The Impact of Urban Gardening on Household Food Security. Evidence from Makhanda East, Eastern Cape Province, South Africa.

By

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DECLARATION

I, Bruwer Guillaume MX, declare that;

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2. This thesis has not been submitted for any degree or examination at any other university,

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Forward

This being a forward, needs to, in all earnestness, be forward.

Moving forwards, I am left with my research. And yet my research has left me with feeling like a bystander. This passage comes from the primary researcher – as my account of my team and I's fieldwork which has had a profound effect on me. "Make food your medicine". Words displayed proudly at the Umthathi Training Project Trust meeting room. I encounter friendly community trainees pouring over the table, peering over their masks and soaking in the recipe for the natural ointment comprised of indigenous herbs and weeds.

Outside, battered and well-travelled debris travel from pothole to pothole watching time eating away at the aspirations and opportunities that still bare to brave the landscape. And yet, as I, a pale faced tourist in the place I call home, trapse through the townships of the newly named Makhanda, I sense what community my own people have lost. Where from behind secure walls of affluence, I played in my own yard, with my own ball, here roaming the block is a perpetual activity and only the imagination can possibly curtail play. Galvanised by prolonged resistance and resilience, the never-ending skirmish with latent Verwoedian Social Architecture rages on.

While all reside under the same blue sky, the young look to graduate from living off the land while the elderly sees no other way. OoMama referred to as "imbokodo" (translated as "rocks" for their character), mine the soils for sustenance. *Usanna, nobhuti, nosisi nceda ukutya*. In so doing, they transform grey into green. Growing your way out of poverty was never real motivation to garden, but putting food in the stomachs of dependents is reason enough. Amen. Playing ball on the street corner, I came to know the friendliest of communities who gladly welcomed myself and my dedicated enumerates into their homes. Children took me by the hand to show me their very own patch of beets and spinach - desperate to glean some knowledge from me. Communicating one way or another they shyly ask me for seeds. Seeds to sow their own success. This morning, amongst the carefully tended plots laid out in organized fashion, I stood alongside an elder in the co-op. We admired his cattle. With respective 2nd and 3rd languages of Afrikaans and isiXhosa we found a way. Conversation really and truly must be shared. XhoRikaans was our chosen dialect – with much gesticulation strewn with discourse markers like …umm…lanthuka (dialect for "whatsitcalled?...said midsentence while the word is located). Eyebrows furrowed as we exchanged complex concepts. Translation

is emergent and takes a willingness to struggle for clarity – but nevertheless, we both seek it out.

The ways of the future and the ways of the past are all but smoke and mirrors in the present. The soils live on - they remember the life put into them have; they remember. The earth is fed by hand, as it always has been. Exploitation undermines scarce agrarian soils - but here there is no exploitation. One can hold the past and the future in your hand, you can taste the endeavour. The care that a seedling perishes without. Although displaced to urban blind spots, the people here have brought home with them. Elders and ancestors take time to invite the spirits to join them - giving them new soil. The kraals, "*ubutlanti*" can be spotted in every other yard. Still protected by the horns of a ram, those that have come before us live on, with respect and reverence.

Less than 10 kilometers from the provincial legislature, the roads struggle to carry the people. Entire settlements await water and electricity - and will continue to wait. Social development is very obviously preceded by graft, malcompetence and no real political will to perform any duty to those in desperate need. Yet very real is the duty that neighbors have to one another. The fabric of society easier is used to being frayed at the ages. It will not rip but has worn thin.

ABSTRACT

Urban gardening in townships is a common coping strategy employed by poor inhabitants to improve food security, earn income through sales, and generate cost-savings through home consumption of fresh produce. Food security is a cornerstone of human development and welfare, and the achievement thereof remains a global challenge. The majority of academic research and policy documentation traditionally positions food insecurity as a rural phenomenon. However, recent trends point to an increase in food insecurity in urban areas, particularly in low-income areas such as townships. In South Africa, rapid urbanization has led to burgeoning townships and rapidly expanding low-income informal settlements characterised by poverty, unemployment, and food insecurity. Research concerned with the role that urban agricultural production plays in contributing to the food security of poor households is scarce and not well understood.

This research, therefore, aimed to contribute to the limited research which specifically examines urban food security, and the role urban agriculture play in the achievement of household food security. The study employed collective action theory and utility theory to firstly provides an in-depth examination of the determinants of participation in urban gardening using Probit regression modeling. The second research objective was to perform an impact evaluation of participation in urban gardening on selected household food security indicators including Household Dietary Diversity Scores (HDDS), the Household Hunger Scale (HHS) and the Coping Strategy Index (CSI) using Propensity Score Matching (PSM). Purposive and snowball sampling methods were employed to obtain a sample of 60 urban gardeners and a control group of 55 non-gardening households from Extension 6, 7 and 10 townships as well as Joza Location in Makhanda East, Eastern Cape Province. Households were surveyed using a structured household food security questionnaire. A focus group discussion was held with the Linomtha Community Garden members and key informant interviews were undertaken with important stakeholders such as the local extension officers.

Descriptive analysis revealed that urban gardening households (UGs) had older household heads who were less educated, and that land and water availability were the dominant constraints to increases in agricultural production. Results from the probit and average marginal effects models showed that the likelihood of participation significantly increased when household unemployment and dependency increased and that households who were engaged

in off-farm economic activity were more likely to participate in urban gardening. The impact evaluation was performed using PSM and Average Treatment Effect on the Treated (ATT). Analysis illustrated that participation in urban gardening does significantly reduce both the full CSI and Reduced CSI. Thus, participation in urban gardening improves the food security of participating households by significantly reducing the frequency of participating households (UGs) applying undesirable coping strategies such as sending children elsewhere other than the household, borrowing food from other households and reducing the number of meals eaten in a day due to food shortages.

This study posits that urban gardening alone will not eradicate the rampant food insecurity and poverty which pervades in South Africa's townships. However, urban gardening participation does contribute to the construction of a sustainable, urban livelihood by reducing the number and severity of the undesirable coping strategies that food insecure households employ by providing some nutritious produce as well improved social capital through gardening networks and supporting institutions. It is recommended that policy makers, at a national and municipal level, need to create a clearer directive for the integration of urban food production into the urban food marketplace thus increasing access to income generating channels for small-scale home, and community gardeners. Co-operation between private and public institutions for food security and urban gardeners needs to be fostered and awareness of opportunities to participate in urban gardens needs to be improved. Central to the developmental challenges that rapid increases in urbanization and food insecurity in poor urban areas, is the need for national and local governments to improve access to economic opportunities in township areas - both in urban agriculture and in other, skills intensive sectors.

List of Acronyms

CAT	Collective Action Theory
CSI	Coping Strategy Index
HDDS	Household Dietary Diversity Scale
HFIAS	Household Food Insecurity Access Scale
HFP	Home Food Procurement
HSS	Household hunger Scale
ICA	Institutions for Collective Action
MM IDP	The Makana Municipality Integrated Development Plan
NGO	Non-Governmental Organization
NG(s)	Non-Gardener(s)
PSM	Propensity Score Matching
rCSI	Reduced Coping Strategy Index
RUM	Random Utility Maximisation Theory
SA	South Africa
SDG	Sustainable Development Goal
SLA	Sustainable Livelihood Approach
SSA	Sub-Saharan Africa
STATSA	Statistics South Africa
UA	Urban Agriculture
UG(s)	Urban Gardener(s)
UNDP	United Nations Development Programme
UTPT	Umthathi Training Project Trust

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CHAPTER 1: INTRODUCTION

1.1 Introduction

Global food insecurity has seen dramatic increases with the Food and Agriculture Organization (FAO) estimating that more than 2.3 billion people had inadequate food access of which more than 720 million suffered from severe forms of food insecurity i.e. hunger (FAO, 2021). This constitutes a global increase of 118 million people facing hunger in 2020 compared to 2019. Sub-Saharan Africa and Asia still bear the burden of almost three-quarters of the world's poor and malnourished. On average, in Sub-Saharan Africa alone, every fourth inhabitant is undernourished (Jouzi et al., 2017). In the continent of Africa, the prevalence of households facing hunger is twice as large as in any other region with 21% of the population experiencing severe food insecurity (FAO, 2021). According to the World Bank (2019), in South Africa the proportion of households experiencing severe food insecurity (hunger) is slightly lower than the regional rate of 19%. Therefore, achieving food security remains a global goal as codified in the Sustainable Development Goal #1 (SDG) being the eradication of poverty and SDG2 (achievement of food security) (UN, 2015).

No universal definition of food security exists due to vastly different contextualities (Altman et al., 2009) and its multidimensional nature. Food security is however, by and large, recognised to be composed of more than just adequate food intake but includes the quality of the diet as well as the capacity of individuals to satisfy their needs and preferences. As such, food security is conceptualized having four dimensions namely: availability (sufficient food production); physical and economic access; utilization (referring to socially appropriateness and optimal nutrition intake), and stability of food prices over time (FAO, 2009; Battersby and Haysom, 2019). The eradication of all forms of poverty and food insecurity and hunger remains crucial to achieving the SDGs.

In particular, the agricultural sector has been identified as an instrument to achieve these SDGs (UN, 2015; Zezza, 2017). The agricultural sector is vital for the alleviation of poverty, socioeconomic inequality, unemployment, and food insecurity (Department of Rural Development and Agrarian Reform (DRDAR), 2019; Bisaga et al., 2019; Machethe, 2014; Van Averbeke, 2007). This sector consists of large-scale commercial agriculture, small-scale and subsistence farming as well as community and home gardens (Phakathi and Wale, 2018; Van

Averbeke, 2007). Particularly small-scale farmers are viewed as a potential vehicle to reduce poverty and food insecurity, especially in rural areas (Chipfupa and Wale, 2018). As a result, the emphasis in the literature and local policy documentation remains focused on the provision of extension services (infrastructure development through agricultural extension support, marketing and value chain information, funding, crop insurance, and skills development) for small-scale, rural producers to boost low production (DRDAR, 2019; Kruijssen et al., 2008). Due to this focus on rural smallholders, research into urban forms of agriculture has been neglected. Mention of urban agriculture and its contribution to urban food security is scarce in South African policy documentation.

Analysis of the comprehensive Urban Food Security Baseline Survey undertaken by the African Food Security Urban Network (AFSUN) in 2008 reveals a strong link between high levels of urban poverty and the critical state of urban food insecurity. Of the poor urban households who participated in the study, 70% reported significant and severe food insecurity (Frayne et al., 2009). The urgency of facing these urban developmental issues warrants intensified efforts from a policy and research standpoint as food insecurity is set to escalate in Sub-Saharan Africa and the globe at large. Food security is undeniably a cornerstone of human development, health, and the development of capabilities. Underpinned by the intrinsic value of human development and human capabilities, enhancing food availability and entitlements is "critical for reinforcing essential human capabilities and therefore constitutes a precondition for sustainable human development" (Conceição et al., 2016:1).

Research posits urban gardens as being key to sustainably reducing food insecurity and poverty (Barthel and Isendahl, 2013; Bisaga et al., 2019; Pienaar and Traub, 2015; Van Averbeke, 2007) as well as fostering social resilience and solidarity, particularly among urban farmers (Vibert, 2016; Wesselow and Mashele, 2019). In the literature, the benefits of garden initiatives are wide-ranging and include building urban resilience and reducing vulnerability relating to inadequate food access, availability, utilisation, and food security at large (Eigenbrod and Gruda, 2015; Guitart et al., 2012; Oduniyi and Tekana, 2020). Moreover, as a catalyst for the formation of social capital, community and home garden networks develop community cohesion; networking, healthy and physically active, sustainable urban lifestyles and less reliance on purchased food (Vibert, 2016). Mcata (2019) points out the link between participation in gardening and reductions to poverty and food insecurity making an endorsement of sustainable agriculture as the "best fit [for] the two SDGs" (Mcata, 2019:216).

In the Makana Municipality Integrated Development Plan 2019-2020, there is no clear directive on any form of urban agriculture. The policy document notes that the activity is prevalent in townships where households supplement food security by gardening but are bound by land availability constraints (Makana Municipality Integrated Development Plan - 2019-2020: 2019).

Within the context of this study, the definition of urban agriculture consists of both home gardens as well as community gardens. The most common form of urban agriculture is home gardening which can supplement food intake as well as lower expenditure on food reducing dependence on purchased foodstuffs (Biaphethi and Jacobs, 2009). Community cooperatives are local institutions for collective action (ICA) that bring vulnerable individuals together increasing the group's bargaining power resulting in lower purchasing prices, increased sale prices as well as shared market, transportation, and social networks thus lowering general transactions costs (Houessou et al., 2019). The broad definition of community gardens denotes them as areas managed and operated by multiple local community members to produce food or flowers (Guitart et al., 2012; Kantor, 2001).

Community gardens differ from home gardens which bring food production into the private space and take place near the household on a small scale, although both serve to increase the intake of fruits and vegetables qualitatively and quantitatively (Sanyé-Mengual et al., 2018). According to Castañeda-Navarrete (2021), significant evidence points to gardens positively impacting the dietary diversity and food consumption of participating households. Home gardens are promoted due to their environmentally benevolent nature and because they are sustainable means to improve the food security of vulnerable households. Galhena et al. (2013) present home and community gardens as fulfilling social, cultural, and economic betterment while supporting and sustaining various ecosystem services. Generally, home gardeners are not motivated by profit and very little produce is sold (Reuther and Dewar, 2005). This constituted one of the primary differences between home gardens and community or co-operative organizational designs. Community gardens are characterized by communal management of resources with formal and informal agreements concerning land, input access, produce distribution as well as personal consumption, sale, or charity (Roberts and Shackleton, 2018). Within the township setting of Makhanda East under Makana Municipality in the Eastern Cape Province of South Africa, households cultivate vegetables in small spaces available to them on

their private properties or opt to access relatively bigger plots of communal land (no more than 100m^2) by joining a community garden co-operative.

1.2 Problem Statement

Developing and underdeveloped countries of the world are plagued with malnourishment, food insecurity, and substandard living conditions. Sub-Saharan Africa has the highest rate of urbanisation in the world (Drimie et al., 2013) with two-thirds of South Africans now living in urban areas reflecting the rapid process of rural-urban migration which has come to characterise both urban and rural spaces (Battersby and Haysom, 2019; Bisaga, 2019). Urbanisation is forecasted to reach almost 80% by 2050 in South Africa (South African National Space Agency, 2019). This puts untold pressure on urban infrastructure, amenities, and food systems still bound by a large reliance on commercial rural production for urban populations. Wanyama et al. (2019) note that over half of urban African dwellers live in slums where food insecurity, undernourishment, lack of access to health and education services proliferate. Roberts and Shackleton (2018) differentiate the urban agricultural activities in the developed and developing worlds positing that in poorer countries, urban gardening is usually a survivalist or subsistence strategy while elsewhere it is seen as recreational or based on health and social premises. Urban gardens may not be a panacea for food insecurity and poverty eradication in the region due to their small size. However, in the achievement of food security in township households, they offer an accessible and cheap opportunity to reduce the number and severity of undesirable coping strategies that households are forced to employ when faced with food shortages and a lack of nutritious vegetables.

Despite the potential role urban gardening plays in reducing food insecurity, it is noted that in policy circles, the study of urban gardens and their impact on food security "is a relatively recent phenomenon" (Castañeda-Navarrete, 2021:669). Participation in urban home and community garden initiatives are increasingly seen as an important coping strategy that household apply to mitigate the onset of poverty, food insecurity, unemployment (lack of income), high food prices, and rapid urbanisation (Thornton and Nel, 2007). However, the extent to which research addresses urban home gardens and community gardening co-operation is lacking and fails to reflect the need for the integration of urban food systems into local, national, and international agricultural production.

No study has undertaken an in-depth investigation of the role that urban gardens play in supporting the food security of township inhabitants in Makhanda. To date, there has been no impact assessment on Umthathi's involvement in urban agriculture specific to Malahnda's Townships and the impact of participation on urban, township food security. This thesis constitutes the first impact assessment of household participation in urban gardening in Makhanda East on various measures of household food security. This lacuna in the literature and local policy documentation motivates this study which aims to fill the gap and investigate the success/failure of urban gardening initiatives, specific to poor urban spaces (informal settlements), and their impact on household food security. This study employed food security indicators as outcome variables (Dietary Diversity Score, Household Hunger Scale, and Coping Strategy Indexes) and employs a probit regression model and the propensity score matching method to ascertain whether participation in urban gardening significantly increases dietary diversity or reduces household hunger and the number of undesirable coping strategies employed by food insecure households.

Developmental projects require measurement of household food security outcomes to identify the food security status and impact of programs on household livelihoods, food security as well as the temporal characteristics of the food insecurity (Hoddinott, 1999). This thesis contributes to the body of literature that measures and analyses the dimensions of food security specific to the urban sphere where, to stave off worsening household food insecurity, many poor urban households participate in subsistence urban agricultural activities. The Sustainable livelihoods approach (SLA) is deployed for this research in tandem with Collective Action Theory and Utility Maximization Theory which address the reason and circumstances under which people choose to join groups such as community gardens and home garden networks. Utility Maximization Theory denotes the individual as a self-interested and rational agent and that their decisions between discrete outcomes (in this case participation in urban gardening or not) are based on that individual maximising the utility they expect to gain from the two alternatives (Hess et al., 2018). Collective Action Theory was used to further investigate the value that individuals ascribe to joining groups and their motivations for doing so. As per the theory, kinship-sized groups such as the groups researched, who share close social times and identities do well in identifying free-riders and managing a public resource among themselves in a sustainable manner (Shur-Ofry and Malcai, 2019).

This problem statement informed the formulation of two research questions which are as follows:

1. What are the factors influencing participation in urban gardening for township households residing in Makhanda East?
2. What is the impact of participation in urban gardening on the household food security of township households in Makhanda East?

The research hypotheses of this treatise are as follows:

a) There is a positive relationship between household participation in urban gardening and improved household food security outcomes.
b) The household food security of township households in Makhanda East is positively impacted by participation in urban gardening.

1.3 Research Goals

The general objective of the study is to evaluate the impact of participation in urban gardening activities on household food security. This will be achieved through these sub-goals:

i. To determine the factors influencing participation in urban gardening.
ii. To evaluate the impact of participation in urban gardening on household food security.

1.4 Justification of the Study

According to Tshwene and Oladele (2016), more than three-quarters of South Africa's population depends on agricultural output to support their livelihoods - as such the growth of the agricultural sector is posited as key in fostering economic growth through improved agricultural productivity. The agricultural sector plays an integral role in supporting the livelihoods of a high number of South Africans in rural and urban areas. The agricultural sector thus underpins the food security of many and in tandem with access to basic service provision provides the very basis for a dignified life lived absent of hunger and poverty.

Research and policy address urban perspectives on agricultural production, food security, and nourishment to a limited extent (Drimie et al., 2013) with fewer still investigating urban community and home gardens (McCormack et al., 2010; Okvat and Zautra, 2011). This imbalance should be rectified through a pointed analysis of the potential benefits that urban

food production generates, particularly with a focus on supporting urban food security and the livelihoods of low-income, township residents. In Makhanda, Eastern Cape Province, Umthathi Training Project Trust has been involved in promoting sustainable urban gardening for 30 years (established in 1992) in support of household food security among township households. However, an impact assessment of their involvement, to date, has not been undertaken. This forms the main aim of this thesis – to assess the impacts of household participation in urban gardening in Makhanda East on household food security. This study focuses solely on residents of informal settlements where educational and nutritional outcomes are severely low (Drimie et al., 2013), and poverty and unemployment outcomes are excessively high (Hunter and Posel, 2012). The evidence produced from this thesis has value to municipal bodies that can use the results to inform improved understanding relating to the effectiveness of the urban gardening being practiced in combatting food insecurity to underpin effective policy formation.

