in ensuring the fostering of formal-informal sector synergies with the objective of integrating the informal sector into the mainstream of the economy.

Micro urban agriculture enterprises, when supported, could engage in a variety of activities such as hawking and street vending, selling fresh produce, food preparation and growing food such as vegetables and other crops (Yanta, 2000).

These are but a few examples of what small to micro enterprises could engage in. In most cases people are already engaged in these activities, albeit without government support. They will benefit a great deal if they were supported. The critical thing is that providing support to this sector will also have the benefit of making the local economy more vibrant. In the long run the support provided will also ensure that this sector integrates fully into the formal economic mainstream.

Since the micro enterprise sector and SMMEs can generate more employment, it makes sense therefore to divert the R120 billion a year spent by government on social grants and spend a part of it in developing local micro entrepreneurs.

6 Chapter Six

6.1 Recommendations

Since the micro enterprise sector and SMMEs can generate more employment, it makes sense therefore to divert the R120 billion a year spent by government on social grants and spend a part of it in developing local micro entrepreneurs.

Effectively supporting urban farming micro enterprises, will mean that as they make an impact on alleviating poverty and job creation, more public funds could be released to other social service delivery issues such as building and maintaining schools, hospitals, roads, providing housing, providing portable water facilities, and ensuring that everyone has access to good public transport.

This chapter contains a number of recommendation that are derived from the previous two chapters as well as an additional section on a practical approach to finance the development of an urban farming initiative in the City of Johannesburg using Social Impact Bonds.

6.1.1 Recommendations from findings

Farming methods

There is a case for the City of Johannesburg to adopt an aquaponics or hydroponics biased form of urban agriculture. This is based on the premise that the paper laid for locating urban farming within the scope of the green economy. As previously stated, urban agriculture fits in well with the green economy because it has a huge potential for food security, social cohesion as well as job creation. The limitation of space in urban areas and the fact that poor urban

dwellers do not have land tenure together with the health risks in terms of crop contamination with urban waste (Whittinghill & Rowe, 2012), makes it necessary for innovative solutions for urban farming.

Making Urban Farming viable

A set of recommendations to facilitate for the viability of urban farming initiatives is discussed below.

Since location impacts the profitability of urban farms, location is a critical decision-making point for urban farmers. It makes sense for urban farms to be located closer to consumers if the aim is to sell direct to them or to be located closer to distributers' warehouses if the strategy is to sell through them.

Selling produce as an emerging farmer requires developing an alternative approach from the "establishment" by establishing a fresh produce markets within communities where people can come with small bakkies and buy sell in the township.

Soil based mediums on vertically placed planting pots could serve less educated people since they do not require technical instruments and know-how for monitoring various things that hydroponic systems require.

Urban farmers can do well if they grow micro greens and herbs which tend to fetch higher prices than most vegetables in the market. These crops do not need bigger spaces to grow them and are therefore suitable for smaller spaces.

Small scale urban farmers need to collaborate and establish distribution channels and pull together their fresh produce in order to supply restaurants and retail stores.

If farming on rooftop using deep water culture system it is necessary to ensure that the rooftop of building are structurally capable of carrying heavy water, otherwise a less heavy system of hydroponics is the a good alternative.

Government support to urban farmers

The lack of a sustainable mechanism to support urban farmers as well as poor management of Cooperative could lead to their failure and points to the need to revisit the approach of supporting urban farming from the perspective of groups (cooperatives) vs supporting highly motivated entrepreneurs willing to take ownership of their ventures.

Government can make a significant impact in the lives of poor urban dwellers by assisting them with resources as well as knowledge to scale up their micro business so that they are sustainable.

Laws such as Human Rights laws need to be enforced to ensure no one sleeps hungry by forcing institutions of government to develop innovative solutions to stop hunger.

Food production of agriculture should be made part of the school curriculum from an early stage of education.

Small scale farmers should have formal supply contract supported by legislation as well as formal tenancy contracts to farm in the land or buildings that often do not belong to them.