This thesis takes a proactive approach to researching the dimensions of food insecurity specific to urban areas to expand knowledge and understanding of the dynamics, shortcomings, and benefits that community food security projects present in poor urban settings. The focus of this research is on both urban community and urban home gardeners referred to as urban gardeners (UGs) hereafter. Households who do not participate in such urban gardening activities are referred to as non-gardeners (NGs).

Due to the precarity of the livelihoods of so many, the global number of people facing acute food insecurity has almost doubled since 2019 (World Food Program, 2020). Urban community and home gardens can address these socio-economic ills by providing freely accessible work and opportunity for food production as well as income generation. According to Mitchell and Hanstad (2004), urban gardening is more easily accessible to the poorer echelons of society.

In the Eastern Cape, 45% of the provincial population (6.3 million) lives in urban areas and the poverty levels have been shown to be worsening for the poor (Musemwa et al., 2015). Official statistics relate the seriousness of economic conditions in the Eastern Cape which has the highest unemployment rate by province (39.5%). In Makana Municipality, industrial activity (manufacturing and construction) only comprises 21% of the total employment composition (Eastern Cape Socio Economic Consultative Council, 2017). This reflects the need for the promotion of labour-intensive economic activities to be endorsed and supported by local and national policymakers: one such avenue being urban food garden initiatives. If local

governments engaged more with urban agricultural programs and specifically community and home garden initiatives, real inroads could potentially be made in securing sustainable livelihoods, food security, poverty alleviation, and the creation of economic opportunities for those out of work. Additionally, there is notable underrepresentation in food security research specific to African townships (Wanyama et al., 2019) which further necessitates the proposed research of this study.

In the Eastern Cape Province, a Non-Government Organization (NGO) called Umthathi Training Project Trust (UTPT) has initiated various training courses in organic agriculture as well as the formation of community urban gardening co-operatives led by local participants in informal settlements. UTPT additionally offers some extension support to home gardeners who seek them out for gardening assistance. The Linomtha Community Garden was started by local community members and aided by the Umthathi Training Project Trust to access a tract of communal land on the peri-urban fringe of Makhanda East.

Urban gardeners, as well as urban policymakers and Umthathi Training Project Trust, stand to gain access to research output specific to the context of Makhanda East's townships and the impact that gardening has on food security as one of the coping strategies employed by households. The Umthathi Training Project has multiple similar community garden co-ops close to this case study making this research highly and readily applicable for other community and home garden initiatives administered by UTPT. The urgency for urban food security research is ever greater in light of the global state of crisis brought on by the Covid-19 pandemic. Social injustices are accentuated during times of crisis directly leading to the emergence of increased urban agriculture as a means to cope with severely worsened financial limitations experienced (Okvat and Zautra, 2011; Sanyé-Mengual et al., 2018).

1.5 Structure of the Thesis

This thesis proceeds by presenting a review of the relevant literature in Chapter 2. An introduction to urban home gardens and community garden co-operatives is presented followed by a comprehensive look at food security and the role that urban agriculture plays in combating global and local food insecurity. The determinants of urban garden participation are examined followed by a review of the policies and institutional support systems in place to combat food insecurity and poverty in South Africa. Chapter 3 presents detailed information on the methodologies used in achieving the research goals. Section 3.2 describes the study area in the

city of Makhanda, Eastern Cape Province. The methodological tools used in this research unpacked in this chapter include the theoretical foundations of collective action and utility maximization theory. The theoretical framework employed is the sustainable livelihood approach (SLA). Data collection and sampling procedures are delineated as well as the empirical methods used. Explanations of the econometric modeling methods: Probit Regression and Propensity Score Matching analysis are given in Section 3.8.

Chapter 4 presents descriptive statistics of the sample of respondents focusing on the significant differences between Urban Gardening households (UG) and Non-Gardening households (NG). UG and NG households are characterized in terms of demographical and socio-economic data collected by survey and compared. Section 4.6 and 4.8 specifically examine the community gardeners surveyed elucidating their market access, biophysical conditions, and communal social dynamics. Section 4.9 reviews the various food security indicators which are analyzed for significant differences between the UGs and NGs. Chapter 5 contains the empirical results for the Probit regression which models participation in urban gardening as well as the evaluation of the impact of participation on food security from the Propensity Score Matching Methods employed. The final chapter (Chapter 6) gives the conclusions drawn from the research as well as policy recommendations that are based on the findings.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Poverty and food security are increasingly becoming an urban phenomenon and especially in South and Sub-Saharan Africa, a multifaceted approach to food security needs to be carefully considered. This review motivates for an approach inclusive of the potential that urban food production systems offer as means to aid in urban poverty and food insecurity alleviation. In particular, this review seeks to investigate the value attributed to urban gardening in improving the food security and socio-economic status of participants and whether advocacy for urban forms of agriculture such as home and community gardens are warranted.

This chapter presents and overview of academic definitions of food security thereafter homing in on urban aspects thereof. Several food security indicators are presented and reviewed. The impact of urban gardening of food security is reviewed through the relevant literature as well as the motivations for participation and the contributing factors to determining involvement of urban households in the activity.

2.2 What is Food Security?

According to Battersby and Haysom (2019) the scholarly definition of food security is contested although in 1996 at the World Food Summit in Rome some consensus was reached. The Food and Agriculture Organisation of the United Nations gave their definition:

> "Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, access, utilization and stability. The nutritional dimension is integral to the concept of food security" (FAO, 2009: no pagination).

According to Napoli (2011), this definition of food security has received the most recognition. Imperatively, the definition specifies food security to include more than just adequate food availability and intake but the quality of the diet as well as the capacity of individuals to satisfy their needs and preferences. The cornerstones of food security are availability, accessibility (physical and economic), utilization and stability. This means that sufficient food is produced (is available) and that the food can be consumed, purchased and traded. The utilisation

dimension refers to the fulfilment of the consumption of foods which are appropriate to a certain social context and promote optimal health and nutritional outcomes. The fourth dimension, stability refers to the stability of prices and supply in such a way that the approach to food access planning can be undertaken with certainty (Battersby and Haysom, 2019:4).

A systematic literature review by Even-Zahav and Kelly (2016) was undertaken with regards to food security. The authors set out to observe the spread of scholarly articles and policy documentation that address one, or a combination of, the three primary dimensions of food security. Their research reveals two primary elements of food security, 'access' and 'availability', are in contention for dominance in the literature with one school emphasizing access (particularly from urban food security authorship) while others placing availability of food as the crux of achieving food security. The former argument is noteworthy as, specifically in urban areas, the existence of supermarkets and shops which avail food to urban citizens, does not amount to food security in the slightest. In other words, in as much as poor urban dwellers live in proximity to the food secure, they may not have the economic resources nor capacity to purchase enough healthy and nutritious food to be considered food secure.

Increases in food availability can largely be linked to commercial food production which makes up much of food supply in South Africa. While increased agricultural productivity will serve to increase the production and profitability of commercial farming in Sub-Saharan Africa (SSA), for the small-scale producer and subsistence farmer, increased productivity can be seen to impact differently. Increasing yields among resources-scarce farmers and gardeners importantly serves to increase household food accessibility which refers to the physical and economic ability to consume adequate and healthy calories. This positively supports one of three vital fundamentals of achieving food security (Battersby and Haysom, 2019) and can directly increase the output that poor households produce for home consumption. Increasing agricultural yields is bound to improve food security in Sub-Saharan Africa and the growth (productivity) of the agricultural sector is a prerequisite for alleviating the mass poverty and food insecurity which grips the region. According to Conceição et al. (2016), whether the potential for these gains to be made are realized in Sub-Saharan Africa constitutes the real question.

2.3 Urban Food Security

Up to 65% of South Africans are living in urban areas - a reflection of the rapid process of rural-urban migration which has come to characterize both urban and rural spaces (Bisaga, 2019). As a result, the growing urban population increasingly access agricultural produce via the market as opposed to the production itself and are thus more reliant on cash (Battersby and Haysom, 2019). Households in informal settlements spend more than half of their income on food and are generally close to, if not severely food insecure (World Food Program, 2020). Compared to rural populations, urban populations in South Africa, and in particular poor households spend large proportions of their income accessing enough food to live (Kekana, 2006). That the cost of urban living is on average 30% higher than in rural areas only stands to further compound the pressures on the burgeoning urban poor (Ravallion et al., 2007). More recent research by Walsh and van Rooyen (2015) indicated that 47% of rural households in areas of the Free State province reported current food shortages while the statistic for urban households was 81%.

Crush and Caesar (2014) in their study on urban food security in Msunduzi, KwaZulu Natal, remark on the nature of food insecurity in poorer urban areas. Urbanised South Africans, for the most part, get their food from supermarkets which have rapidly proliferated throughout the country. While the scale of the influence of the informal economy cannot be underestimated, the formal marketplace has expanded with supermarkets provisioning cities with most of their food. Crush and Caesar (2014) refer to cities characterised by this severe lack of food sovereignty as “food desserts” where the incomes of poor urban dwellers are predominantly spent on purchasing food. In tandem with the market orientated location and pricing policies that supermarkets employ, the consequence of this dynamic, is that quality food is placed outside the reach of the most poor and marginalized households Thus, constrained to purchasing from supermarkets, the most vulnerable in urban areas suffer endemic “lack of choice, food shortages and a lack of dietary diversity” (Crush and Caesar, 2014:167). In other words, as a result of the supermarket model, those at the bottom rung of the social hierarchy are most at risk of food insecurity. Although food security is traditionally labelled a rural responsibility, urban contributions must be considered as means with which to reduce pressure on rural food production systems.

Food poverty has been linked to rural communities in the past – however, the combined forces of urban migration, sharp increases in basic food prices and national economic stagnation have prompted the suggestion that "poor urban households are experiencing a widening food gap" (Frayne et al., 2009:5). Eigenbrod and Gruda (2015) necessitate an approach to urban agriculture in which urban production systems must be seen as complementary to rural agriculture and not in competition with not undermining of the current systems. Additionally, they put forward the idea that urban gardeners who produce on a small scale should not be considered as an issue because of their low productivity but instead be welcomed as making contributions to urban sustainability and food security (Eigenbrod and Gruda, 2015).

In low- and middle-income countries, urban centers will absorb most new population growth increasing the mounting pressures on urban resources and administrations in regions where service provision is generally deficient, and governance is defunct. The urgency of facing these urban developmental issues warrants intensified policy and civil society efforts as food insecurity deteriorates. Whereas rural development has in the past been seen as the catalyst for social and economic betterment in South Africa, Frayne et al. (2009) asserts that the growth of urban centers will need to be considered the central developmental challenge. It is noted that the deterioration of urban food security is in part due to the disappearance of much of urban food production. If the trend of dissipating urban resilience and food security is to be halted, Barthel and Isendahl, (2013) put forward that the problem of integrating food systems into the urban sphere must be afforded equal consideration relative to other public services.

In South Africa, the rapid influx of rural migrants and formations of many sizable townships can be attributed to the legacy of Apartheid homeland policy and the subsequent abolishment of "influx control" in 1986. Many rural migrants flocking to developed urban centers in search of economic opportunities, and a modernised, urban life was however faced with a South African economy which flagged into recession curtailing the efforts of many to improve their livelihoods. Urban agriculture is predominantly found in these poor townships and informal settlements in South Africa - a fact that is inextricably connected to the deterioration of the urbans poor's economic and social welfare. The precariousness of such a livelihood spurred the emergence of urban agriculture and community gardens as a livelihood strategy by the poor (Reuther and Dewar, 2005:98).

While further development of rural agricultural production will continue to be central to rural livelihoods, Eigenbrod and Gruda (2015:484) highlight the urgent need to integrate vacant urban and peri-urban spaces as sites of cultivations. Expanding the scope of urban gardening facilitates increases future urban food security and resilience as well as alleviates pressure from rural agricultural systems under increasing pressure due to population increases coupled with an increasing trend to urbanisation. Localized vegetable cultivation in suburban and peripheral areas promote a more sustainable, resilient and food secure system. Decentralized food systems characterised by short supply chains and localised markets are beneficial to urban gardeners who would venture into commercial sale of their surplus produce. The reduction in costs associated with urbanised food production systems are generated by reducing costs of transportation, delivering of fresher produce, storage as well as packaging. Shorter and more varied urban supply chains also decrease the costs associated with wholesalers and retailers which consequently decreases the gap in prices between the supplier and the final consumer. By closing the price differential, increased consumer surplus is generated benefiting the welfare of particularly the urban poor (Sithole et al., 2012).

Eigenbrod and Gruda (2015) undertook a review of the literature regarding urban vegetable production for urban food security. Their research is presented on three fronts: Ecological, Economic and Social with results identifying that horticulture is the largest contributor to food security of all other urban food sources. An agroecological approach inevitably champions low-input/minimum external input farming systems due to the sustainability of such an approach and the need for resilient and secure food production in the future. Social development and the integration of horticulture and environmental/ecological awareness into education is also imperative for transforming nutritional knowledge into healthier urban diets.

In the contemporary city context, socio-economic issues and pressures are mounting due to population growth, unplanned urban expansion as well as the deterioration of food and nutrition security. Other factors that are interconnected with urban poverty include unhealthy dietary shifts and wide health disparities. These pressures are integrally linked with growing socio-economic inequalities negatively affecting the most marginalised individuals in our society. Women, youth, migrant workers and indigenous groups bear the brunt of widening inequalities and account for much of the most vulnerable individuals in our society (Vaarst et al., 2017).

The current state of food security in South Africa at large reflects the structural economic and social inequalities which are still prevalent. The sobering realities of widespread poverty, unemployment and economic decline in much of South Africa is compounded in the face of food insecurity and malnourishment. The dire consequences of undernourishment and food insecurity are breathtaking with a child (between 12 and 24 months old) stunting rate of 17% in two of the five informal settlements in Pretoria under study by Van Averbeke (2007). A survey respondent noted deficiency of iron and calcium in local diets - an issue which can be greatly improved through increased home consumption of vegetables (Van Averbeke, 2007). Foeken and Mwangi (2000) found that, in Kenya, households which were involved in urban agricultural projects and groups had lower rates of stunting and malnourishment due to a higher intake of energy (Foeken and Mwangi, 2000).

In South Africa and SSA at large, evidence of malnutrition and undernutrition in poor communities, and specifically among children, is indicative of the traditional focus food security scholars have on undernutrition as being food insecurity. More than that, a holistic view is propounded by Even-Zahav and Kelly (2016) which recognizes and incorporates overnutrition as an identifier of food insecurity. In South Africa concerns about the negative consequences of a "nutrition transition" are increasingly prevalent as increases in obesity and overweight individuals are observed caused by shifting of dietary behavior away from healthy food intake (Even-Zahav and Kelly, 2016:13). Battersby and Haysom (2019) presents a similar case noting a similar pattern in the West in which as hunger disappears (undernutrition), it is subsumed and replaced by obesity (overnutrition) as a result of the diet easily and inexpensively available to the South African urban poor. Since these flaws in the recognized definitions of food security have been uncovered, focus has been firmly on a 'nutrition transition' which has included micronutrient deficiencies ('hidden hunger') and overnutrition ('overweight and obesity') as a part of food security.

In developed and developing economies, Wallinga (2010) cited in Dwivedi, (2017:845), attributed this phenomenon of obesity replacing hunger to cheap food policy which subsidizes a small range of commodity crops facilitating the shift in diet. In order to not replicate an equally unsustainable food system (as described above) and diet, the need for a diverse approach to the food systems inclusive of horticulture, biodiversity and more efficient use of urban spaces needs to be incorporated into policy discussions. In an appraisal of the food security of urban South Africans by Battersby and Haysom (2019), the authors note that the

nature of food insecurity is changing. Obesity and diet-related non-communicable diseases are on the rise in food insecure households while 30% of men and more than half of South Africa's women are obese (The South African Demographic and Health Survey (SADHS), 2016 cited in Battersby and Haysom, 2019). The reasons for this decline in the health of South Africans is in part due to decreasing physical activity but more crucially, because of the nutrition transition observed in the country (Battersby and Haysom, 2019).

The rampant food insecurity among South Africans, particularly the urban poor, is due to multiple factors. Nutritional insecurity is at the heart of the national dilemma as the high levels of income poverty drive impoverished households to substitute away from relatively more expensive nutritious foods such as fruits and vegetables supplementing their food consumption with cheaper and more accessible and inexpensive food stuffs such as cereals and high sugar content items. The decline in physical activity among urban populations compounds the struggle for healthy intake of fresh produce. Local community and home gardening initiatives are in the unique position to aid in mitigating both unhealthy behaviors and dietary intake and in so going combat the nutrition transition precipitating across the country.

2.4 Measurement Indicators of Food Security

The measurement of food security takes many different forms and is undertaken from many different perspectives. Generally, food security indicators measure a specific dimension of food security (access, availability, utility, stability) or a combination of multiple dimensions. Development economics requires such indicators and measurements of food security outcomes in order to assess and better understand the nature of food security specific to a certain population or area. Identifying and monitoring the food security status of individuals, households, communities, and regions is important for development institutions who are engaged in food security interventions and wish to assess the impact of the intervention as well as the temporal characteristics of food security (Haddinitt, 1999). Food security is a precondition for the development of human resources in a sustainable manner (Conceição et al., 2016). This section examines a variety of food security indicators commonly employed within the literature. Based on their relative strengths and weaknesses, this study then selects the indicators which are best suited for the research objectives and specific characteristics of the households that make up the sample.

2.4.1 Household Dietary Diversity Score

The Household Dietary Diversity Score (HDDS) indicator is used to test the number of food groups consumed over a defined time period (Hoddinott, 1999:8; Maxwell et al., 2014:108; Peng and Barry, 2019:5). This requires the construction of a comprehensive food list undertaken via appraisal exercises, discussions with key informants and past lists used in similar research from locales in close proximity to this research (i.e. Cheteni, 2020; Chakona and Shackleton, 2017). The choice of a dietary diversity and food consumption scale indicators to measure food security are employed based on empirical observations that in developing countries, as households become better-off, they diversify their intake of different foods. Additionally, HDDS is predominantly well correlated with calorie consumption (Maxwell et al., 2014) and is easier to capture. HDDS follows the increasing emphasis in nutritional literature on dietary diversity as "a valid welfare outcome in its own right" (Hoddinott,1999:10) while its main disadvantage is that the resultant indicator does not take frequency of consumption into consideration. What is does tend to observe are the aspects of food insecurity relating to quality and diversity of intake (Maxwell, 2013).

The research and literature regarding the potential for home gardening to contribute to a homesteads' dietary requirement shows divergent results. According to Kumar (2021) the inherently variable nature of the productivity in home and community gardens informs the contrasting empirical findings. Urban gardens are highly variable in terms of size, biophysical conditions, use of natural an inorganic inputs and climate. Khumalo and Sibanda (2019) investigate the impact of UA and UPA on household Food Security in Tongaat, eThekwini Municipality using Probabilistic Regression analysis as well as Household Dietary Diversity Scores as measures of household food security similar to this research. Statistically significant variables in determining HDDS (food security) at the household level included employment status, land access, land tenure, and income (Khumalo and Sibanda, 2019). Dietary diversity was not significantly different between households who took part in UA or UPA and those who did not (Khumalo and Sibanda, 2019). The mean household Dietary Diversity score was found to be 4.75 and households were classified as having low DD (<3 food groups); medium Dietary Diversity (4-5) and high Dietary Diversity (>6). Following Rajendran (2012) and Khumalo and Sibanda's (2019) recommendations, computing the HDDS requires defining a cut-off/threshold above and below which households are to be classified as food secure or insecure. For this purpose, they suggest the use of the distribution/mean of the scores should be employed as

threshold. Swanepoel et al. (2021) reveal that in several Western Cape informal settlements, although the mean Household Dietary Diversity Scores of Gardening Households (10.4) were higher that the scores of Non-Gardening households (10.3), there was no statistically significant difference.

2.4.2 Household Food Insecurity Access Scale

A further indicator recently endorsed by international institution the Food and Agriculture Organisation (FAO), is the Household Food Insecurity Access Scale (HFIAS). Access to food, as a recognised component of food security, refers to the existence of sufficient incomes/resources to obtain socially acceptable foods and sustain consumption of an adequate diet. The HFIAS indicator is premised on measurement of the 'access' component and is derived from the notion that, when faced with household food insecurity, predictable reactions and responses (behaviour) signifying insufficient quality and quality of food can be observed and quantified via survey and can thus be summarised on a scale (Knueppel et al., 2009; Peng and Barry, 2019). Behavioural changes observed relate to inadequate quantity, quality, acceptability and worries over insecure access to enough food. The construction of a HFIAS combines measurement of food insecurity factors namely relating to sufficient intake as well as psychological dimensions (Maxwell et al., 2013).

The HFIAS has been designed in order to capture food access and the various components thereof inclusive of worry about household food supply; inadequate quality, diversity as well as preferences and social acceptability. Also, the prevalence of not having enough food supply and the physical consequences thereof are addressed (Dietcher et al., 2010). A limitation of the HFIAS as an indicator of insecure food access is that several of the nine questions used to construct the scale are observed to be rooted in culture and thus can take on different meanings to different groups. Examples given by Deitcher et al. (2010) point to the fact that "worry" which is contained in question 1 tend not to be a commonly understood concept across cultures and in cultures where is it commonly identifiable, it may be perceived to occur at different levels of severity in different cultures.

Analysis of the HFIAS by Khumalo and Sibanda (2019) reveals that households who participated in urban and peri-urban agriculture were better off in terms of food access than non-participating households. Swanepoel et al. (2021) analysed the extent to which UA and in particular home gardens contributes to household food security in several of the Western Cape

Provinces informal settlements. Analysis of food security by means of constructing HFIAS reveal that households engaged in home gardening were slightly less food secure than NGs i.e. the means scores were 13.52 and 14.05 respectively, although the values are not significantly different.

2.4.3 Household Hunger Scale

The Household Hunger Scale (HHS) was selected as an indicator of the access component of food security and due to its strength at capturing the most sever forms of food insecurity i.e. hunger. The HHS indicators is a sub-scale of the Household Food Insecurity Access Scale (HFIAS) which similarly measure food access through the observation of certain behavior indicative of worsening level of food access. The underlying theory of the HSS is thus very similar to that of the HFIAS reviewed above.

Qualitative feedback on the nine HFIAS questions was captured by Deitcher et al. (2010) which revealed that similar inconsistencies occur with regard to cross-cultural comparability for questions 1-6 while questions 7, 8 and 9 were found to be more consistent across differing cultural contexts. This informed the decision to capture data on the Household Hunger Scale only as it is made up of those questions from the HFIAS which are consistent cross-culturally.

Furthermore, the Household Hunger Scale was used as it is the appropriate indicator to be used where areas under study have excessively high levels of food insecurity and poverty - as it to be expected in the Eastern Cape (IPC, 2021; Pauw, 2005) and Makhanda's informal settlements. The Household Hunger Scale as a food security indicator measures the most severe manifestations of insufficiency (Maxwell et al., 2013). Classified as an experimental measures of food insecurity, the HSS measures seek to obtain both the "behavioural and psychological dimensions of food insecurity experience along a spectrum of severity" (Maxwell et al., 2014:109).

Data collection included observation of the prevalence of situations in which households have no food in the household at all, where households consume no food during the whole day and go to bed hungry (Maxwell et al., 2013). These points are reflected by questions 7, 8 and 9 of the HFIAS – which was not included in this analysis. Noteworthy is that Dietcher et al. (2010) through a process of cross-cultural comparisons, found responses from different cultures to be consistent with regards to the experience of household hunger. Household Hunger Scales were

constructed based on the number of specified questions which were answered affirmatively where the higher a score, the greater the food insecurity. Each question has pre-coded responses which reveal the frequency of occurrence with regard to that question where 0= Never; 1=Rarely or Sometimes; and 3=Often. Dietcher et al. (2010) uses a recall period of 4 weeks.

Deitcher et al. (2010) categorized households into three groups based on their HHS from questions 7, 8 and 9. The categories are as follows: Households which generate scores of 0-1 are classified as: Little or no Household Hunger. Households which generate scores of 2-3 are classified as: Moderate Household Hunger Households which generate scores of 4-6 are classified as: Severe Household Hunger (Dietcher et al., 2010:21).

2.4.4 Coping Strategy Index

The Coping Strategy Index (CPI) act as a metric to describe certain behaviors which arise as household descend into situations of food shortages as well as their frequency. According to Kruger et al. (2008), these food-acquiring activities referred to as food-coping strategies, can be described as mechanisms used when usual channels are disrupted. These channels include but are not limited to insufficient income to access food stuffs, natural disasters which disrupt the normal means through which food is acquired. The Covid-19 pandemic constitutes one such disruption as the mobility restrictions enacted through the Nation Lockdown limited access to resources and led to tremendous loss of employment and income. Although these strategies are by no means universal, a generic list of coping strategies has been constructed and can be categorized into 4: changing diet, reducing food consumption, “food-seeking strategies, and altering the household” (Kruger et al., 2008:4).

The strength of this particular measure is that the information required is not data heavy, are quickly and easily collected and are cheaper compared to real household food consumption levels. The list of question is easy to administer and often applied in situation when time is limited. Developed in Ghana, Uganda and Kenya, the CSI is ideal for early warning and monitoring of food security (Maxwell and Caldwell, 2008). The ways in which households deal with food shortages are gaged and added creating a numeric score which can be monitored to either be increasing or decreasing over time. Taken from the Coping Strategies Index Field Manual composed by Maxwell and Caldwell (2008), the following list depicts the behaviors characteristic of the strategies employed by households in the advent of approaching and present dire food shortages. As an indicator of household food security, the number of coping

strategies employed by a household and their frequency reveals important information about the level of strain households are experiencing and to what extent their experience of food insecurity is motivating actions by household members to combat the experience of food shortage. These statements are translated into the list of questions posed by way of survey. They are categorized in the aforementioned manner into four broad types of coping strategies:

Table 2 1: List of Coping Strategies

Changing Diet	**Altering the Household**
1. Rely on less preferred and less expensive	6. Send children to eat with neighbors
Food-Seeking Strategies	7. Send household members to beg
2. Borrow food from a friend or relative	**Reducing Food Consumption**
3. Purchase food on credit	8. Limit portion size at mealtimes
4. Gather wild food, hunt, or harvest immature crops	9. Restrict consumption by adults in order for children to eat
5. Consume seed stock held for next season	10. Reduce number of meals eaten in a day
	11. Skip entire days without eating

Source: Modified version of Maxwell and Caldwell (2008:6)

A second version of the CSI was modified to reflect a more universal picture of the coping strategies employed under food duress. This is referred to as the Reduced Coping Strategy Index (rCSI) and has been found to be reflect food insecurity almost as well as the full CSI which was originally created but does so across different contexts while the full CSI appears more context specific and malleable to each context. The rCSI consists of a subset of the full CSI consisting of the strategies numbered 1, 2, 8, 9 and 10 in Table 2.1. It is however, not as proficient at identifying the most vulnerable households as it does not gather as much information (Maxwell and Caldwell, 2008). For the purposes of this study, both indicators were used, as the rCSI is simply a subset of the full CSI and analyzed.

For both the full and reduced coping strategy indexes a frequency range of 0-4 was identified by the respondent relating to each coping strategy. Given the questions relating to the coping strategies, respondent replied identifying whether they “never” exhibited the behavior in question (code = 0), whether they experience it less than once per week (code=1), once or twice weekly (code=2), every second day (code=3) or every day (code=4). Given that the full CSI consists of 11 questions the range of the indicator is 0-44 where for the reduced CSI the range is 0-24.

What sets this indicator apart from other indicators of food security, is that while all the aforementioned measures of food security are static (that is they do not account for vulnerability of food insecurity going into the future) the Coping Strategy Index is dynamic in that those households who employ more coping strategies and more severe coping strategies are more likely to be currently under duress due to food shortages as well as being more vulnerable to future food insecurity (Christiaensen et al., 2000). The authors also posit that both the Coping Strategy Index as well as the household dietary diversity measure of food security are reliable indicators of caloric intake – but that the CSI does slightly better in terms of its power to predict food insecurity. Analysis of the impact of crop production on household food security through the lens of the CSI, Mjonono et al. (2009) found 61.6% of their respondent household in Umbumbulu, Kwa-Zulu Natal, relied on less preferred foods. Furthermore, over half of respondents had to borrow food or money (52.80%) and/or receive help form relatives/friends in addressing food shortage (53.50%). The authors conclude that households were generally food insecure in the study area.

In a comparative food security study based on analysis of the type of coping strategies employed as well as the Index Score of households in QwaQwa by Majake (2005), it was found that households who were participant in a food security program were generally more food secure and exhibited lower CSI scores of 17.9 compared to mean scores of 27.0 for non-participating households. Their findings are validated by results which reveal that participating household applied the coping strategies which indicate less severe food shortages more than non-participating households, who applied the more severe coping strategies to combat food shortages. The least severe coping strategies included reliance on less preferred/expensive foods and reducing meal sized while the more severe strategies included borrowing food from relatives/friends, going an entire day without eating and sending household members to beg for food. It must be noted that the study area is in the rural context and thus results reflect that specific context which differs greatly form the area under study in this thesis.

2.4.5 Self-Assessment of Household Food Security

Self-assessment or self-report measures of household food security is a relatively new indicator of food security. It is a simple and effective indicator which entails directly asking a household head (preferably the head of the food unit) about the level of food security in the household. They are asked to identify the household as being: food secure, mildly/marginally food

insecure, moderately food insecure or severely food insecure (Fawole and Ozkan, 2017). The indicator specifically monitors the preference dimension of food security and in so doing addresses the utilization component of food security which sets it apart from tradition measures of food security. According to Fawole and Ozkan (2017), this indicator does well to capture the sufficiency dimension of food security as it reveals the self-contentment of a household with their level of food security. This method is limited by potentially biased responses if respondents stand to gain food aid based on their responses – however, for research purposes, where ethical standards denote no exchange (generally food aid) between researcher and respondent, this limitation is immaterial.

2.4.6 Food Consumption Score

This indicator is comparable to the Household Dietary Diversity Score indicator but differs in the makeup of the list of food groups as well as recall period. Food Consumption Scores are estimated by noting the frequency of consumption of 8 specific food groups. The listed food group are assigned weights based on the nutritional density of the groups which are then multiplied by the frequency of consumption over the recall period. The resultant score is the Food Consumption Score (Fawole and Ozkan, 2017). Where the Household Dietary Divesity measure is a simple count of food groups consumed, the Food Consumption Score takes into consideration the frequency of consumption and is thus preferred by some researchers. It does however require knowledge of the nutritional density of the food groups which lies outside the purview of economic research and requires specific knowledge of nutritional values (Peréz-Escamilla et al., 2017). According to Fawole and Ozkan (2017) and Peréz-Escamilla et al. (2017), a weakness of the food consumption score is that the food groups vary across different contexts making it a controversial measure of food security. For example, in Sub-Saharan Africa, dietary diversity is, on average, lower than in South Asia and thus, the methodology needs to be adjusted to reflect the specific region under study (Smith and Weismann, 2007). This consequentially means that, because the food groups and threshold values are subjectively chosen by the researcher, results may not be comparable across different contexts (Peréz-Escamilla et al., 2017).

Constructed HDDS and HHS produce scale values in continuous form necessitating a transformation into categorical or status-level classification so as to identify the food secure from the food insecure. In order to achieve such classification based on the various scores, scale threshold values are utilized from the relevant literature (Cheteni, 2020; Chakona and

Shackleton, 2017; Bickel et al., 2000). The construction of a dichotomous indicator of food security status derived from the HDDS forms the basis for creating a binary dependent variable indicative of whether any given household from the sample of co-op members, as per Objective 1, are classified as being food secure or not - allowing for interpretation of statistically significant determinants of their food security.

2.5.1 The Impact of Urban Gardening on Food Security and Income

Household participation in urban gardening was found to have a positive impact on the food security and income in Emfuleni Municipality, Gauteng Province. Modibedi et al. (2020) found 78.7% of the sampled households to be primarily gaining income from their involvement in the various local community gardens. As a main source of income, involvement in a community garden project was essential to their livelihoods and food security consequently making the sustainability of the gardens critical to their continued welfare and income security. Only 60% however relied on the income generated from produce sales as almost half of the respondents received social support from private or public programmes in the last 9 months.

Research into the community gardens of Bulawayo, Zimbabwe revealed that participants were largely self-sufficient in terms of vegetable cultivation and consumption from their allotments. Sithole et al. (2012) reported that 80% of their study participants depended on their gardens for vegetables all year round thereby improving their food security and diet. Diversifying vegetable cultivation is also cited as potentially exerting positive impacts on dietary diversity and quality although the extent to which diet is improved is dependent on the diversification of farming efforts (Poulsen et al., 2015). This also requires that specific vegetables be grown which may provide a community with micronutrients which are lacking in their diet. The cultivation and consumption of vegetables in disadvantaged communities go further than just supplementing food security but increases the access these communities have to nutritious foods.

Alaimo et al. (2008), in their study on the effect participation in community gardens on the intake of fresh fruits and vegetables in Michigan State, found that implementing community garden interventions may constitute a valid nutritional intervention. Households with a member taking part in community gardening were found to be 1.4 times more likely to consume fruits and vegetables as well as 3.5 times more probable to consume fruits and vegetables at least 5 times a day. Research regarding urban agriculture in Pretoria's Townships found that home gardens only provided 6.7% of the recommended daily intake of vegetables – an amount

insufficient to be considered a strong contributor to household food security (Van Avebeke, 2007:340).

Baiyegunhi and Makwangudze (2013) tested for the significance of home gardens in determining food security among HIV/AIDS affected households in Mpophomeni Township, KwaZulu-Natal. Their findings reveal that households with home gardens who cultivated food to supplement household diet were statistically more likely to be food secure than those who did not. The case study reaffirms that as (HIV/AIDS affected) households begin to participate in home gardening, so does the likelihood of food insecurity decrease (Baiyegunhi and Makwangudze, 2013). An estimated 20% of South Africa is HIV positive and as such Thornton and Nel (2007) present small-scale, low input and intensive urban agriculture as "perhaps best suited for HIV/AIDS-affected households" (Thornton and Nel, 2007:19). Additionally, Stimie et al. (2010), recognise that there is a pervasive scarcity of cash (poverty of income) in disadvantaged South African households and as such puts forward Low-External-Input Sustainable Agriculture (LIESA) as the optimal farming system for home gardening.

In research conducted in Peddie, Eastern Cape concerning the significance of the impact of UA on local livelihoods, Thornton and Nel (2007) found the incidence of urban and peri-urban agriculture to be lower than expected with only 1 in 5 households on average practicing a form of agriculture. However, for a small number of the poorest households who did not receive a state grant, garden activities contributed enough to households' food security and income to be considered a subsistence level practice. These urban gardeners saved more than R300 per month on total food costs. Vitally, these savings came in a time characterised by food prices inflating and compounding food insecurity. The Masizame Community Garden Project in Durban Village, Peddie has found some measure of success as members in the garden successfully started supplying vegetables as well as broiler chickens to the formal market as well as community members (Thornton and Nel, 2013).

In the Eastern Cape Province, a case study conducted on the role of urban agriculture in Lukhanji Municipality reports similarly modest effects on income and job generation as well as cost-savings and improvements to household food security (Kasumba and Morongwe, 2017). Participants were however primarily cultivating to increase the intake of fresh food as well as cost-saving on purchased produce while income generation was a subsequent concern. Of the sampled farmers only 18% were motivated by all three while the vast majority produced

for subsistence (Kasumba and Morongwe, 2017). Due to the unreliability of food production throughout the year brought on by seasonal changes, not one participant in the Lukhanji Municipality case study considered gardening as their main source of household food supply. Of those participating in UA, a large proportion were highly reliant on unearned income in the form of state pensions (57%) and social security grants (47%), which was their dominant source of income. Most of the sampled households survived off this stable unearned income which "seemingly contributed to their not being zealous to take urban agriculture for commercial gains" (Kasumba and Morongwe, 2017:10). Chakona and Shackleton (2017) elaborate stating that promoting awareness and capacity building about household food production as a way to improve food security may contribute to shifting the income circumstances of households who receive grants and depend on this money alone to purchase food.

In the rural setting of the Maphepheteni Uplands in Kwa-Zulu Natal, results indicated that participation in local community gardens did not improve their food security. Shisanya and Hendriks (2000) do however attribute this to the small plots under cultivation and postulate that if the garden size was expanded and crop productivity improved, that participation would improve household food access and generate income to upscale and improve production (Shisanya and Hendriks, 2000). In the urban context, land availability and land use competition constitute a more prominent constraint compared to rural areas. Garden projects supported by an NGO called Abalimi Benzekhaya in Cape Town area were found to generate low income for participants. The garden project instigated contracted sales of vegetable boxes on a weekly basis from which less than R150 per month was earned by participants in the scheme. Gardeners also made individual sales which only amounted to between R15 and R45 a week (Tembo and Louw, 2013).

In the Kayamandi settlement on Stellenbosch's periphery, an NGO (Love2Give) plays a direct role in supplementing food security among households by granting food hampers to those involved in participating. As an incentive to participation, gardeners must qualify for the hampers via their involvement and harvesting of their own produce (Salah, 2019). Several of the participants indicated that it was the hampers that improved their food security more than the vegetables that they grew which bring the sustainability of such an incentive scheme into question. If those involved in urban cultivation are seeking the support of NGOs and state institutions for food security because of the material support they are afforded (inputs,

resources, hampers) and less so to build a productive garden and improve their food security - it does not bode well for the financial viability and sustainability of such a program.

In research into the impact of UA on food security in Southern African cities, Frayne et al. (2014) put forward the notion that the level of engagement by urban inhabitants in UA and the scale of cultivation activities can be attributed to "economic, political and historical circumstances and conditions of a city" (Frayne et al., 2014:177). In their systematic literature review on community gardens, Guidart et al. (2012) found that the value of properties neighboring community gardens increased as a direct result of their proximity to the garden. Voicu and Been (2007) corroborate this finding with similar results. They posit that the positive effect that community gardens and other green spaces have on neighboring property values is more significant in the context of low-income, disadvantaged residential areas. Furthermore, when gardens are of a high quality, the extent of the increase in property values increases over time. This phenomenon, largely observed in the United States of America, is ponderous because the resultant rise in property values neighboring community gardens has ultimately led to many community gardening initiatives being forced out. Property owners seeking to profit from the favorable property values then close the gardens for redevelopment. According to Guidart et al. (2012) however, whether a similar problem is experienced in other countries is yet unclear.

Thus, while monetary benefits from participation in urban gardening is underwhelming, the dietary and food accessibility of gardeners do appear to be positively impacted by their decision to take part in urban growing. In the urban sphere, the size of garden plots, no matter how productive, are constrained. There is also stiff competition for the use of peripheral and marginal urban space for other developmental agendas such as housing, infrastructure and commercial developments.