Municipal governments should pay for small farmers' market infrastructure and establish management companies that run local community markets as well as

build local community hubs because small urban farmers will never be able to compete with large commercial farmers

There is a need for policy and regulations regarding the use of rooftop spaces for agricultural purposes. The City of Johannesburg could develop such a policy.

There is a need for farmer training to ensure that farmers can synchronise their growing processes and not all grow the same items at the same time and also that when they grow, they can grow and harvest all the time thereby ensuring a constant supply to their customers.

6.1.2 Social Impact Bonds

This research paper proposes a financing mechanism for urban farming entrepreneurs using the idea of social impact bonds (SIB). SIBs, explained below, can be a social entrepreneurship funding approach to tackle innovative solutions to social problems such as poverty, unemployment and low entrepreneurship levels in the City of Johannesburg.

The proposed solution will explore how the private sector can invest in solving these social problems profitably using social impact bonds.

Social impact bonds may offer “an innovative means of harnessing private capital to achieve measurable gains on some of the most persistent social ills” (Pettus, 2013).

Social Impact Bonds are also known as “social innovation financing” or “pay for success”. They are an innovative way in which the private sector intervenes to tackle a social problem in return for profit. In this way government, can divert public resources to some other needs (Pettus, 2013).

How they work, explains Pettus (2013), is that "usually, governments decide what problems they want to address and then enter a contractual agreement with an intermediary (or bond-issuing organization) that is responsible for raising capital from independent investors including banks, foundations, and individuals, and for hiring and managing non-profit service providers. If the project achieves its stated objectives, the government repays the investors with returns based on the savings the government accrues as a result of the program's success. (Taxpayers also receive a portion of the budget gains in the form of freed-up public resources, though the investors may need to be fully paid first). A neutral evaluator, agreed on by both parties, is hired to measure the outcomes and resolve any disputes that arise."

One organisation that implements social impact bonds is the Social Finance organisation based in the UK. It states in its website, that "Social Impact Bonds provide up front funding for prevention and early intervention services and remove the risk that interventions do not deliver outcomes from the public sector. The public sector pays if (and only if) the intervention is successful" (Bonds, n.d.).

Further lessons are derived from the University of Cape Town's Bertha Centre for Social Innovation. "In September 2013, The Bertha Centre, Genesis Analytics and Social Finance formed a research coalition and were awarded a grant to explore the applicability of Social Impact Bonds (SIBs) as a financing instrument in South Africa" (Bertha Centre, 2014). This study was commissioned by the South African Government through the National Treasury department to investigate whether Social Impact Bonds will prove to be a viable way to raise levels of entrepreneurship in South Africa and consequently address unemployment. The preliminary findings of the Bertha Institute research are that "SIBs are an exciting opportunity to shape private and public capital in South Africa" (Bertha Centre, 2014).

Key findings of the study are that SIBs transfer risks to socially-motivated investors who have a greater appetite for testing innovation and funding new models. For Social investors and philanthropic foundations, they offer an opportunity to invest in outcomes related to important social issues with the possibility of recycling their capital. They also found that experience elsewhere "has shown that SIBs add the most value in situations where:

- a *pressing social problem* has been identified which is a priority for both outcomes funders and investors;
- a *target group* has been identified with sufficient clarity;
- *evidence-based interventions* are available for the target group;
- *robust outcomes metrics* can be developed to measure and attribute success;
- a *viable investment proposition* can be developed; and
- there are *willing outcomes funders* who will pay for the identified outcomes if they are delivered." (Bertha Centre, 2014).

This approach contrast with traditional philanthropy work of NGOs and foundations because here the funder can expect some form of return as opposed to donations given by foundations without expectations of financial return.

6.1.3 Joburg Agri-Social Impact Bond

This research paper proposes the establishment of an entity with the City of Johannesburg Metro which will help micro urban farmers to start and run urban farms profitably whilst addressing ways in which they can contribute to developing their own communities as well as end poverty. It is recommended that the City of Johannesburg should consider establishing this proposed entity to facilitate for private investors and project managers to source funding using the SIB model and support prequalified urban farmers with the potential to run successful urban farms profitably. This entity should also provide support to them such as skills in business services, marketing and mentorship.

The object of the proposed dedicated entity will be to provide business development services (BDS) to urban farm entrepreneurs to ensure that they are supported to succeed. The specific services and activities could include:

- Developing and setting up a Social Impact Bond with all relevant partners in place. The Bertha Centre in Cape Town could be consulted to assist in this process. As mentioned earlier, they have developed a model for the South Government Treasury Department as well as practically assisted the Western Cape Provincial Government to establish the first Social Impact Bond in South Africa;
- Business processes: services to be provided here could include assisting urban farmers with company registration and legal requirements; Tax compliance; Shared services (accounting, IT, HR, Sales & Marketing, Ops, Planning); facilitating market access; etc; and
- Mentorship: This could be conducted by the invested partners, retired business people wanting to give back to society and hired professional mentors.

Not only will this help them to alleviate poverty, but the supported urban farmers will employ other people in their communities.

One of the most important issue for the success of this proposed model of financing is the need to set, upfront, specific selection criteria for urban farmers so as to avoid wasting time and resources on candidate entrepreneurs who may not stand a chance to succeed.

It is extremely critical to enlist partners early on. Below is a list of potential impact funders who may be approached to invest in the proposed Agri-Social Impact Bond (ASIB). These potential impact investors are suggested herein because of their stated focus of investing for social impact beyond mere financial returns. They are:

- South African Investors: Atlantic, Mergence, FutureGrowth, IDEA Fund, Masisizane Fund (Old Mutual), Edge Growth, RaizCorp, Vumelana Advisory Fund, Awethu; Seed Engine
- International Investors: Root Capital, Acumen Fund, Clearly So!, Grass Roots Business Fund
- South African (Development Finance Institutions) DFI's: PIC, IDC, Development Bank of South Africa, Jobs Fund
- European DFI's: SwedFund, NorFund, KfW, BIO, FinnFund, FMO, Proparco, CDC
- American DFI's: OPIC, IFC

More work needs to be done in crafting this solution further because the concept of a social impact bond is a relatively new one. There are many failed impact bonds globally and lessons of such failures must be taken into account. It is not the purpose of this research paper to go into details on the intricacies of Social Impact Bonds. However, the view of the researcher is that the problems of unemployment, food insecurity as well as low levels of employment need bold and innovative solutions, and that Social Impact Bonds offer such potential for innovative financing.

7 Chapter Six

7.1 Conclusion

Strategies exists to end poverty using food production technologies that have proven successful in other parts of the world, some of which are implemented locally as discussed in this research paper. These technologies are assisting to put food on the tables of urban dwellers and generating income for poor people.

The biggest threat to our planet more than global warming is the exponential growth of poverty. Poverty causes families to have more children so that there are enough hands to work for food in the family (Polak, 2012). More procreating appears to serve as an insurance for the likelihood of kids dying young due to malnutrition. In some countries, it also serves as insurance for "lobola" or "dowrie", because if a girl child is married well, that increases the family's chances of survival. There is also the potential for one of the kids succeeding at school and helping the family. If poor people are out of poverty soon enough, there is a slight chance that the anticipated world population growth of 9 billion by 2050 may be curtailed.

Polak (2012) makes some observations which are mostly ignored by authorities and academic institutions who are hell-bent on serving the rich. The prevalence of poor people congregating at the market to sell much of the same things that are in season has the effect of reducing prices and limiting the profits and income that the growers and the traders make.

The business principles which are obvious to most entrepreneurs but not so to most poor subsistence farmers, that is, instead of growing crops that are in season, subsistence and small-scale farmers could do well by learning to grow off-season crops which naturally fetch higher prices (Polak, 2012). The way to do this is to have the knowledge of what it is that causes these crops not to grow well during off-season periods. Some of which are simply about controlling

temperature as well as improving watering systems. The proposed farming methodology of aquaponics has the advantage that in controlled environments, urban farmers can grow vegetables all year round.

Developing farming methods that use less water and are not susceptible to too many diseases nor heavily affected by changes in temperature may be the answer to the limitation of arable land in urban setting where nutrient rich vegetables are grown in temperature controlled environments allowing for crops to grow all year round. This paper has argued that aquaponics offers such a possibility.