2.5.2 Social Developmental Benefits Associated with Urban Gardening

Information on urban agriculture in South Africa is largely qualitative and while quantitative studies do exist, the large majority ascribe weak economic outcomes. Van Avebeke (2007) in his study of Atteridgeville informal settlement in Pretoria found modest but insufficient economic savings and sales. However, participants ascribe other benefits relating to community cohesion, social integration and networking as well as benefits associated with increased physical activity. Similar results from research by Tembo and Louw (2013) into garden projects

in Cape Town's townships were found as study respondents indicated numerous social benefits obtained from participation in the projects but income generation was low. According to Ghose and Pettygrove (2014), local social networks are essential in developing and sustaining grassroots initiatives as those involved leverage their connections to acquire the information and resources necessary to overcome barriers to development of their community gardens. These social networks however contain power dynamics which can tend to disadvantage the marginalized and empower those with large resource endowments and political power to serve their own interests. The unequal power relations are a feature of any social network and can result in reinforcing existing unequal power dynamics even when the networks were formed to leverage resources for the benefit of the marginalized. Other social positive outcomes generated from community garden initiatives relate to recreation (Voicu and Been, 2007), learning about crop cultivation, problem solving, negotiation and skills related to shared decision making (Shisanya and Hendriks, 2000). Other perceived learning outcomes as a result of the provision of training for urban community growers include "improved skills and techniques; knowledge; awareness; and attitude of the gardeners" (Tembo and Louw, 2013:226).

The given state of social support services and networks also informs the viability of urban agriculture as well as the compatibility of these facilities to be substituted with urban agricultural initiatives (Reuther and Dewar, 2005). In areas, such as informal settlements and townships, where the state of social facilities and support is generally low, urban agriculture is all the more important due to the potential social benefits that are said to arise (Reuther and Dewar, 2005). Community gardens offer society the means to restore balance to urban life which straddles not only an opportunity for the social development that comes with community building but also benefits individuals and the natural environment (Okvat and Zautra, 2011). Seen as a shared space which supposedly spurs social integration among community members, urban gardening is frequently posited to mitigate social fragmentation and as an effective means to collaborate with and benefit a specific public (Ernwein, 2014).

Intangible benefits are also attributed to community and home gardening which instills a sense of self-worth and empowerment for those involved. Psychological benefits accrue to participants related to aesthetic improvements to community spaces as well as generating feelings of self-reliance as a result of cost-savings by cultivators which lowers their dependency on commercial markets (Parry et al., 2005). Conceptualised as spaces in which disenfranchised members of society can involve themselves in community life and networks as well as share in

efforts towards a common goal, "community gardens may be more about *community* than they are about *gardening*" (Parry et al., 2005:180). Following this line of inquiry, Tembo and Louw (2013) attempt to re-conceptualize community gardens in terms of their value as a social developmental apparatus because sole focus on economic outcomes relating to income, employment and poverty may overlook less overt welfare benefits. Given the numerous benefits that are prescribed to involvement in community garden projects, the authors call for "systematisation and clarification of what is supposed to happen as a result of communities engaging in this kind of activity" (Tembo and Louw, 2013:224). This literature review aims to answer this call giving a comprehensive and holistic view of urban community and home gardens and the motivations for participation as well as benefits and costs attached to involvement.

2.5.3 The Importance of Urban Gardens and Collective Action for Livelihoods

The Sustainable Livelihood Approach (SLA) is a useful means to describe and consider the forces which impact on the livelihoods of the poor who operate within a context of vulnerability to shocks and stressors. The SLA recognizes the diversity of livelihood strategies that poor individuals and households employ in an attempt to construct a sustainable livelihood (DFID, 1999). Participation in urban gardening is one such livelihood strategy undertaken to diversify food and income sources among poor households which in turn builds resilience to shocks and stress. The SLA denotes that poverty alleviation and the improvement of food insecurity can be effective when the capabilities of the poor are expanded empowering them to build and attain assets (Salah, 2019). The SLA is based on understanding that a livelihood is underpinned by different forms of capital which all combine to contribute to enabling an individual to live in a sustainable way while being free of poverty and food insecurity. A more comprehensive investigation of the Sustainable Livelihood Approach to development research and as a theoretical framework is given in Chapter 3, Section 3.6.3.

Large social and economic disparities between the Global North and South have led to divergent approaches and meanings of urban gardening. In developed countries, the conceptualisation of urban gardening leans towards ideas of socially and environmentally beneficial activities which may be undertaken as a leisure activity or to socialise by the middle class. While by no means implying this to be unequivocally the case, community gardens in the developed world have been likened to "the child of the environmental and social justice movements" (Mok et al., 2014:22). In their systematic review of urban community gardening

research, Guidart et al. (2012) note that most of the research emanates from developed countries and reflects the American socio-political context in which community gardening is conceived of as a "socialistic enterprise reflecting communitarian values" (Guidart et al., 2012:14).

However, in the undeveloped context where poverty generally pervades - community food growing is an important coping strategy and provides the means to bolster household welfare and food security. This is often not so much out of choice but motivated by the need for subsistence and survival (Maughan et al., 2018). Exemplifying this difference in conceptualisation of community food gardens is evidence from Lesotho where community gardens were initiated in order to combat rampant malnutrition and nutritional disease (Mashinini, 2001). Similarly, the Hlakateni community garden in Limpopo province was initiated by the community's women who made it their responsibility to expel severe protein malnutrition from the children in their communities. The endemic poverty, unemployment and hunger drove the women to initiate self-production efforts which was made possible by the formation of a community garden (Vibert, 2016). Research into the impact of participation in household food garden initiatives on food security in Gauteng Province using propensity score matching methods reveal positive outcomes for food security. Participants were found to be as much as 41.5% less likely to be food insecure (Tesfamariam et al., 2018).

The Community Survey 2016 of Agricultural Households by Statistics South Africa (2016) found that households engaging in agriculture were predominantly doing so in their backyards in the Eastern Cape (80.8%) with the national statistics slightly higher (83.8%). Of the agricultural households in the Eastern Cape, less than 10% were using communal land as their main place of cultivation with the national rate less than 1%. The main reason for agricultural activity was reported as the main source of food (52.7%) and as an extra source of food (33.7%) in the Eastern Cape. The national trend mirrors this as less than 10% of participants reported household agricultural activity as their main or supplementary source of income (StatsSA, 2016). To a large degree, these statistics reflect the large rural nature of the Eastern Cape Province. It is expected that the proliferation of urban home and community gardening is less in urban areas and that the land constraints associated with urban livelihoods limit the amount of food production taking place.

Onyango (2010) posits that, particularly for women who traditionally shoulder the household responsibilities, home gardens or kitchen gardens are established as an inexpensive means to provide even small amounts of produce to the household and in so doing supplement household food security and dietary diversity. Home gardening is characterized as a household and/or family activity which in turn lowers the likelihood of conflict among gardeners. Households also tend to employ household and/or family labour lowering the overall labour costs of maintaining a garden (Onyango, 2010). Home gardening is indeed not bound by structured workday hours and may be practiced outside of traditional work hours and work weeks.

Kumar (2020) presents home gardening as uniquely placed as they combine divergent production service functions around a household and supply fresh nutrients. As a system, home gardens (HGs) are unique due to the decentralized nature, thus perhaps reducing wastage in the food supply chain downstream. A fundamental of home gardening is its support of biodiversity and conservation. Home gardens also have the potential to improve food utilisation as households' personal and cultural preferences may be fulfilled through cultivation of indigenous and traditional produce (Tasfamariam et al., 2018) which have seemingly been banished from commercialized food outlets and supermarkets.

Subsistence home gardeners are usually constrained by a lack of access to resources – particularly land access. As such, home gardening uses little or no external chemical inputs. Consequently, it is hypothesised that the output produced by these systems are "supposedly of better quality" (Kumar, 2021: 4). Beyond the cost-savings and nutritional value that home gardens present, they play an important role as a catalyst for the promotion of physical and social wellbeing. Dissanayake and Dilini (2020) undertook a qualitative analysis of home garden systems positioning and exploring urban gardening in the context of "stress release, collective work, family harmonisation, exercise, sharing and social cohesion, knowledge and experience, and healthy foods are the outcomes received in the aspect of social well-being and mental health" (Dissanayake and Dilini, 2020:185). Within the urban context, research into the impact of perm-cultural garden intervention programs in Ethiopian urban centers by Alemu et al. (2019) show that dietary diversity, measured by the consumption of fruits and vegetables increased for the treated group compared to control group. Making use of propensity score matching, results indicate that households who had received training (treatment) in sustainable farming practices (local resource identification, compost production, natural pest controls, crop

rotation and nutritional education) had more regular intake of vitamin A rich and dark green vegetables which improved dietary diversity outcomes (Alemu et al., 2019).

While home gardens are the most common form of urban agriculture, communal forms of urban agricultural production such as community gardens are also more commonly found in urban areas compared to rural systems. Community gardens are defined by multiple community stakeholders grouping together motivated by limited control or ownership of agriculturally viable land. Critically they do not resemble top-down initiatives and rather form at the community level as a communal initiative to grow food (Okvat and Zautra, 2011). Their grassroots nature conforms to the organizational design of an Institution for Collective Action (Shur-Ofry and Malcai, 2019). Once a community has gained access to an arable urban tract of land, usually with the assistance of a non-governmental organisation or local authority, participants demarcate allotments which they use to cultivate crops individually while sharing responsibility and use of communal resources (water, equipment, fences etc.). Although akin to other forms of urban agriculture like allotment farming, community gardens are not identical in form and function. As a community-based entity, community gardens also differentiate themselves from home-gardens which are private spaces cultivated by a household (Guidert et al., 2012:2). Those involved in community growing projects either use cultivated produce to supplement home consumption and in doing so generate savings on expenditure on produce which is otherwise more expensive in formal markets. Alternatively, produce grown can be sold to generate household income (Stewart et al., 2013). As a component of urban agriculture, community gardens are different to home gardens in that they are generally more established, larger in size and aim to produce monetary benefits to the multiple community members involved. Home gardens are generally smaller, produce for household consumption and are less established (Reuther and Dewar, 2005).

Community gardening initiatives can be posited as part of the urban socio-ecological system which aids in fostering civic participation and community resilience. Viewed as such, “community gardens nurture constructive, positive feedback loops and are self-organised” (Tidball and Krasny, 2007:156). Community participants engage with learning and organizational activities often empowering them with gardening and organisational skills and a sense of self-efficacy - a catalyst for community action and advocacy. Community networks, which are grown by both community and home gardening, foster social learning and networks which spur community development and food security (Tidball and Krasny, 2007).

To maintain community gardens sustainably, leadership and organizational structure must be of a bottom-up nature as active participation in planning is important in fostering a sense of local responsibility and ownership. Ward et al. (2004) further argue that, as a prerequisite for success, targeted communities must have ownership of the community gardens instituted for the improvement of their welfare. Given these characteristics of community ownership of local food gardens, Modibedi et al. (2020) recommend increasing the adoption of farming assets such as greenhouses, irrigation and drought resistant cultivars. These physical and natural forms of capital are pivotal to the successful functioning of communal schemes. Households engaging in community gardens can decrease the impact that seasonal growing has on food security by expanding productive capabilities to a point where farmers can provide year-round produce and ensure stability of food security. Provisioning urban gardeners with opportunities to expand their production into the lean season, however, is easier said than done as the asset endowment and wealth of poor urban South Africans has generally deteriorated leaving little capacity to invest in productivity enhancing technology.

Agricultural cooperatives, such as the community garden under study, are a unique form of business organization which can instigate a three-dimensional contribution to poverty alleviation programs. Being member-owned and cooperative organizations controlled by community members, they fully encapsulate the democratic, social and economic dimensions of poverty alleviation (OCDC, 2007 cited in Ahmed and Mesfin, 2017). As an emerging institutional innovation, cooperatives are said to positively impact on poverty when participants are form the poorest farmer demographic and where interventions create real impact on farmer income and wellbeing. Agricultural cooperation is generally linked to collective action and social capital and thus, as an institutional form, is considered to be more inclusive (Verhofstadt and Maertens, 2014).

Given the resource constrained environment that the farmers find themselves in Sub-Saharan Africa, cooperation presents a rare economically and socially beneficial opportunity to gain collective strength, social cohesion and bargaining power. As a household coping strategy, participation in urban cooperative agricultural efforts presents township inhabitants with an opportunity to supplement food security. Niles et al. (2021) conducted research into the prevalence of home food procurement (HFP) and its relationship with the onset of the covid-19 pandemic. Historically. HFP has typically been important to maintaining food security via

gardening, foraging, hunting and backyard livestock and many of these strategies have been employed in the past during times of crisis. In contemporary times, gardening has risen as a more popular HFP strategy compared to others. In their study of HFP in Vermont, USA, Niles et al. (2021) found that food insecure households exhibited a higher propensity to turn to gardening, foraging and hunting as the HFP strategy and that of those participating in these activities, more than half intensified their efforts as a result of the pandemic.

Urban agricultural community co-operatives, are socially beneficial and freely available to all. Whether it be for subsistence and food security entirely, commercial sale, or both, local co-operatives provide a social safety net and opportunity for communal ownership of land. Economies of scale can also be garnered because of cooperation within community gardens as members can share costs related to water and electricity as well as tools, infrastructure, facilities and networks. According to Reuther and Dewar (2005), capturing these economies of scale by organizing individual gardens into larger community gardens is prudent and beneficial to participants. In the urban sphere, participation also is an opportunity to access larger tracts of land far greater than the size of back yards thereby expanding their productive potential through the capture of economies of scale.

In their study of the impact of membership in Rwandan agricultural cooperatives, Verhofstadt and Maertens (2014) use propensity score matching techniques to show that the likelihood of a household participating was increased in households where the household head had higher education and where there was more household labor available for agriculture. Notably, results indicate that member households generated significantly more income (46%) and were up to 14% less likely to be poor and food insecure. A critical consideration however was that a case of negative selection was observed whereby the extent to which membership improved income increased for households who were less likely to be members. This gives rise the need to instigate inclusive mechanisms to as not to marginalize the already vulnerable, less educated, and female farmers who were found to be less likely to participate (Verhofstadt and Maertens, 2014).

2.5.4 Motivations for Participation in Urban Gardening

Participation in urban agriculture, whether it be through community gardens or home gardening, is motivated predominantly by the need to supplement household food security and diversity as well as cost-savings on purchased produce and the sale of surplus for the generation

of income. However, Kanosvamhira and Tavera (2019) found that urban gardeners in Mitchells Plain, Cape Town were motivated foremost by the social benefits associated with UA while health benefits associated with consumption of fresh produce also featured prominently. The majority of households sampled consumed all produce grown while only 1.7% did not consume their produce and sold all of their crops (Kanosvamhira and Tavera, 2019). Guidart et al. (2012) outline widely reported motivations for participation in urban gardening which includes consuming fresh produce, social cohesion and cultural exchange with the desire to better individual, household and community health also prominent among community garden practitioners. Other less featured motives included access to land, education, enjoyment of nature and environmental stewardship, keeping physically active as well as to enrich cultural and spiritual practices.

Barthel and Isendahl (2013) argue that conventional supply systems characterized by long distance trade of food stuffs leaves urban areas vulnerable to harvest failure and that urban agriculture can be developed as a bastion against urban food insecurity in the event of a climate or economically driven calamity. Urban agriculture provides densely populated urban areas with an option for producing and storing food and water within their settlements. This is exemplified by the rapid proliferation of various forms of community gardens in Spain in the aftermath of the 2008 financial crisis. Palau-Salavador et al. (2019), explore the link between times of economic, social and political crisis and the catalyzing effects it has on the subsequent proliferation of community gardening in Valencia, Spain. They posit that community gardening spaces act as a "refuge sector" for the unemployed who gained access to land made available due to the collapse of the property market. Unemployment tripled, driving many low-income citizens to participate in cultivation of fresh produce to assist in household provisioning. For the working class however, community gardening projects were sites of reconnection with nature and food production (Palau-Salvador et al., 2019). The fact that youth unemployment has risen from 40% in 2015 to over 50% in 2020 in the Eastern Cape (Eastern Cape Socio Economic Consultative Council, 2020) increases the saliency of this research.

Krasny and Tidball (2009) in their research concerning community gardening education programs, position community gardens as possible contexts for scientific education (e.g ecology, botany and natural resource management) and spaces where a sense of community environmental stewardship over natural resources can be garnered. Community gardens are unique in that they bind food production with environmental stewardship as communities grow

a sense of responsibility for the natural environment and ecosystem services and restore vacant and degraded urban plots for the benefit of the community. Turner et al. (2011) concur noting the role community gardens play in promoting active civic participation and awareness around living a sustainable urban lifestyle. In Port Melbourne, Australia, research indicated that community garden members felt a sincere connection with the natural world through their involvement as well as a feeling of spirituality in their lives. Interaction with the garden gave a sense of being close to God according to one respondent from the study (Kingley et al., 2009).

Willingness to partake in the joint management of resources in community gardens and/or household food gardens are suggested to be hinged on the rapid loss of formal employment income and the resultant food insecurity vulnerability that it created (Mwakiwa et al., 2018). Households which chose to be involved in community gardens in Gweru, Zimbabwe had more household members due to the availability of labour supply. Other significant factors which facilitated or mitigated participation in community gardens was the size of on- and off-plot farming area with households residing in high-density suburbs with small on-plot areas for cultivation as well as households with little access to off-plot land more likely to participate in a community garden. Urban inhabitants living in high-density suburbs tend to be poorer and have limited access to land and water resources thereby increasing the value that urban gardens present as an avenue to improved access to land, food and extra income. Further findings from Mwakiwa et al. (2018) indicate that participation in the community gardens was subject to self-selection by households from high-density residential areas with limited or no access to on-plot areas for growing. This claim may provide a vital insight into the potential that availing land for community gardening in densely populated, township settings may have on the demographics of those choosing to involve themselves. This is a valuable insight for the purposes of this research as survey respondents all came from the townships of Makhanda – an area densely populated as a result of a colonial and apartheid history of limiting home ownership and thus precipitating informal housing (Møller, 2008).

Participation is conceptualised as a rational response by urban dwellers who are unable to earn enough income elsewhere to support a sustainable urban livelihood. Poverty stricken households tend to turn to urban gardening as a "temporary survival strategy" in order to provision the household with food and/or income if inadequate income is generated through formal/informal employment to meet needs (Kekana, 2006:17). Primarily households produce fruits and vegetables as a means to improve household food security while the sale of produce

in local markets occurs when there is surplus. Reuther and Dewar (2005) recognise that urban growing constitutes only one of the many diverse livelihood and coping strategies which enables the urban poor to decrease vulnerability and manage risk of severe food insecurity. Profit is not a prominent motivation with very little produce making it to markets as households, bound by abject poverty, rather improve their diets and become less dependent on purchased food. Poulsen et al. (2015) however, in their systematic review of urban agriculture and food security in low-income countries, finds that urban agriculture generates insufficient food to adequately release pressures on urban households in their fight to gain access to enough food.

2.6. Socio-Economic Factors Impacting in Urban Food Security and Participation in Urban Gardening

2.6.1 Gender

Stewart et al. (2013), note the close link between household socio-economic status and food security as well as diet and nutrition. The intersection of gender, food security and urban forms of agriculture is complex and multifaceted. Participation in urban food production is higher among women (Van Veenhuizen, 2006). One of the reasons for women being the main beneficiaries of urban gardening is that urban gardening "meshes well with women's other household activities such as cooking and childcare" (Kekana, 2006). Provisioning the household with food is traditionally considered within the female domain and as a result, women cultivate kitchen gardens and participate in community gardening more than men. Research from Sikkim in India reveals that women ascribe higher value to homestead garden production and therefore support of kitchen gardens can be promoted as "women-centric and women-driven initiatives" (Jha et al., 2020). Household food production reduces dependency on market outlets and income as women have increased control over household food source (Kekana, 2006). In research concerning community gardens in rural Mali, Ward et al. (2004) posit that the gains accrued to female gardeners increased their social and financial duties and thus impacted on "shifting gender dynamics within the family" (Ward et al., 2004:510).