From the onset, the research papers set out to assess the extent to which urban agriculture and relevant technologies for urban agriculture (vertical gardens, rooftop gardens and aquaponics) can help communities within the City of Johannesburg to provide food for themselves as well as create their own jobs. Believing that most poor urban dwellers in the City of Johannesburg need assistance, this research sought to explore the extent to which such support can be achieved through a programme of entrepreneurship driven through urban agriculture.

The researcher went about to answer the research question, “how can urban agriculture increase food security in ways that aid in job creation and stimulate entrepreneurship among urban dwellers in the City of Johannesburg?”, using literature review, primary data as well as secondary data to support the conclusions and recommendations stated in the previous chapter.

With regard to urban agriculture’s contribution towards food security, job creation and poverty alleviation, the literature surveyed supported the use of urban agriculture for these objectives stating its significant contribution to enhancing nutrition and health among urban dwellers and supporting them to create their own jobs and also creating a platform for social cohesion and community

development as well as making the living environment in urban cities to become better living spaces.

The benefits as well as potential threats of urban agriculture techniques such as green roofs, vertical gardens, aquaponics reveal that there is room for innovation in urban agriculture where problems of land tenure and lack of water sources are prevalent.

Increased urbanisation, projected to be 9 billion people in 2050 by the UN and 70% of them expected to live in cities by that time, and the already huge crisis of unemployment as well as hunger affecting millions of people, needs a fundamental transformation of how food is grown. There is no doubt from the discussions in this research paper that it would make absolute sense to grow food in cities. With high levels of migration from rural agricultural lands to cities, rural areas will no longer be the food basket producers of food for most nations. The City of Johannesburg in South Africa is not immune from this world trends.

Food insecurity affecting many people across Johannesburg, is not merely a result of lack of food, but fundamentally it is about lack of access to food and the means to buy food as a result of people not finding jobs. Therefore, designing strategies that give people access to food by allowing them to grow their own food and selling their surpluses to earn an income is at the core of the findings this research and the recommendations made for the establishment of a government entity to support urban agricultural initiatives as proposed in this chapter.

As the United Nations points out in its report on Trade and Environment Review 2013, “Quick fixes will not be able to deal with the complex interplay between energy intensity, greenhouse gas emissions, global warming and food security needs. (UN, 2013). This suggests and calls for collaboration of efforts at all levels of government.

This paper examined the research question by discussing various topics, the conclusions of which are summarised below:

- **Green economy** - Through urban agriculture, green economy objectives are met by the improving the wellbeing of people as they eat fresh and healthy vegetables as well as facilitating an environment of social cohesion and social equity as a result of breaking the barriers of access to food;

- **Techniques of urban agriculture** – a focus on the technology of growing food in a soilless growing medium given the scarcity of agricultural land in Johannesburg was proposed. This technology can be used a horizontal planting system resulting in prospects for farming in places with limited spaces such as on rooftops of buildings;

- **Can urban agriculture stimulate employment**? – With the prospect of 'massification' of urban farms, not only will many currently unemployed or not gainfully employed have jobs, they will likely employ other people and also increase the number of street traders who will sell their produce; and

- **Can urban agriculture stimulate entrepreneurship**? – whilst this report discussed the GEM survey which showed that South Africa has low levels of entrepreneurship, the reality is that the area of urban agriculture is a new phenomenon which is also innovative. Hence paper proposes the setting up of a financing solution for would be urban farmers using Social Impact Bonds. The paper also proposed further investigation of the applicability of the concept of urban agriculture in Joburg.

The posture taken by the researcher in discussing issues in this paper stems from the belief that if more and more people are going to be living in the cities in years to come, virgin as the concept of urban agriculture is, it will be inevitable to grow

food in cities. As such, the time is now for the creation of innovative urban agriculture strategies within the City of Johannesburg and others.