However, the cultural and social norms often discriminate against female gardeners as they are often afforded little control over decisions made in the public sphere - they are relegated to "a subordinate status in society" (Ward et al., 2004:514). Given that women constitute the main beneficiaries of urban gardening projects - advocacy of UA can be conceptualised as a "gender

focus strategy" and can impact on gender and wealth-based inequality which go hand in hand (Kekana, 2006:21). Results from van Avebeke's (2007) study of UA in Atteridgeville Townships in Pretoria attest to this as female headed households were both earning less monthly income and displayed higher rates of unemployment. Provisioning the household with food through urban cultivation was observed to be firmly within the female domain and was for the most part a strategy undertaken by women in their middle- or old- age. It is noted that in urban centers in low-income countries - urban agriculture may increase food purchasing power which may distinctly accrue gains to women who suffer higher unemployment rates and barriers in the labor market compared to men (Poulsen et al., 2005).

Vegetable production and household vegetable access generated form community garden participation in Emfuleni Local Municipality, Gauteng Province was found to be equitable between male and female respondents implying that variation in food security could not be attributed to the gender of the community garden participant (Modibedi et al., 2020). Results from a Mitchells Plain study on UA found participation was higher among women (58.3%) (Kanosvimhira and Tavera, 2019). In fulfilling their role as the primary providers of household food, women are motivated to participate in urban agriculture and community gardening. In the Eastern Cape's (EC) Ngqushwa Local Municipality research on food access by Musemwa et al. (2013) found female headed households to be more food insecure than male headed households. This is as a result of the patrilineal nature of local cultural practice in which ownership of land and control over tenure is predominantly in the hands of men disincentivizing women to invest their time and limited resources into sustainable gardening activities. As a consequence, their productivity is undermined resulting in less income generation for women and constrained ability to provide enough food for the household (Musemwa et al., 2013).

In order to leverage the involvement of marginalised female gardeners in community growing projects and promote long-term productivity, Ward et al. (2004) assert that access to technical training, sufficient credit and transportation are of equal importance. To generate the sought-after benefits relating to health and food security, it is of paramount importance that an educational component is incorporated into projects - specifically concerning nutrition. Women, who shoulder much of the household responsibilities, stand to pass the benefits of improved nutritional knowledge onto their households thus instigating the call for community and home garden initiatives to strengthen and work closely with local women's groups (Ward

et al., 2004). One such initiative in the Cape Flats, Western Cape considers the positive impacts that female cultivators experience above and beyond quantitative measures of income and produce. By strengthening social bonds among women and empowering them, Olivier and Heinecken (2017) posit that the social isolation women face in societies where violence and crime are pervasive can be lessened by involvement in community growing initiative. The women also gained more control over the quality of food they provided for their families as they both retained their own produce and sold crops with the assistance of NGO supported community schemes which afforded them market access. Crucial to the value that the women gained from cultivation was the versatility they were afforded - some of the women made a full time living selling produce while others went to market only when it was necessary to purchase processed food stuffs.

A Probit model employed by the authors Swanepoel et al. (2021) denotes the likelihood of a household taking part in urban agriculture. Results from the dichotomous model show that the household head's gender (Female household heads were more likely to be involved in urban gardening) as well as distance to markets and access to land are significant determinants of the likelihood a of a given household choosing to participate in UA.

2.6.2 Age

In the Khayalitsha and Nyanga settlements outside of Cape Town, gardening projects were initiated by mothers and grandmothers as means to cultivate produce for consumption in their households (Tembo and Louw, 2013). The same was observed in Emfuleni, Gauteng Province, with participants in the community gardens predominantly elderly women with youth involvement noted to be low. The low rate of youth involvement - which is a common trend in studies in SSA (Onyango, 2010; Maswikaneng et al., 2002; Modibedi et al., 2020) - poses a threat to the sustainability of future community garden initiatives as well as the households who rely on elderly members for the provision of food. Older generations played a prominent role in establishing, and sustaining community gardens in Michigan State, USA where they pass on knowledge on gardening techniques and supervise garden activities (Allen et al., 2008). Younger women cultivating alongside predominantly older women in the Cape Flats also took advantage of the wisdom and experience that they recognized in the elders (Olivier and Heinecken, 2017). Mcata's (2013) findings point to a positive relationship between age and participation in both rural and urban gardening activities. This is hypothesized to be due to the positive correlation linking age and agricultural experience implying that older persons already

have experience gardening/farming and therefore are more likely to participate in similar hardening activities.

Younger generations have an appetite for a modernized urban life characterized by stable waged employment away from agriculture, which is perceived as labor intensive, demeaning, and a rural activity. Vibert (2018) also found large age disparities when it comes to participation in the Hlakateni Community Garden as elders attribute low youth interest levels to the fact that so many farmers face high levels of poverty and "the yearning of younger people" for waged labor (Vibert, 2018:264). If the community farms were able to produce enough to support a wage - farmers believe that younger women would be motivated to join. Speaking to the resilience and work ethic instilled in the elderly women whom daily labor in their community gardens for the wellbeing of their households and community, one respondent encapsulated their resilient attitude saying: "I'm like a bird that goes far to look for soft seeds for the babies" (Vibert, 2018:261). The literature also indicates that youth involvement in community gardening projects can aid in their cognitive development as they learn interpersonal skills, cognitive and behavioral competencies as well as enhanced awareness of the benefits of a nutritious diet made up of more fruits and vegetables (Allen et al., 2008). Involvement in community garden programs expanded the diversity of dietary preferences of the youth involved as well as lowered the likelihood of involvement in socially undesirable activities such as substance abuse.

2.6.3 Education

Results from research conducted in Kayamandi settlement in Stellenbosch, Western Cape reveal the importance of educational outcomes among the urban poor in relation to food security. Households where higher educational outcomes were observed were found to be more likely to have more diverse income sources through multiple par-time jobs - thus reducing the risk of food insecurity (Salah, 2019). Walingo (2006) elaborates submitting that developmental projects which integrate education effectively into poverty and food insecurity alleviation strategies stand to enable individuals to recognize and diversify their resource base. Education level thus aids in the building of resilience, a diversity of income sources and consequently food security outcomes. Observing the relationship between educational outcomes and participation in urban agriculture in Orange Farm, South Johannesburg, Onyango (2012) surmised that most of the gardeners had only primary school education and that, among surveyed participants, higher educational attainment was associated with a lower willingness

to engage in urban gardening. In Soshanguve, Pretoria, Kekana (2006) found similar demographics among participants in urban gardening with over half reporting not having attended any high school education. In Msunduzi Municipality education levels were even lower with 30% of community garden respondents having attended no formal schooling at all (Madlala, 2012). Research conducted in two informal urban settlements in Kenya found a statistically significant negative relationship between the level of education attained and level of food insecurity. Controlling for other explanatory variables such as wealth, which may have explained improved food security, Mutisya et al. (2016) found that the probability of being food insecure reduced for every additional year of education attained in a household.

Making use of Propensity Score Matching and endogenous switching regression, Tasfamariam et al (2018) model the determinants of gardening households' decision to participate in the Homestead Food Garden Programme. Results indicate that education and the willingness to participate in the homestead food garden programme were significantly and negatively correlated – implying that less educated households were more likely to participate in the program. Household income and land size was significantly positively correlated to the willingness to participate with access to extension services, other forms of social capital and credit also exerting a positive effect (Tasfamariam et al., 2018).

2.6.4 Income

In the South African Urban Food Security Baseline Survey, a clear relationship is observed between household income and food security. In the formal and informal urban settlements, low income is closely related to high food insecurity (Frayne et al., 2009). Very little evidence from South African community and home garden initiatives (Modipedi et al., 2020; Olivier and Heinecken, 2017) has found urban cultivation to be the primary household livelihood strategy for participants. As means to mitigate against the impacts of economic and social shocks however, multiple livelihood strategies and income sources reduce vulnerability and the risk that the household will suffer food insecurity (Salah, 2019). Resilience against shocks and stressors in urban areas is therefore underpinned by the diversity of livelihood strategies and income sources available to them - of which participation in urban agricultural efforts constitutes one. Community cooperative membership among farmers was shown to exert a positive effect on farmers' access to agricultural finance/credit (financial capital) - a vital resource in promoting farmers to invest in productivity-enhancing technologies which

generally take considerable capital investment (Ahmed and Mesfin, 2017:2). Thornton and Nel (2007) note the widespread proliferation of social grants in the Peddie community and the EC at large. About 68% of urban poor households in South Africa are reported to receive a social grant from the state - interestingly the participation in UA of those households who did not receive a grant was significantly higher than households who did receive a grant (Thornton and Nel, 2007). In other words, it appears that there is a link between the large number of grants received and those households' agricultural activity and reflects badly on the grant system as the households who received grants spent the vast majority of the money on food and yet were less likely to have a home garden. Households who did not receive grant money however, were much more likely to be supplementing their food intake from their own garden. Whether the grant itself acts as a disincentive to engage in household gardening activities remains contentious.

Akinboade and Adeyefa (2018) reject hypotheses surrounding a dependency of South African households on social grant income stating that they provide the most vulnerable households with income vital to their survival as well as an important social safety. What is made clear however, is that the structural unemployment, poverty of income and livelihoods as well as lack of opportunity and means to overcome these barriers has facilitated some level of reliance on transfers by households with no other potential opportunity to provide income for necessities. The importance of the grant system for the urban poor cannot be ignored as vital in supporting income and hence food security. Grant money will remain central to supporting livelihoods unless the economic, social and institutional environment is drastically reformed to instigate widespread employment and income generation.

Van Averbeke (2007) found that, of all households sampled in various informal settlements in Pretoria, 54% were engaging in urban farming. However, the monthly mean income of farming households was found to be not significantly different compared to non-farming households. Compared to dry land and community gardening, home gardening was far more common. Backyard home gardens are relatively small which goes some way in explaining why the impact that farming had on household income was found to be statistically insignificant. Large reliance on social grants was found as expected as 86% relied on the grant for income. Findings from Tongaat, eThekwini Municipality show there to be no statistical connection between households receiving grants and the likelihood of gardening (Khumalo and Sibanda, 2019). In the informal settlements of the Western Cape, gardening participants were found to be spending

on average R70 less on food. However, the mean food spending of R286.35c was not statistically different to the R359.35c spent on food by non-gardeners (Swanepoel et al., 2021). Mean income of a NGs was R3 690.00 – slightly higher that of the mean income of UGs which was R3 486.47 (Swanepoel et al., 2021).

In Hammanskraal, Pretoria, half of the members in local township community gardens under survey by Nkosi et al. (2014), reported that they sold all produce cultivated in the gardens. This indicates that income generation was their primary motive for involvement in food garden projects. Nearly all the participants experienced large seasonal fluctuation in garden produce and income generated from their sale – although during harvesting time they sold produce making income of up to R664.50 per month (Nkosi et al., 2009). Using a Propensity Score Matching and the Average Treatment Effect methods in examining the impact of participation in urban agriculture in Zambia, Mupeta et al. (2020) found that compared to non-participating households, participating households had significantly higher income as a result of participation. It was calculated that the incomes of participating households were increased by between 13.7% and 19.1% due to both sales of garden produce as well as economic savings on food purchases. In Nasarawa State, Nigeria urban agriculture was found to be contributing a large proportion of household incomes of respondents. Salau and Attah (2012) found that urban agriculture contributed as much as 74% of the total annual income of this participating in the study. As a result of the severe lack of employment and income generating opportunities in the region, the authorship calls for urban agriculture to be considered as a crucial contribution to urban income as well as food systems and job creation.

2.6.5 Household Size

Household size was positively correlated with engaging in urban agriculture as more mouths to feed imply greater need for a garden (Khumalo and Sibanda, 2019). Employing a Maximums Likelihood Estimation model with a binary dependent (logit regression) variable reflecting home garden ownership, Mcata (2019) found household size to have a positive coefficient as a determinant of participation is home gardening – the variable was however not significant. Particularly against the backdrop of pre-existing mass unemployment in South Africa and the Eastern Cape Province as well as the negative impact of the Covid-19 pandemic on employment and business outlook, households tend to have idle but willing family labour who have been starved of opportunity for gainful employment. As per Oyango (2010), the availability of family labour reduces overall labor costs while additionally presenting a

motivating factor for participation in UA. Households with more members – have more mouths to feed and in situations characterized by food insecurity, this may contribute towards the decision to participate in urban gardening as a means to add to food stores in a sustainable manner.

2.7 Institutional Factors, Policy, Structure

2.7.1 NGO and State Food Security Interventions

The private and public sector promotion of urban agriculture in low-income communities has the potential to build and sustain capabilities and coping strategies. However, in order to generate sustainable outcomes, three dimensions need to be considered in tandem. Socially, economically and environmentally sustainable outcomes can be garnered when local communities lead the way and themselves instigate initiatives under their control and embedded in their specific context. In the formation of urban community and home garden programs, a community-led approach is critical (Bisaga et al., 2019). If UA projects are to achieve any measure of success, then initiatives, policy makers, municipal powers and NGOs need focus on the sustainability and continued maintenance of society's investment in urban food production (Bisaga et al., 2019).

Community and home gardens are to a large extent supported by public and private initiatives who cite the relatively low start-up costs, ability to adapt to harsh biophysical conditions as well as the generation of sustainable environmental outcomes as reason for their ongoing support of community gardening (Ward et al., 2004). Home gardens are dynamic and support indigenous biodiversity and leverage local knowledge systems. According to Mitchell and Hanstad (2004) poor households may need institutional assistance in accessing land in particular. Where households do generally have ownership of land, homestead gardening interventions can become a "self-sustaining intervention" in which the households specific livelihood needs are addressed and that household's continued dependence on state resources is reduced away (Mitchell and Hanstad, 2004:no pagination).

In Emfuleni Local Municipality in Gauteng Province of South Africa, 43 urban community gardens are active with 31.4% of households said to engage in vegetable production while to a lesser in livestock and poultry production. In recognition of this, the local government has endorsed support given to community gardens to combat food insecurity (Modibedi et al.,

2020). While support does need to build on community initiative and participation, the effort to endorse such urban food gardens needs to be more proactive in identifying communities where structures and farming skills are already evident. Identifying areas in which participation in home and community gardening is high needs to include assessment of the willingness of prospective participants to work collectively as well as the resource constraints specific to that location.

The Makana Municipality Integrated Development Plan (MM IDP) 2019-2020 contains minimal policy pertaining to urban agriculture and community gardening. Noted in the MM IDP 2019-2020 is that much of the urban agriculture takes place in townships to supplement food and income requirements and thus is subject to land availability constraints. The Municipality currently supports five food gardens in urban areas including community garden initiatives administered by the Umthathi Training Project Trust. Municipal support came in the form of compost, seedlings and gardening tools awhile the challenges identified included lack of skills, training, education and working capital. Noted was the insufficient support provided by the Department of Agriculture in terms of extension services and mentorship (Makana Municipality Integrated Resource Plan 2019-2020, 2019). As one of the many agricultural development priorities set by Makana Municipality, promotion of urban sustainable community agricultural initiatives is mentioned as well as the promotion of women and youth in agriculture (Makana Municipality Integrated Resource Plan 2019-2020, 2019).

Mead et al. (2021) investigate the association between home gardening, perceived food insecurity and well-being. They conclude that policy interventions that aid home food gardening and enable access to arable land in a sustainable manner "may be beneficial for food assistant resilience and well-being" (Mead et al., 2021:2). Tesfamariam et al. (2018) found the impact of participation in urban gardening programmes in South Africa to be a significant determinant of household food security. In the households under study in Gauteng Province, participation in a homestead food garden programme reduced food insecurity by as much as 41.5% which informs the authors push towards home gardening as the means through which to mitigate against widespread food insecurity in South Africa. Although the context is a rural one, respondents were not located in remote areas as major South African metropoles such as Johannesburg and Pretoria were relatively close by. Tasfamariam et al. (2018) present an evaluation of the South African state's homestead food garden programmes in Gauteng Province which targets vulnerable demographics (HIV/AIDS positive individuals, the elderly,

unemployed). The program was initiated in 1997 as a response to rampant increases in urbanisation which precipitated heightened urban food insecurity, poverty, hunger and malnutrition. Proponents of home gardens contend that the "system is well adapted to local agronomic and resource conditions, and to cultural and food preferences" (Tasfamariam et al., 2018:96).

Community and home gardens afford the state and advocating institutions an opportunity to expand the scope of options and livelihood strategy opportunities to those on the bottom rung of the socio-economic ladder (Salah, 2019). Enabling policies and institutions, in this way, expand the scope of sustainable livelihood outcomes. One of their pre-eminent functions played by institutions involved in urban cultivation is facilitating the allocation of land to urban growers as well as increasing access to agricultural inputs (Salah, 2019).

Battersby and Haysom (2019), in their appraisal of the South African Governments' policy pertaining to food security and in specific urban food security, discuss three primary bottlenecks to achieving a more food secure urban and rural South Africa. They are as follows: a) state policy regarding food security is strongly orientated towards production in rural areas; b) the scale and scope of urban food insecurity is largely underappreciated; and c) there is an acute lack of formalized directive from municipal departments regarding combatting rampant urban food insecurity. These stumbling blocks hamper increased urban food security in South Africa both directly and indirectly and lay the groundwork for a problem ridden food security environment in the urban centers of South Africa (Battersby and Haysom, 2019). Thus, the potential of UA seems great, but largely untapped. Urban agriculture/gardening has more recently received increased attention from policy makers, researchers, and urban planners. To a large extent however, the development of green policy for a robust supply of urban produce (i.e. more internally food secure urban areas) is in its infancy and legislation concerning the potential and growth of urban agriculture is obscure. In other words, institutional factors relating to extension services, infrastructure, transactions costs and market accessibility are central to the ability of (urban) farmers to flourish.

Although the smallholder has been identified as the sector through which agricultural growth, poverty alleviation and employment creation can be achieved, the diversity and heterogeneity of South Africa's farmers and farming conditions must be considered and inputted into the formulation of policy which will effectively intervene to create meaningful change (Pienaar

and Traub, 2015). A homogenous outlook in terms of the intervention and outcomes thereof when it comes to smallholder policy implementation fall very short of the realities. Olivier (2018) speaks to sustainable development and its integral connection with agricultural development and growth. In order to benefit the most marginalized groups through agriculture, one must remove the barriers to entry and initiate farming practice which uses minimal external inputs so as to not inadvertently grow dependency. It is only when the most powerless become independent of external resource inputs that "it is possible to initiate a virtuous cycle of empowerment in a community" (Olivier, 2018:2).

Regarding the status of urban food security in South African cities, Battersby and Haysom (2019) hold poorly drafted and mandated policies and the incumbent (African National Congress) governance regimes responsible for the dire and deteriorating food insecurity found in South African cities. In simple terms, unless the incumbent market and governance structures in South Africa are reassessed, urban food security will remain pervasive (Battersby and Haysom, 2019).

Conventional agricultural systems transport produces from a vast distance making the system susceptible to disruptive forces as observed by the impact of the Covid-19 pandemic. Urban food production produces approximately 15 to 20% of the world's food supply – a notion which is made more salient by the global crisis created by the pandemic (Lal, 2020). Food security research has risen to prominence impacting on policy and literature in South Africa and globally. The factors which affect South African households' decision to participate in homestead/community gardening and what the impact is on food security has however not been thoroughly explored (Tasfamariam et al., 2018).

Rural-urban migration, persistent food and water insecurity and the urgent need to generate income in a flagging economy has necessitated and sparked the expansion of UA activities in the poorest echelons of South African society. However, the further development of UA continues to be hamstrung by deeply rooted structural and socio-economic constraints as well as the legacy of the Apartheid government regime (Thornton and Nel, 2007). Frayne et al. (2009) elaborates stating that unless urban agriculture is integrated into South African development policies and urban planning, it will be continued to be practiced as an "ad hoc" activity. Therefore, the potential development in the economic and social spheres that urban community agriculture offers as a sector will remain unrealized under current modes of

governance (Frayne et al., 2009:19). Increasing voluntary participation in urban agriculture is hinged on institutional and financial support systems - particularly for those bound by urban poverty and food insecurity. Schram-Bijkerk et al. (2018), call for urban gardens to become more closely and directly linked to policy goals and as a means to achieve health and sustainability targets within cities. Where coherent and comprehensive policy directives are applied, urban gardens have the potential be transformed from sporadic, transient and localized projects to a more structural element of sustainable urban management (Schram-Bijkerk et al., 2018:870).

Wesselow (2019:855) contextualizes this by adding that the institutional structure and policy regarding agriculture are biased towards the large-scale commercial agricultural sector and favor marketing through franchised supermarket outlets which only acts to marginalize small scale and community farmers and leave them at the wayside. On urban food security in informal settlements, Battersby and Haysom (2019) highlight the link between residents of townships (informal settlements) which are characterized by a sparsity of shops and public transport and elevated risk of food insecurity. Furthermore, for the urban poor, the lack of public transport and formal shops directly impacts the types of food access afforded to them. In South Africa, the challenge of urban food insecurity is dominated by the proliferation of informal settlements and insufficient job growth to keep up with the process of urbanisation into townships. The resultant poverty of income and economic opportunity has escalated to the point where persistent hunger is more likely in urban areas than in rural areas (Kekana, 2006).

Hallberg (2000) speaks to the vital role fulfilled by local governments in advocating community garden projects and enabling low-income urban residents a higher level of access to nutritious food. The socially and economically vulnerable urban inhabitants marginalized by the supermarket system would benefit the most from coordinated collaboration between all stakeholders involved. Local governments need to take advantage of opportunities to integrate food security efforts with community members, community development institutions as well as health, nutrition and environmental proponents (Hallberg, 2000).

From an institutional perspective, urban agriculture and the endorsement thereof also needs to be conceptualized in terms of the opportunity cost it presents to cultivators as well as state policy makers. In assessing the impacts of urban production in reducing urban food insecurity consideration must be given to the relative benefits that more efficient urban food markets will

have on the urban poor i.e. lower the price of food stuffs thereby increasing real income (Stewart et al., 2013). There is an established link between increased income and the quality and quantity of food access at the household level - however this must be weighed up against the benefits of increased household production of produce. Urban growing for improved urban poverty and food security outcomes is however generally endorsed citing low input costs.

2.7.2 Extension Services

In order for urban forms of agriculture to meaningfully generate employment opportunities and income, efforts need to be made to transform predominantly subsistence urban agriculture to more commercially and market driven and motivated units. Extension services are central to this effort as they provide training and marketing skills as well as information to urban growers (Kasumba and Morongwe, 2017). In Limpopo Province, the Hlakateni Community Garden has benefited somewhat from extension services in terms of access to inputs, techniques to grow new vegetables as well as infrastructure and training. However, while extension services often encourage the use of agrochemicals and pesticides, they are mostly too expensive prompting most of the support to be concerning agroecological farming practices (Vibert, 2018). The tenants of agroecology include minimizing external inputs, resource and nutrient cycling, the importance of contextual considerations, resilience as well as the endorsement of principles of equity and nourishment (Vaarst et al., 2017). These principles overlap with the principles of traditional farming methods to the extent that is appears as a codification of low-input agricultural practices which have been in use for millennia the world over.

For extension services to reach commercially motivated urban gardeners effectively and efficiently - farmer co-operatives provide an ideal entry point for support. Farmer co-operatives facilitate contact with commercial market outlets as communally grown produce is sold collectively to both informal and formal produce markets (Kasumba and Morongwe, 2017). Community co-ops present support institutions with points of entry for both public and private extension as farmers are already grouped together allowing for extension support to reach more individuals and consequently improve their household food security.

While community collectives present opportunity for providing extension to gardeners already organised into groups, the nature of the community agricultural co-op also has is pitfalls (group conflict, freeriding problem, inadvertently creating dependency on institutions) which had spurred a different approach in many cases. Stimie et al. (2010) note the inherent challenges

that are strongly associated with group agricultural projects (i.e. communal gardens, irrigation schemes etc.) when it comes to conflict typically concerning group finances. From an institutional perspective, targeting group projects has the potential to reach more people but does not account for, nor engage with households who wish to operate independently from a group. That being the case, individual home gardeners who are commercially minded and have enough arable land at their disposal, present an alternative entry point for institutions looking for motivated gardeners who wish to operate alone to avoid the free-riding problem.

Research regarding the linkages between urban farmers and the various state and non-profit stakeholders in Michells Plain, Western Cape, found that supporting NGOs focused their resources on household gardeners for several reasons. Collaboration with community gardening was identified as being difficult due to the problem of freeriding and the subsequent conflict generated form the dynamics of working with a group of farmers (Kanosvamhira and Tavera, 2019). Additionally, NGOs such as Soil for Life who operate in the Western Cape Province have experienced problems regarding the sustainability of providing resources to community gardens. They thus focus on supporting self-motivated home gardeners and avoid creating dependency among community farmers on resource aid. Although this approach may appear to be a more sustainable way to engage with urban gardeners individually, additional evidence from Cape Town, Western Cape Province by Paganini and Lemke (2020) refutes its success. Their findings revealed that among black female farmers, who make up the majority in the sample, affiliation with the NGO was the most cited reason for engaging in urban gardening. Although affiliation with institutions promoting social development does positively impact the social capital of participants, it does not reflect the overarching goals of programs instituted for urban food security by promoting UA as a sustainable livelihood strategy and may well create dependency on these institutions.

2.8.1 Challenges Hindering Urban Gardening

To a large degree, the potential of urban community and home gardens hinges on the natural, socio-economic and institutional characteristics in which the activity takes place. In terms of the biophysical condition's gardeners face, where soil is fertile and land abundant - yields will be higher and input costs lower and vice versa in the opposite case (Reuther and Dewar, 2005). Among other things, labour availability and the relative returns of available alternative economic opportunities compared to the returns of gardening are imperative if sustainable positive socio-economic outcomes are to be reaped (Reuther and Dewar, 2005).

The predominant challenges to urban farming were cited by van Averbeke (2007) as being a lack of access to land and water for irrigation which limit productivity. Bisaga et al. (2019) report similarly dominant constraints on UA in Durban's informal settlements where issues pertaining to insecurity of land tenure and poor soil fertility continue to subdue the productivity of local food growing. The expansion of gardening activities was further limited by inadequate resources with which participants could protect their farms and gardens by putting up fences. Acquisition of secure land rights are crucial in enabling and incentivizing urban dwellers to make long-term development investments on their land as well as operating under the assumption that any added value on the land will be bequest to ones' descendants (Tshwene and Oladele, 2016). In addressing the recurrent land availability constraints, community food growing initiatives need to gain access to less marginal and more productive and arable land in proximity to water resources (Shisanya and Hendriks, 2011).

This is a challenging directive for urban planners to enact in rapidly urbanising areas. Thornton (2009) elaborates on the issue of land reallocation in South Africa in his case study of the Masizame Community Garden Project in Peddie, Eastern Cape. Although a national directive empowers municipalities to grant land to poor inhabitants for the establishment of garden allotments and pasture - the enactment of such a process has largely bottlenecked and the reallocation of municipal commonage land use rights for community gardens remains "confusing, slow and chaotic" (Thornton, 2009:15). The case study epitomizes the struggle that even highly motivated communities face in attaining rights to land tenure - where provincial and municipal officers themselves often lack the capacity and capability to enact the national, pro-poor land reform policies which specifies their rights to the use of commonage for cultivation. As part of undoing the unequal land distribution brought about as a result of Apartheid-era spatial policies, clearer policy surrounding land reform as well as their clear communication to communities is essential if community-based agriculture is to be effective as a food insecurity intervention. By clarifying land reform policy and creating awareness of said policy among historically excluded and disempowered communities, a culture of self-sufficiency entrepreneurship can be cultivated (Thornton, 2009).

As means to mitigate the prominent constraint faced by urban growers with respect to land access and availability, Faber et al. (2011:26) argue for the need to create and expand entry points for community-based agricultural interventions. As platforms to combat urban food

insecurity and nutrition deficiencies among the poor, community gardens as well as schools, clinics and crèches have the potential to provide much needed points of access to vulnerable communities. Reuther and Dewar (2005) contextualize the challenge or opportunity cost of land availability for urban gardening in Khayalitsha, Cape Town against the backdrop of stiff competition for other land uses. The need for housing and other public service infrastructure, social consumption goods as well as urban green corridors, reserves and stormwater management systems all contend for use of finite urban and peri-urban land and inform the complexity and challenge of allocating land for agricultural activities (Reuther and Dewar, 2005). Similarly, in Bulawayo, Zimbabwe, the need for other land use activities, particularly housing, relegates the demarcation of land for urban community agricultural purposes to a secondary land use option (Sithole et al., 2012).

Research conducted in the town of Alice, Eastern Cape reveals that, as expected in urban food systems, land ownership, availability and tenure remains the primary constraints. Mcata (2019) examines the determinants of having home garden in Alice households using a Binary logistic regression model to determine the factors influencing ownership of the food garden. Results showed significant variables were location, land access, and education level (Mcata, 2019). Mcata (2019) postulates that generating access to food gardens through policy interventions in inner urban areas can improve the food security status of inhabitants. Due to land access being a predominant constraint, it is recommended that urban associations should be promoted through which skills can be provisioned to improve productivity.

2.8.2 Challenges for Community Gardens: Conflict and Social Dynamics

The organisational structure and ethos associated with community gardening projects are eminent as indicators of co-operative group dynamics. Inclusivity and full participation by those involved in communal decision-making processes promotes sustainable management of community gardens. As a prerequisite for sustainable management of community gardens, allocative decisions concerning resources ought to be collectively made and consensus among participants be cultivated (Mashinini, 2001). The case study of Lesotho's community garden network by Mashinini (2001) identified however, that in-group conflict was rife caused by multiple factors. Socio-economic status differences such as age, gender, economic power, and political affiliation resulted in unequal withdrawal rights of communal equipment and subsequent conflict. Disputes over communal land tenure agreements which failed to stop the problem of free-riding on communally managed resources, as well as competition with

livestock owners sharing water resources were also identified as causes of internal group conflict (Mashinini, 2001). Observations out of the Cape Flats garden projects supported by NGO Abalimi Benzekhaya, noted that conflict within groups tends to occur more so during the early stages of a group forming. During the budding stages group numbers tend to be volatile as those seeking to receive handouts ultimately leave after which the committed participants work past conflicts and maintain an established group (Olivier and Heinecken, 2017).

Far from being a panacea for social ills, community gardens can also be hamstrung by the very collaborative nature of community gardens which can exacerbate social divisions and stimulate exclusionary dynamics as well as abet homogeneity in ways of thinking among participants (Shisanya and Handriks, 2000). Insofar as community gardens are said to contribute to a sense of community - bringing people together can result in hostilities over values, ideas and needs. Community garden co-operatives may give rise to resentment from the wider community as well as from within the participating group who may experience a sense of community division and exhibit exclusionary behavior (Okvat and Zautra, 2011). According to Ernwein (2014) community gardens are bound by the societal micro-politics specific to the city in which they exist and that, as a result, the differing levels of inclusivity and exclusivity within community gardens vary greatly.

2.9 Divergent Perspectives on the Advocacy of Urban Gardening

Literature concerning urban and community gardens seem to be divergent when it comes to poverty and food security outcomes and the role UA has to play. A cadre of scholarship advocate UA as an effective and pro-poor development strategy which alleviates poverty and food insecurity while the contrary position cites limited evidence to support these claims (Frayne et al., 2014). Scholarship do also warn against incidentally endorsing urban agriculture as a path out of poverty. Supporting UA as a main livelihood strategy for poor households may inhibit the development of the skills needed by individuals to participate in the modern economy - thus locking them in backwards practices and the poverty cycle (Reuther and Dewar, 2005). The South African economy is observed to be moving away from the primary sectors which requires labour intensive work towards tertiary and service sectors which are far more skills intensive (de Lannoy et al., 2018). There is a structural skills deficit is South Africa which needs to be addressed in order for the full capacity of the South African public to be leveraged in improving the sustainability of the livelihoods of the poor in particular.

Development initiatives based on agricultural activities will only serve to deepen poor households' poverty if they are forced and initiated without the proper consideration of resources requirements specific to that context as well as the integral involvement and motivation of local community members. The physical and institutional constraints that urban growers' faces are well-documented and compete with a range of potential benefits which are less proven to accrue to those involved prompting sound skepticism regarding urban gardening and its impact on the food security of the urban poor (Poulsen et al., 2015). Scholarship surrounding UA has undulated several times with regards to the real potential for UA to be economically viable and academically verified with empirical evidence. According to Webb (2011), early South African engagement with UA as an academic field in earnestness painted a rosy picture of it's potential, was in fact flawed. Early empirical evidence on UA which informed the fervent advocacy for UA in South Africa was however derived from research findings which themselves were already generalizations (Webb, 2011). The nature of the academic literature advocating for urban agriculture was to then to repeat these findings promoting further growth of UA advocacy in academia - although still based on flimsy footing. Webb (2011), in light of the weak empirical evidence to back up the slew of proposed social benefits said to accrue to those who practice urban agriculture, calls for grounded analysis on the benefits and significance of urban agriculture unswayed by bias towards or away from advocacy. According to Webb (2011), the weak evidence form around South Africa does not warrant any further advocacy for urban agriculture, nor criticism for that matter - not until evidence legitimately validates its viability.

Stewart et al. (2013) displays doubts alike to Webb (2011) concerning the fervent uptake of UA in the literature and its increasing advocacy from academia which is evidently based on a deficient evidence base. The benefits and costs of implementing widespread UA in developing countries is yet to be proven particularly adept at significantly improving the food security and livelihoods of poverty-stricken urban communities. Put differently, the frequently touted range of societal benefits have not been empirically shown to accrue to those in need of such theoretical benefits. This study hopes to counteract the uncertainty surrounding the validity of the empirical evidence.

Considering the collection of evidence presented thus far, the economic gains of participation in urban community and home gardening are underwhelming. Participation does contribute to cost savings on food purchases, and in some cases small amounts of income although the gains

from gardening alone was rarely enough to be considered as a primary livelihood strategy. One must however, contextualize the economic viability of participation in UA in terms of alternative economic opportunities at hand. Set against the background of excessively high national unemployment and inequality and situated in the South African economic landscape which remains stagnant if not deteriorating - participants of UA, regardless of the low impact on socio-economic status, are not afforded higher alternatives income generating opportunities elsewhere. Faced with scarce economic opportunities, households thus produce what they can with what they have - a surplus of labour - as one of the coping strategies employed to construct a sustainable urban livelihood and endure the social and economic ills that they face living in township areas. Even underwhelming returns from urban gardening, set against the backdrop described above, may yield crucial additional income (Reuther and Dewar, 2005). If meaningful and sufficient alternative income earning opportunities did exist - the viability of UA as means of poverty and food insecurity alleviation would be weakened (Reuther and Dewar, 2005:99) - but sadly, that is not the case. This case study aims to add valid empirical evidence to the literature untainted by bias for or against the endorsement of UA as a developmental agenda. By methodically capturing a dataset on the observed impact of participation in an urban community garden cooperative, sound inference can be made on the socio-economic status of participants and whether membership significantly improved it.

CHAPTER 3: RESEARCH METHODS, PROCEDURES AND TECHNIQUES

3.1. Sustainable Livelihoods Approach

The Sustainable Livelihoods Approach was developed in 1997 by the UK Department for International Development (DIDF) Rural Livelihoods and Environment Division with the primary aim of eliminating poverty in poorest countries (Brocklesby and Fisher, 2003). The Sustainable Livelihood Approach propounds that household livelihood choices are governed by the assets and services afforded to them. The conceptualization of households involved in community agricultural projects is thus undertaken taking assets, resources and livelihood strategies into careful consideration (Mthethwa, 2012). In addition, as a tool in evaluating livelihoods of urban gardeners, the SLA is cognisant of the role that physical, natural, economic/financial, human and social capital plays in the construction of a sustainable livelihood. In the absence of the different forms of capital, community garden interventions will ultimately fall short in mitigating and eradicating poverty and food insecurity. Individuals' capabilities are underpinned by these capitals which enable them to improve and diversify their livelihoods. Capitals are defined as the resources that people or households possess which can be invested or used to create more resources. The approach addresses how households may sustainably combine processes of asset development and diversification of income sources to support their livelihoods (Gutierrez-Montes et al., 2009). The 5 core asset categories or capitals and how they are relevant to this research is presented hereafter.

Natural Capital refers to the natural resource assets and environmental services. These are the basis for agricultural activities such as land, water, climate as well as the existence or absence of pollution as a constraint. These factors were captured via survey and were used as proxies for measuring the natural capital based that gardeners have access to. Financial capital is characterized in monetary terms and includes the individuals' cash, savings and access or ownership of credit or debt which are imperative in maintaining any livelihood (Scoones, 1998). This research forms a proxy for financial capital through the measurement of household income and credit access as well as the source of the credit. Human capital is constituted by the individuals'/households' level of education, skills and knowhow as well as ability to labour (Brocklesby and Fisher, 2003). Human capital is also inclusive of the health and physical ability necessary for the achievement of a sustainable livelihood. The elements of the human capital base were observed from the educational data of the sample as well as the years of

gardening experience which is indicative of a stock of knowledge developed over time and employed in improving garden productivity.

Social capital is conceptualized as all the social resources that individuals leverage and have access to in the pursuit of a sustainable livelihood. Livelihood strategies often require coordination between members of society who will thus employ and utilize their connection to social networks leveraging their "social claims, social relations, associations" (Scoones, 1998:8). The social capital of the households surveyed was captured by proxy and is constructed by households' membership or connection to social organizations, networks and groups. In addition to membership in the community garden schemes, which is also an important contributor to social capital, other organizations such Stokvels, Burial Schemes and Religious/Church Groups were proxies for social capital. Lastly, physical capital is captured as the individuals' access to productive, physical moveable and immovable assets. In the context of urban agriculture these physical assets include: agricultural equipment and tools, energy, communications, water storage tanks, transport vehicles, fencing, greenhouse technology, agricultural inputs etc.) (Brocklesby and Fisher, 2003). These movable assets were all captured and collated to form the physical asset endowment.

This approach has become prominent as other initiatives which were premised on the provision of relief and welfare were seen to be only providing temporary relief against deprivation and poverty. Although relief and welfare support does have value, the approach tends to treat the symptoms of the poverty and marginalization and not the underlying causes (Salah, 2019). The SLA has thus risen to prominence as means to generate a lasting impact on the ability of vulnerable peoples to sustainably cope with and improve their livelihoods. The approach moves away from hand-outs and towards a "hand-up approach" in which self-reliance is promoted by capacitating individuals Chikadzi and Munatswa (2014: 598). By building the capacities of poverty-stricken communities to maintain livelihoods sans dependency on state or welfare support programs, the SLA aims at empowering people to become self-sustaining (Chikadzi and Munatswa, 2014).

The combination of the different capitals that individuals have at their disposal forms the "asset pentagon, which is used to assess people's overall asset base" (Brocklesby and Fisher, 2003). The asset pentagon is depicted in the diagram produced by the DFID (1999) (Figure 3.1). The diagram positions individuals/households in a vulnerability context where their livelihoods are

threatened by economic shocks. Individuals seek positive livelihood outcomes through the utilization of their capital endowment. Lastly the institutional and policy environment exerts an impact on the access to strategies and activities which shape livelihoods as well as the vulnerability context in which they find themselves. The impact that institutional processes have on livelihood activities can be linked from the household level (micro-scale) to the macro-level of policy and institutional environments (Brocklesby and Fisher, 2003).