Since the problem statement of this research was about addressing both food security and unemployment in the City of Johannesburg, the research conducted pointed to the huge potential that urban agriculture has. The City of Johannesburg can learn from lessons in other countries where this has been implemented successfully. It is also expected that the technologies and the innovative financing approach suggested, that of Social Impact Bonds, will provide learning potential for the City of Johannesburg and that more research will need to be undertaken in terms of the most relevant of these technologies and financing options. Another knowledge contribution of this research is the potential stimulation of policy changes to allow a more effective way to support urban agriculture in Johannesburg. The researcher hopes that the research adds to a body of knowledge on urban agriculture and will contribute to stimulating further research on urban agriculture and that someday, the City of Johannesburg can be an example of how to successfully implement an urban agriculture strategy.

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9 Appendices

9.1 Field research

9.2 Questions for respondents

Retailers interviews

1. Where do you currently buy the agricultural produce you are currently selling, e.g. from the market, direct from the farm or through a third party?

2. What major issues do you experience associated with the above sourcing, e.g. transportation, logistics, warehousing, quality and consistency with your standards, etc?

3. Do you have any assistance from the government/municipality, if so what kind?

4. How likely are you to buy agricultural products from local city producers and growers if they existed?

5. If so, would you be willing to enter into contracts with local producers and train them to meet your quality requirements?

6. Do you know about urban farming, if not the researcher will outline that it means the growing of vegetables and fruits in the urban areas as opposed to agricultural land.

7. Do you have existing urban producers/farmers that you work with?

8. Do you see the development of urban farmers as a positive initiative that can assist your business?

9. What other suggestions do you have regarding improvement in urban food security initiatives?

Informal traders

1. Where do you currently buy the food produce you are currently selling and how often do you stock?

2. What problems do you experience with sourcing your produce, e.g. transport, storage, etc.

3. Do you have any assistance from the government/municipality, if so what kind?

4. What support do you need to make your business thrive?

5. Do you know about urban farming, if not the researcher will outline that it means the growing of vegetables and fruits in the urban areas as opposed to agricultural land.

6. Do you see the development of urban farmers as a positive initiative that can assist your business?

7. What other suggestions do you have regarding improvement in urban food security initiatives?

Government officials

1. What policies are in place for supporting urban agriculture and what has been their impact so far?
2. What funding is in place for innovative agriculture initiatives?
3. What non-financial support exist urban farmers?
4. Are there any particular urban farming technologies you currently support or promote as best practice?
5. Would you be willing to support new technologies such as Vertical gardens, rooftop farming and aquaponics?
6. Is the provincial government aware of successful urban agriculture initiatives supporting new technologies such as Rooftop gardens, vertical gardens and aquaponics?
7. Recently the MEC went on a tour to talk to entrepreneurs in the townships, where there any who are engaged in farming and if so, what are the major issues discovered during these interactions?

9.3 Letter to research respondents

Dear Research participant

This letter serves to confirm that Thendo Ratshitanga (student number: 9510544v) is a Masters Student at the Wits School of Governance and is conducting research towards the development of a Research Thesis as part of a Masters of Management Degree. The purpose of the interviews he will be conducting with you to collect information about the views and perceptions of participants involved in urban agriculture. Information gathered from this interview will be analysed and written up as a part of a research report.

This interview is voluntary and anonymous. You will not be required to record your name if you do not wish to, including any identifying information. If you agree to participate, you may withdraw your consent at any time and simply not answer any questions. The data obtained in the study maybe kept for only the purpose of this study, but no findings which could identify any individual participant will be kept.

If you choose to participate in the survey, please append a signature at the bottom of this letter indicating your consent to do so. If you have any queries, please contact the student's academic supervisor, Dr. Ivor Sarakinsky at this email: Ivor.Sarakinsky@wits.ac.za.

Signed:

_____ _____

Name (optional) Signature

9.4 Online discussion on FaceBook

See overleaf



QUESTIONS RESPONSES 2

Section 1 of 10

Prospects of Urban Farming in Johannesburg

Thendo Ratshitanga is student at the Wits School of Governance (WSG) conducting research towards the development of a dissertation for a Masters of Management Degree. This Facebook platform aims to collect information about the views and perceptions of participants involved in urban agriculture. Information gathered here will be analysed and written up as a part of an academic research report.