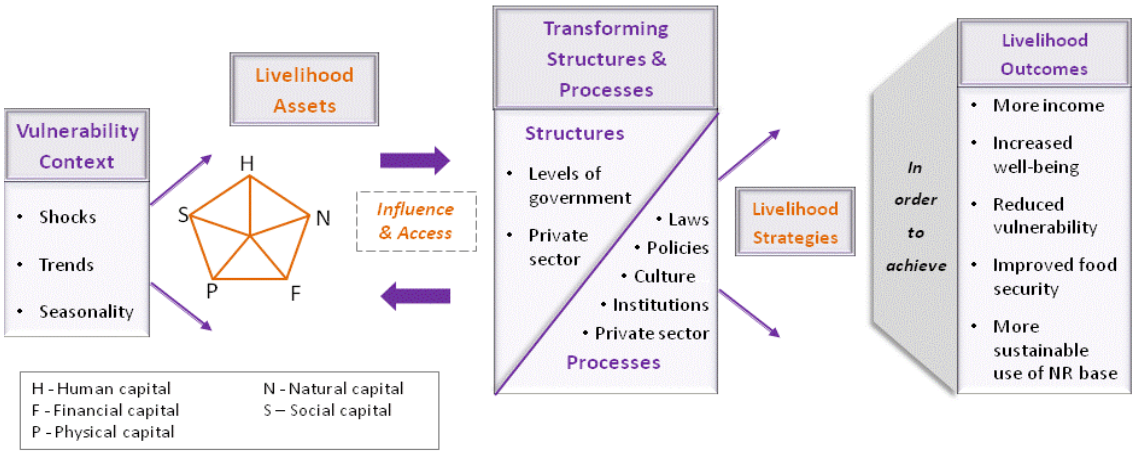


Figure 3. 1: Sustainable Livelihood Approach

Source: (DFID, 1999)

Institutions are recognized as powerful in creating an enabling or impeding environment in which gardeners operate which impacts on the manner in which households adapt their livelihood strategies. As such, institutions can influence the attractiveness of a livelihood or coping strategy by either minimizing the level of risk associated with that strategy or devaluing households' asset bases by reducing livelihood diversity and in so doing shape how households utilize their assets (Mthethwa, 2012:79). Institutions and state policies are factors which either facilitate or hinder the creation of livelihood assets by poor communities. For example, by increasing gardeners' access to (micro) finance and credit, institutions enable gardeners to access the financial capital necessary for investment into productivity enhancing physical capital (agricultural equipment, inputs communications) as well as human capital (skills training and knowledge). As a component of the SLA, the institutional, organizational and

policy structure can thus create an environment in which poor individuals can utilize their assets sustainably (Salah, 2019).

As explored in Section 2.6 of the literature review, the institutional climate in which the urban gardeners of Makhanda East are positioned in is riddled with institutional impediments to the attainment and sustained achievement of a sustainable livelihood. The context in which the urban gardeners are embedded lack efficient and relevant transforming structures and processes which serve their needs.

3.2.Research paradigm

As an economic study, this thesis and its' research design denoted as high reliance on quantitative modes of analysis. At its core this research employs economic theory to investigate a causal relationship between households' choice to participate in urban gardening activities and the impact that would have on their household food security and livelihoods strategies. These research characteristics informed the researchers' positioning of this treatise in the research paradigm of post-positivism. Guided by the framework of the Sustainable Livelihoods Approach, the research is informed by the application of Collective Action Theory and Utility Maximization Theory to the household decision to participate in urban gardening. Post-positivists believe the best mode of investigation is to search for commonalities in causal relationships among components of the social world (Miller, 2000). An accompaniment of the post-positivist paradigm is the use of inductive reasoning which is characterized by making inference (statistical in this case) based on a sample of observations and the quantitative analysis derived therefrom. This process is characterized by the development of theory through observation and making inference with regards to variables or agents (Rahi, 2017).

Post-positivism goes beyond a paradigm which is purely based in realism and the assumption that the physical and social world is independent of an individual's perspective and the theories developed to explain phenomena. Post-positivism incorporates aspects of social constructivism so that "this realism is tempered by the argument that humans cannot fully apprehend that reality and the driving mechanisms in the social and physical world cannot be fully understood" (Miller, 2000:58). Ryan (2006) similarly characterizes the post-positivist research paradigm asserting that theory cannot be separated from practice – that is to say that it is unacceptable to disregards theory for the sake of "just the facts" (Ryan, 2006:12). The researcher must remain unbiased in relation to the subjects of the research and the optimum manner in which to achieve

this is by employing the scientific method, although blind obedience of this method is rejected (Miller, 2000).

Core to the post-positivist research paradigm is the creation of new meaning and knowledge in the support of social movements which "aspire to change the world and contribute towards social justice" (Ryan, 2000:12). As a catalyst for community solidarity and securing nutrition for the vulnerable during times of economic duress, Ralston (2014) positions gardening projects as educationally beneficial for the public and emergent in blighted urban areas and as means to resist "neo-liberal city planning policies" – as a grassroots effort to reclaim food sovereignty and secure control over food systems. Citing Dewey (1996), who characterizes gardening activities, the author understands these public educations as "the fundamental method of social progress and reform" (Ralston, 2014: 2). Thus, the conceptualization of gardens encapsulates their unique position as places of community solidarity, development and communication as well as the organization of collective action.

This thesis, although largely quantitative does incorporate some elements of qualitative analysis as it draws on the Focus Group Discussion as well as key informant interviews with local extension officers and other key stakeholders within the community and Umthathi Training Project Trust. As such, the research can be characterized as having components of mixed method analysis. The mixed method constitutes an in-between which "aims at reconciling 'the world of facts', quantitative research, with 'the world of meanings', qualitative research" (Corbetta, 2003: 2, as cited in Akimowicz et al, 2018). According to Akimowicz et al. (2018), in the field of agricultural economics the use of such a mixed method of analysis is lacking. The authors posit that results of qualitative analysis do well to contextualize and better explain the causal relationship derived from quantitative causal analysis.

The strength of such a mixed method approach is that it achieves "complementary results by using the strengths of one method to enhance the other" (Sale et al., 2002:48). Rahi (2017) and Akimowicz et al (2018) concur stating that the goal of this type of research is to supplement one approach or method with another in order to address its weaknesses and strengthen the overarching research procedure. Due to its reliance on statistics and data procedures, quantitative research appears more objective in nature and has strong statistical generalizability in comparison to quantitative research. While qualitative research generally lacks the same statistical generalizability, it does do well to impart meaningful explanations and better

explains causal relationship while allowing for the emergence of information (Akimowicz et al, 2018).

Field work was undertaken to apply a structured household survey of two groups: urban gardeners and non-gardeners (control group) from the same geographical proximity being four of Makhanda East's various townships (Extnesions 6, 7 and 9 as well as Joza Location) Data collection (predominantly quantitative with qualitative elements) was undertaken to collect data on social, demographic and food security status of the households. Complimentary qualitative information was garnered through the facilitation of a focus group discussion with the goal of contextualizing the data reliant quantitative questionnaire. In addition, key informant interviews were held with the extension officers who offered extension support to the urban gardeners. Sikwela and Mushunje (2013) employed a similar mixed method approach in their study of the impact of participation in farmer support programs on income (in which they used propensity score matching as this research does).

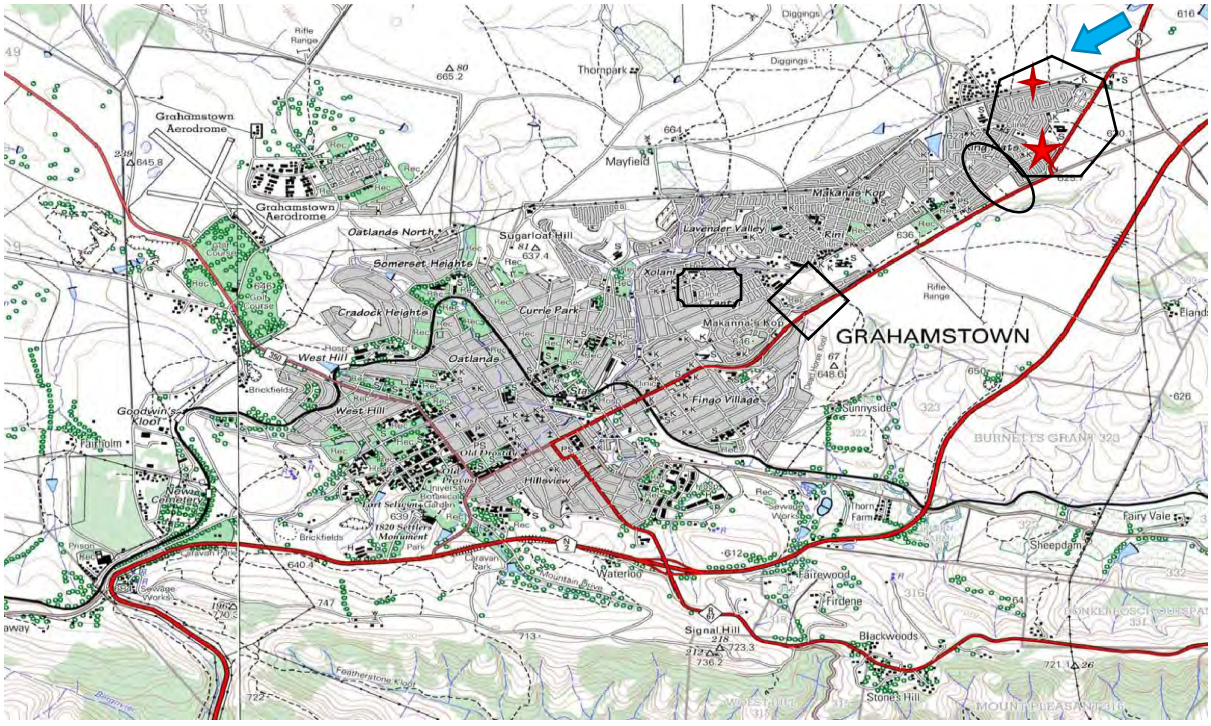
3.3. Study Area Description

Located in the Eastern Cape Province of South Africa, the city of Makhanda (previously Grahamstown) is situated 120km to the East of the provinces' largest urban center Port Elizabeth and 180km to the South-East of East London. The main seat of the District Municipality is in Makhanda as well as the seat of the Eastern Cape High Court although the Provincial Capital is Bisho located 130km to the North-East (Makana Municipality Integrated Development Plan 2019-2020). The Linomtha Community Garden and Extension 7 Community Gardens are situated in Extension 7 suburb of Makanda's sprawling informal settlements. The neighborhood is situated on the north-easterly periphery of Makhanda and thus is one of the furthest from the city entre (8-10km).

The climate in Makhanda is classified as moderate with year-round rainfall and an average precipitation of 680mm. The municipality experiences seasons characterized by warm summers (January) and cold winters (July) with average maximum and minimum in summer of 26°Celcius and 15°Celcius. Winter maximum and minimum averages are 18°Celcius and 4°Celcius (Makana Municipality Integrated Development Plan 2019-2020). The soils of the Eastern Cape are of low quality particularly lacking in vital nutrients required for high productivity crop cultivation. Physical soil degradation in the Eastern Cape Province is big challenge as arable land productivity remains low (Nebo et al., 2020) due to deficiencies in

various nutrients notably soil organic matter, phosphorous, potassium and calcium (Mandiringana et al., 2005). Communally and subsistence cultivated land exhibited very low fertility status due to insufficient nutrient inputs which is often the case due to financial constraints putting inorganic nutrient inputs out of reach (Mandiringana et al., 2005).

The Makana Municipality is one of the seven local municipalities contained within the Sarah Baartman District Municipality in the Eastern Cape Province of South Africa. As of Quarter 2 in 2020, the Eastern Cape has the highest unemployment rate in South Africa (36.9%) with youth unemployment shockingly high at 53.3%. These high rates of joblessness are paired with abysmal educational outcomes which show that 48.9% of the working population not having completed secondary schooling. Over half of the unemployed persons in the province has not completed high school demonstrating the importance of education level in obtaining a job and generating income (Eastern Cape Socio Economic Consultative Council, 2020).



Linomtha Community Garden: ✦ Extension 7 Community Garden: ★

Extension 7 Township: ⬡ Extension 6 Township: ⬮

Extension 10 Township: ▭ Joza Location: ◇

Contaminated River feeding into Onsite Water Source: ➡

Figure 3. 2 Map of Study Area

Source: Erasmus (2012)

Møller (2001) found that 48% of residents of Extension 7 were participating in gardening activities. In her updated analysis of social indicators in Grahamstown East however, Møller (2008) found the incidence of household gardens to have drastically decreased from 51% to 26% or halved in the period between 1999 and 2007 with the vast majority of gardening households indicating that they grew for home consumption only. Participation rates in urban home and community gardening in Makhanda is likely to have continued to diminish although due to the relatively small sample size and scope of this research, the rate of participation will not be analyzed. Focus rather is on food security outcomes connected to participation in urban gardening.

The location of respondent households both gardening and non-gardening was predominantly in Extension 7 Township. This is partially due to the fact that both community gardens under study were located in Extension 7 Township. Additionally Extension 7 Township is on the very periphery of Makhanda's locations – the peri-urban fringe. This has precipitated increased access to the tracts of land granted to the two community garden co-operatives near their homes. Extension 7 is approximately 10km from 'town' and has higher levels of urban garden participation compared to townships such as Joza Location and Extension 10 which are older and more developed suburbs in closer proximity to 'town'. The households sampled in Extension 10 mainly consisted of a group of home gardeners whom wished to register a community co-operative and be granted a tract of land but had yet to succeed in doing so. Extension 6 is adjacent to Extension 7 and can be characterisezed as similar to Extension 7 and being within 3km of the two community gardens in Extension 7. The blue arrow located in the top righhand corner identifies the poluted river which feeds into the Linomtha Community Garden's on-site water source.

3.4.Theoretical Framework

3.4.1. Collective Action Theory

Collective Action Theory and Utility Maximisation Theory were used in tandem as the theoretical framework of this research. Utility maximization inform the approach this research takes to model the discrete choice between participation and non-participation in urban gardening. Collective Action Theory forms the theoretical mean with which this research

understands the factors which shape and determine participation and the impetus of household to involve themselves in urban gardening groups.

In 1965, Macur Olson published his seminal work *The Logic of Collective Action: Public Good and the Theory of Groups* which acts as the basis for further development of collective action theory to be applied in many different contexts. Predominantly applied in the social sciences, Agrawal (2001) cites work done in the fields of anthropology, economics, sociology and politics as contributing to expanded focus on collective action theory and its applications. Olson (1965) examines and rejects the traditional view of why individuals form and join collectives. Based on the premise of rational and self-interested economic agents, Collective Action Theory (CAT) assumes that people further the interests of the group through actions taken due to those interests being shared.

However, Olson (1965) posits that this action is always geared towards acquiring a public good for the individual and not through nor due to a sense of altruism or belonging in the group. Olson's theory is that, in small groups in particular (referred to as kinship groups where interactions are generally face-to face), the action of the individual is more impactful on the collective compared to in large groups where individual action does not impact on the collective to the extent that it does in small groups. In small groups, where participants are in close proximity to one another as well as the collective resource, monitoring for free-riders and the enforcement of the rules of the ICA is easier. The rules around access and management of the public resource should be devised by the participating community and should be easily understood if the institution is to be a success (Agrawal, 2001).

Elinor Ostrom, a pioneer of collective schemes (Institutions for Collective Action i.e. ICAs), addresses the classical problem associated with the management of collective resources. Concomitant to CAT, Ostrom proposes that the problem can be overcome through self-organized informal ICAs which collaborate and coordinate the management of the collective good thus avoiding the well-known commons dilemma (Shur-Ofry and Malcai, 2019). Thus, ICAs also enable, by virtue of their organizational structure, the efficient utilization and sustainable management of public resources in the long-run, even as the means to restoration or conservation of physical common resources in some cases. Additionally, by leveraging the strong social networks and connections in integrated communities, costs are comparatively

lower compared to top-down regulation. This is because the enforcement and monitoring of the management of the public resources is more efficient (Shur-Ofry and Malcai, 2019).

Several conditions for the success of ICAs are cited in the literature the most prominent of which is that small groups are far more effective at mitigating free-rider problems. Shur-Ofry and Malcai (2019) promote small scale local ICAs because they can be more geared towards the specific needs of the participants. Small, closely connected kinship collectives involve individuals who have "a close stake at the common resource and … they may frequently manifest the advantages of locality" (Foster & Iaione (2016) cited in Shur-Ofry and Malcai, 2019:4). Agrawal (2001) constructs a list of factors which contribute to the institutional success of ICAs adding that the boundaries of collective resources as well as the specifics of user group membership ought to be well defined. Additional factors contributing to success of ICAs in terms of the group characteristics include: "Shared norms; interdependence among group members; heterogeneity of endowments, homogeneity of identities and interests; past successful experiences" which refers to there being existing social capital and experience of ICAs (Agrawal, 2001:1654). Agrawal (2001) adds that the external environment also contributes to the success of these institutions and that there needs to be an absence of interference from central authorities that compromise the local authority's ability to efficiently operate.

Grassroots ICAs are also posited to be far more effective where the collective operates in a relatively small geographical area as collective members share strong social ties. An essential characteristic of ICAs is their bottom-up and collaborative approach to the management of the collective resources. This bottom-up, participatory approach has been applied to the management of a variety of public resources such as urban public spaces, irrigation schemes and fisheries (Shur-Ofry and Malcai, 2019).

CAT also points to incentives for participating in collective action over and above access to the desired collective good. The theory proposes that selective individual incentives play their part in incentivizing participation i.e. attainment of personal gain or avoidance of social sanction associated with non-participation. In addition, social incentives also contribute to the motivations for collective action such as the bolstering of the individuals' reputation, social standing or the privilege and connections acquired as a result of participation. Olson (1965) also examines the notion of coercion to join groups stating that it plays a large role in forcing

the action or commitment (usually mandatory as a prerequisite for involvement i.e. membership fees) to join the group.

Olson (1965) identifies the problem of free-riders in groups – individuals who do not contribute to the provision of the collective (non-excludable) good but benefits from its provision through collective action. These free-riders are far easier to identify in kinship sized groups while in large groups, they can constitute a serious threat to the achievement of collective common interest. Based on these fundaments of collective action, the theory states that, as a rational utility maximiser, it is in the individuals' best interest to be a free-rider. This is particularly the case when they are not coerced into joining or have individual selective incentives to partake in the collective action for personal gain. Furthermore, the theory states that these group dynamics "need not apply to the privileged or intermediate groups, because these smaller groups can often provide a lobby, or any other collective benefit, without any selective incentives" (Olson, 1965:134). Smaller groups thus provide better opportunity for successful collective action towards a collective good as the problem of free-riding can be better managed and smaller groups usually share close social, cultural and personal ties. Olson's observations in this regard are poignant to this research as the community garden collective under study are small (Linomtha Community Garden Co-operative had 17 members & Extension had 7) and the problem of free-riders can be mitigated against due to the close-knit nature of the community and the shared social, cultural and personal connections.

Seldom researched from the collective action perspective, community gardens are increasingly characterised as an emergent form of the commons or 'new' commons relating to their mostly self-managed communal management of resources and social imperative (Göttl and Penker, 2020:31). The theory posits that participation in collective action is undertaken premised on proportional claim to the collective's output/earnings dependent on proportional input onto the collective (Ortmann and King, 2015:28). Members of the collective perceive the benefits of membership or participation in urban gardening (improved food security, possible access to communal land, income, training, inputs, market access, social networking, physical exercise, esthetic improvements) to outweigh the costs (labour, time expended on co-op activities such as meetings, membership fees) in terms of their perceived marginal utility gained and therefore participate. Furthermore, embedded in the underdeveloped economic landscape found in the Eastern Cape Province, gardeners face institutional and structural impediments related to lack of physical, financial and natural capital which hampers their opportunities to access and

initiate bottom-up, community level institutions in a sustainable manner (Thornton, 2009:13). As per CAT, this forms part of the external environment and constitutes another constraint to the success of the gardening community collective.

3.4.2 Utility Maximization Theory

The Theory of Collective Action is used as the basis for the formation of Institutions for Collective Action. Both are firmly based on the assumption of the rational, self-interested economic agent and the corollary thereof being the normative paradigm of utility maximization.