Participation is voluntary and could be anonymous if you choose so. You will not be required to record your name if you do not wish to, including any identifying information. If you agree to participate, you may withdraw your consent at any time and simply not answer any question. The data obtained in the study maybe kept only for the purpose of this study, but no findings which could identify any individual participant will be kept.

If you choose to participate in this Facebook discussion, please keep your contributions constructive by offering your experiences avoiding to be argumentative with others contributions. This is also not a platform to solicit business or advise but purely to share your experiences. If you have any queries, especially in terms of the authenticity of this process, please feel free to contact the student's academic supervisor, Dr. Ivor Sarakinsky at this email: Ivor.Sarakinsky@wits.ac.za.

Thanking you in advance for your valued contribution.

After section 1 **Continue to next section**

Section 2 of 10

Which category best suit you?

Please tick the relevant category and when done with that section, submit the form.

After section 2 **Continue to next section**

Section 3 of 10

Urban Farmer/Consultant in urban farming/ or similar experience

Question

Option 1

After section 3 **Continue to next section**

Section 4 of 10

Government official/policy maker/ similar experience

Description (optional)

Question

Option 1

After section 4 **Continue to next section**

Section 5 of 10

Trading in farm produce

Description (optional)

Question

Option 1

After section 5 **Go to section 8 (Farm produce trader)**

Section 6 of 10

Urban farmer/ urban farming consultant

Description (optional)

What form/type of urban farming are you engaged in?

- [ ] Institutional farming (Commercial scale)
- [ ] Community gardens
- [ ] Community farms
- [ ] What type of technology do you use, e,g, Rooftop garden/Vertical garden; aquaculture; aquaponics; tunnels; etc? Please d

Do you have contracts with retailers for the sale of your produce, if so, what is the nature of such contracts. No need to state the name of companies you have contracts with.

Long answer text

Describe the ease or difficulties involved in your type of farming.

Long answer text

Do you make profit from your venture and how profitable is the business?

Long answer text

How did you finance your enterprise?

Short answer text

Where and how do you sell your farm produce?

Long answer text

What opportunities do you see for the growth of urban agriculture in terms of food

Long answer text

What challenges do you currently have in running your business?

Long answer text

What is your advice to anyone who wants to make urban farming their livelihood?

Long answer text

If you know any urban farmer, would you mind to refer me to them by giving their contact details. Their input will add to this study.

Long answer text

After section 6 **Go to section 9 (The end)**

Section 7 of 10

Government official or policy maker

Description (optional)

What policies are in place for supporting urban agriculture and what has been their impact so far?

Long answer text

What funding is in place for innovative agriculture initiatives?

Long answer text

What non-financial support exist urban farmers?

Are there any particular urban farming technologies you currently support or promote as best practice?

Long answer text

Are you aware of any successful urban agriculture initiatives supporting new technologies such as Rooftop gardens, vertical gardens and aquaponics in any South African city or town?

Long answer text

If don't currently support these, would you be willing to support technologies such as Vertical gardens, rooftop farming and aquaponics? If so, what do you as the benefits of these forms of farming.

Long answer text

Is your department organisation willing to make facilities available for Urban agriculture? If so where are the potential areas where such facilities can be made available such as open spaces, parking, and rooftops?

Long answer text

What has been your experience in implementing urban agriculture initiatives? Please state both challenges, successes and opportunities

Long answer text

After section 7 **Go to section 9 (The end)**

Section 8 of 10

Farm produce trader

Description (optional)

Please describe the type of farm produce you are involved with

Short answer text

Where do you currently buy the food produce you are currently selling and how often do you stock?

Short answer text

What problems do you experience with sourcing your produce, e.g. transport, storage, etc.

Long answer text

Do you have any assistance from the government/municipality, if so what kind?

Long answer text

What support do you need to make your business thrive?

Long answer text

What do you know about the concept of urban farming?

Long answer text

Do you see the development of urban farmers by government as a positive initiative that can assist your business to thrive?

Long answer text

What suggestions do you have regarding improvement in urban food security initiatives especially in Johannesburg?

Long answer text

Section 9 of 10

The end

Thank you once more for taking the time to contribute your knowledge and experiences.

After section 9 **Submit form**

Section 10 of 10

Untitled Section

Description (optional)