These models are referred to as Random Utility Maximization (RUM) and were initially proposed by Marschak (1960). The utility maximization framework presents the economic agent as facing choices between a finite set of exclusive and exhaustive outcomes, a choice which will be taken to maximize utility gained conditional on the particular constraints and characteristics of the agent. According to Hess et al. (2018:181) the process by which agents make their choice is unknown to the researcher, that "agents' behaviour is likely to vary, systematically and/or idiosyncratically". This notion necessitates that the model has a random element and is illustrated in probabilistic terms. This has precipitated the name Random Utility Maximization choice modeling.

According to Hess et al. (2018), the utility maximization theory has informed the majority of discrete choice models which models the likelihood of an individual choosing one of multiple discrete alternatives. This research denotes the discrete choice that urban Makhanda East residents face in terms of participation in urban gardening activities. As such, choice is considered as constrained maximisation (Swann, 2002:26) and reveals the preferences of a given individual. The utility maximisation framework informs the assumption that gardeners weigh up the utility associated with the choice to participate in the co-op. The choice taken by individual gardeners reveals whether the expected utility from participation in urban gardening i.e the expected utility gained from opting to receive treatment ($U_i^{\text{treatment}}$) is more than being a non-gardener i.e. expected utility from opting out of treatment and to be in the control group of non-gardeners ($U_i^{\text{non-gardener}}$) (Ma et al., 2018:125). The decision is explained by observable explanatory variables including institutional factors, demographics and social characteristics (Baiyegunhi, 2014:35). Gardeners will choose membership when expected net utility is greater than zero i.e. $U_i^{\text{treatment}} - U_i^{\text{non-gard}} > 0$ (Sinyolo and Mudhara, 2018:2). Thus, as rational individual

maximisers, gardeners weigh up the expected utility from alternate actions (membership or not) and maximise accordingly (Aleskerov et al., 2007:1).

Agricultural collectives are heavily endorsed in the literature (Eigenbrod and Gruda, 2015:496; Houessou et al., 2019:2; Overseas Cooperative Development Council , 2007:iii) for their ability to improve the collective bargaining power of farmers/gardeners thus reducing risk they face in the market as individuals, reducing transactions costs and information asymmetry, increasing negotiation power with regards to input and output prices, improving the adoption of productivity-enhancing technologies and mitigating constraints relating to farm credit and infrastructure. For household whom participate in urban gardening (both community and homestead gardeners) expected benefits also emanates from the utility gained from eating fresh and healthy produce from your garden. This can improve household food access (Khumalo and Sibanda, 2019), utilization and diversity (Kumar, 2020) as well as offer opportunity to grow social and financial capital in some cases (Vibert, 2016) which all motivate participation and the perceived level of $U_i^{\text{treatment}}$. On the other hand, $U_i^{\text{non-gardener,}}$ the perceived utility from non-participation in urban gardening activities, is dependent costs associated with participation. Non-gardeners forgo any membership costs paid by community gardeners as well as any start-up cost associated with starting a home garden. Non-participation also implies avoidance of any free-riding problems associated with agricultural collectives which lowers the benefits of involvment (Mojo et al., 2017) as well as any time spent attending group meetings and settling conflicts among members. $U_i^{\text{non-gardener}}$ also encapsulates the opportunity cost of time spent tending home or community garden patches as non-gardeners may obtain more utility form undertaking other activities for which the expected utility gained is more than that of participation in urban gardening.

3.5. Sampling Framework

The specific goals of this research required that a sample of urban gardeners be surveyed alongside a control group with similar characteristics. The study area focusses on the urban township context and thus the respondents needed to be from Makhanda East – in this sense the sampling was purposive as households were sought out who participated in urban agriculture in the specific context of interest. The sample of control group households were sampled using snowball sampling thereafter from the same geographical locations being Extension 6, 7, 10 and Joza Locations. The objectives of this research require individuals or

households who have knowledge of urban agricultural activities allowing for better quality data expressed in an articulated manner (Etikan et al., 2016). To that end, the specific suburbs in Makhanda East were selected – particularly the election of Extension 7 as the main sample area was taken due to the two community gardens which were central (Extension 7 Community Garden) and on the periphery (Linomtha Community Garden) of the suburb. The total sample of community gardeners was therefore: n=24. A purposive sampling method is comparatively inexpensive and time saving, namely homogenous sampling, which focusses on individuals who share a lived experience and culture. This applies to Makhanda Easts' townships which is typical of the South African low-income urban context where, pervasive poverty has galvanized the meaning of urban gardening and differs drastically from that of the affluent portion of Makhanda.

Purposive sampling implies that the researcher employs subjective methods in determining the distribution of the sample. This method does away with pure randomization of observations rather opting to purposively select participants which suit the research objectives and are thus included (Etikan et al., 2016). As a goal directed sampling method, the dominate strength and reason for employing such sampling procedures is its ability to match the participants to the aims and goals of the research which may positively impact on the "rigor of the study and the trustworthiness of the data and results" (Campbell et al., 2020:652). Also referred to as judgement sampling, the researcher requires to apply deliberate judgment on the specific data needs of the research guide sampling and thus participants are selected because of relevant qualities (knowledge and willingness to divulge information) they possess in addressing the research objectives (Sharma, 2017).

The sample population was accessed through the local extension officer who provides a list of the members in the Linomtha and Extension 7 Garden Co-ops as well as indications of which households are participating in urban homestead gardening within the selected study area. An estimated 250 households were participation in urban gardening in the sample area. 37 home gardeners were sampled amounting to 15% of the population which satisfies the minimum of 10% of the population sampled (Gujarati and Porter, 2009). From the identified locations of homesteads who were participating in gardening, households were randomly selected for a potential interview. Following Zakari et al. (2014), a random sampling procedure was undertaken randomly selecting households from the list to be surveyed. Simple random sampling procedures were applied in such a manner that, within the purposively selection areas,

the sample of Urban Gardening household and the sample of control units had equal chance of being selected in the sample (Bhardwaj, 2021). The random number table method was used: from the table of households identified, each were assigned a number and then numbers were randomly selected to be in the sample. The simple random sampling was done without replacement meaning that once a number had been randomly selected from the table, it was removed, and the following number was selected from the remained. The strength of this method of sampling is that does well to represent the population and generalizations from the sample results can be applied to the population (Sharma, 2017).

Due to the small population under study and the need for maximum observations for quantitative econometric analysis, the maximum number of community gardeners were surveyed from both Extension 7 and Linomtha Co-operatives. This follows the total population sampling method which is a method falling under the purposive sampling procedures. Total Population Sampling only applies to the selection of the community gardeners in Makhanda East where only a very limited number of cases are existent – in these instances this sampling method is commonly used (Etikan et al., 2016). In this case there are only two community gardens in the area and they represent an important subpopulation of urban gardeners which could not be left out of the study – thus all community gardeners were selected. Due to the subjective nature of purposive sampling methods and the inherent risk of underlying biases (Sharma, 2017), this research enacts a tentative approach to generalizing any results outside the sample area.

The sample population of this study consists of two groups. The first consists of members of the Linomtha and Extension 7 Community Garden Co-operatives as well as a sample of home gardeners from the suburbs of Extension 6, 7 and 10 as well as Joza Locations. The second group consists of a control group who do not participate in any form of urban gardening. The control group were accessed via referrals from home and community gardeners as well as other control units all of which were located in close proximity to the treatment group (urban gardeners) and thus can be considered as a relative homogonous community. The control group was sampled using Snowball sampling – a variant of non-probability sapling methods. Initial contact was made with the group of community and home gardeners connected to Umthathi Training Project Trust who constituted the core sample of urban gardeners. These gardeners then freely referred the primary researcher and research enumerators to other households within the area who did not participate in gardening. The principles of snowball sampling denote that,

after contact has been made with a group relevant to the research topic, they refer the researcher to others who are a good fit for the achievement of the research objectives (Rahi, 2017).

3.6.Data Collection

3.6.1. Household Food Security Survey

To aid in the data collection process four enumerators were hired who speak the predominant language being isiXhosa. The questionnaire was relatively short taking approximately 20 minutes each - translating into approximately 1-2 months of data collection which took place in May-June of 2021.

The structured household food security questionnaire was designed to garner full and accurate responses from respondent households. Data was collected on a wide range of demographical indicators as well as the information required to construct the various food security indicators. A total of 2 questionnaires were available to the enumerator pending the agricultural status of the respondent and their preferred interview language. One survey for the urban gardening household and another for the non-gardening households. Household and demographical survey questions were standardised across both surveys. The surveys administered to Urban gardeners and Non-gardening households were identical with respect to demographical and non-garden related questions. However, gardening households were required to answer specific sections of question relating to their home gardens and/or community garden plots which did not appear on the non-gardener survey. Questionnaires for both gardening and non-gardening households were translated into isiXhosa – where the choice to answer the English or isiXhosa survey was afforded to the respondent so that the quality of information may be optimised and the interviewees are made to feel comfortable responding in their home tongue. The head researcher and/or one of the research enumerators approached a senior member of the household onsite and explain our research objectives. Consent by each household which was surveyed was ethically explained and pending their knowing signature, the interviews proceeded.

In assessing the influence of the ‘lockdown’ period on food security, the US Department of Agriculture’s (USDA) Household Food Security Survey Module was used with specific alternations made to temporalities and respondents recall period. While the standard food security survey methodology is maintained as per USDA’s module in Bickel et al. (2000),

alterations resemble Niles et al. (2020), who supplemented the survey questions by inputting a temporal element to reflect changes in indicators over time. This was achieved by altering additional questions about changes in food security, consumption, dietary diversity and access with the qualifier: 'since the national lockdown was imposed on March 26th 2020'. Data was also captured on variables such as household income, food and non-food expenditure in the periods prior to – and after the lockdown period in order to conduct significance testing on the values establishing whether the aforementioned variable were significantly different in the two periods. Thus, changes over time may be garnered relating to coping strategies, dietary changes and increasing concerns over food access as well as measure of income and expenditure. Data analysis was done using STATA 17.0 statistical analysis software.

3.6.2. Focus group discussions (FGD)

Qualitative data was collected through FGDs among co-op members as well as key informant interviews with co-op committee leadership and the Umthathi Training Project management with the view to clarify both parties' goals, challenges and opportunities. Focus group discussions, as means for qualitative data collection, must be designed and moderated so as to provide all participants with equal opportunity to express or decline to express their views freely (Sim and Waterfield, 2019: 3006). According to Nyumba et al. (2017: 23), focus groups should be 1-2 hour long and consists of standardised, grammatically simplistic and short questions. Rabiee (2004) posits the need for 3-4 focus groups with an optimum number of group discussion participants between 6-10 people.

A FGD was organized with the members of the Linomtha Community Garden Co-operative to take place on the 11th of June 2021. A suitable time was organized, and all the members congregated outside besides a container used for securing communal tools – tools which I soon learned were almost non-existent. The location was chosen as the Co-op members would not have to travel away from their community garden plots during valuable daytime hours in addition to covid-19 concerns and social distancing. Masks were worn by all in attendance for the duration. Approximately 15 co-op members attended the meeting, several arrived late having come from receiving the first dose of their covid-19 vaccine. The FGD was facilitated entirely in isiXhosa, the 1st language the participants sampled. Two of the enumerators under the principal the researchers were selected to aid in the facilitation of the FGD as a good repour had been build up during the questionnaire process. One employee was tasked with verbatim transcription in IsiXhosa which was later translated into English for the purposes of analysis.

The other employee was the main facilitator as she orated the FGD Questionnaire question by question. Additionally, she was tasked with making general comments on the nature of the FGD and the social dynamics within the Co-op.

3.7. Food security indexes

To achieve objective 2, various food security indicators and indexes are constructed in order to establish the factors determining food security and hence inform classification of households as food secure or insecure. Informed by the numerous academically verified measures of household food security, the selection of specific food security indicators is made on the grounds of empirical success and its specificity to the given research survey context/characteristics/objectives as well as time, skill constraints. The use of multiple indicators is advised by Maxwell et al. (2014). This is based on analytical evidence presented by Maxwell et al. (2013) which reveals that reliance on one measure of food security increases the risk of significant misclassification. This is because indicators tend to measure only some of the four dimensions of food security while other remain unobserved. Hence three indicators are selected for the study allowing separate indicator outcomes to be tested for comparative consistency and robustness of results.

Section 2.4 presented a review of a number of food security indicators which vary in terms of the component of food security which they monitor as well as the method of data collection. Based on the indicator's specific strengths, indicators were selected as outcome variables for the propensity score matching analysis. The Household Dietary Diversity Score was selected because, as an indicator for food security, it is well correlated to calories consumption which requires far more complex data capture (Maxwell et al., 2014). Household Dietary Diversity Scores also monitors aspects of food security related to quality of food intake and nutritional security (Maxwell, 2013).

The Household Hunger Scale was selected as it is an indicator of food access and is more proficient at capturing the most severe form of food insecurity being hunger. In this research only, the Household Hunger Scale was captured because the nature of the questions that make up the Household Food Insecurity Access Scale have been observed to be rooted in culture and thus can take on different meanings to different groups. Deitcher et al. (2010) found that the concept of "worry" (contained in the HFIAS) tends not to be a commonly understood concept across cultures and in cultures where is it commonly identifiable, it may be perceived to occur

at different levels of severity in different cultures. This study focusses on the township context in the Eastern Cape which is characterized by high unemployment and food insecurity (Eastern Cape Socio Economic Consultative Council, 2020; Pauw, 2005). The Household Hunger Scale has also been observed by Deitcher et al. (2010) and Knueppel et al. (2009) to be cross-culturally applicable as an indicator of severe food insecurity.

The Coping Strategy Index (CSI) and its sub-index the Reduced Coping Strategy Index (rCSI) are the third and fourth indicators of food security selected. These indicators were selected because due to its dynamic nature which does more than present a static picture of household food insecurity in the present. The CSI and rCSI monitor the household food security in the present as well as the risk of food insecurity going into the future (Christiaensen et al., 2000).

As a measure of food utilization, which refers to whether cultural and social food preferences are being met, a Self-Assessment food security indicator was also chosen for analysis. Fawole and Ozkan (2017) strongly endorse the use of self-reporting measures of food security because of its ability to reveal whether preferences are fulfilled – a property which is not evident in most other indicators of food security. The popular definition of food security by the FAO (2009) denotes food utilization as one of the four cornerstones of food security. Measurements of food security therefore must carefully consider this dimension. This motivates the inclusion of a Self-assessment of household food security in this research.

3.8 Empirical Methods

3.8.1 Probit Model

A probit model is preferred for regression analysis as it takes on a binary dependent variable hence reflecting the two food security outcomes of households who participate in urban gardening and those who do not participate. According to Koop (2003), the probit model is commonly used when the regressand is qualitative and usually indicative of the unit of measurement (in this case the household unit) and their choice of outcome as one of two categories. Probit model is based on the assumption of a utility function which governs the choice of an individual to select into one of the two categories. This is in line with the theoretical framework of utility maximization theory. The individual, or household in this context, makes the choice to participate based on the utility they expect to gain from

participation (U_{1i}) compared to the utility they gain from non-participation (U_{0i}). The choice to garden in the urban context can thus be depicted as follows where y_i^* is the unobserved latent variable:

$$y_i^* = U_{1i} - U_{0i}$$

Probit estimation assumes that the utility is a function of the observed characteristics, x_i, with and error term which is normally distributed. The error is random in these models precipitating their name as random utility models (Koop, 2003).

Different to the other most common estimation methods with binary dependent variables (logistic regression), Probit models emanate from the normal cumulative distribution function where the dichotomous regressand is also referred to as the latent variable (Ii). The latent variable is an unobserved utility index which is assumed to be the basis for the households' decision to participate in urban gardening or not. At some given threshold the latent variable breaches the threshold above which the decision to participate is taken the latent variable $(I$i) is a function of the explanatory variables included in the model – these variables are outlined below in Table 3.3 and constitute X_i, X_j, X_k etc.

$$I_i = \beta 1 + \beta 2 X_i + \beta 3 X_j + \beta 4 X_k .... \qquad \text{(Gujarati and Porter, 2009).}$$

The probit model is also selected as it minimises bias when sample size is small (n<300) (Sharaunga et al., 2016:5; Ye and Lord, 2014:25) and thus performs better than a logit regression given the sample size of this study (n=115). The probit model, a contraction of Probability Unit, is utilized for the analysis of the determinants of the choice in favor of participation in urban gardening or not. The probit model calculates predicted probabilities of membership (the treatment) based on observable co-variables (characteristics) (Dan-Baki and Aboubé, 2019). The binary outcome denotes that household participating in urban gardening (Yi=1) are codified differently to the control group of non-gardening households (Yi=0) thus enabling comparison of the determining factors. The specification of a model with dichotomous dependent variables necessitates the use of non-linear data procedures namely the maximum likelihood estimation method. Several factors motivate this decision and include that when employing Linear Probability Models with a binary dependent variable, the disturbance term violates the normal distribution as well as homoscedastic variances. Estimators from binary linear probability models thus will not be efficient and although they may still exhibit minimum variances (unbiased), they are still statistically untenable thus necessitating the use of

maximum likelihood methods (Gujarati and Porter, 2009). Other justification for the use of a maximum likelihood method over a linear probability model is that the R^2 statistic can no longer be reliably used to show the goodness of fit of the model (in the case of a binary regressand) and critically the problem of the non-fulfilment of the intuitive assumption that estimated probabilities should fall between values of 0 and 1:

$$0 \leq E(Y_i|X_i) \geq 1$$

This makes regression results intuitively less appealing than a probability model which solves this problem - namely a Probit transformation rendering the above identity fulfilled and thus interpretation of the results less complex. Comparisons between Probit and Logit models are marginal with the main difference being that the logistical probability distribution has slightly fatter tails compared to Probability Unit distribution. Gujarati and Porter (2009) posit that the choice between models is based on "comparative mathematical simplicity" (Gujarati and Porter, 2009: 571). Other differences in terms of interpretation are that the standard R^2 and F statistics illustrating the overall explanatory power of the model no longer are applicable. Alternative measures of the power of the specified model are used namely a pseudo R^2 in this case McFadden's R^2 and the Likelihood Ratio (LR) which performs the same function as the f statistic for overall significance in OLS regressions (Gujarati, 2009: 562-563).

The probit model, primarily employed due to the relatively small sample size of this study, aims to balance the distribution of the covariates (observed characteristics) between the groups so as to neutralize skewness resultant from differences in characteristics as well as to preserve the impact of urban gardening alone on food security status (Dan-Baki and Aboubé, 2019:3; Osabohien et al,2020:8). The probit model calculates predicted probabilities of membership (the treatment) based on observable co-variables (characteristics) (Dan-Baki and Aboubé, 2019:4).

In order to interpret the probit output, the first derivates of the estimates must be taken allowing for the interpretation to be a rate of change of probability (of participating in urban gardening) with respect to the given x variable (Gujarati and Porter, 2009). The value here is that, given a well specified set of covariates, model output sheds light on the statistically significant covariates which factor into the choice of households in Makhanda East to participate in urban gardening. The more urgent enquiry with regards to this treatise however, is the impact of participation on household food security as denoted by the chosen outcome variables.

Table 2 contains the explanatory variables included in the probit model as well as the expected relationship they have with the treatment variable i.e the relationship between the variable and participation in urban gardening. Additionally, the outcome variables used in the propensity score matching analysis are presented.

Table 3. 3: Explanatory Variables included in the Probit model and PSM Models

Variables	**Explanation**	**Expected Sign**
Outcome Variables		
Food Security Indicator: Based on Dietary Diversity Score	0 = Dietary Diversity Score < Mean; 1 = Dietary Diversity Score > Mean	
Coping Strategy Index	Number/ Frequency of Food Coping Strategies	
Reduced Coping Strategy Index	Number/ Frequency of Food Coping Strategies	
Household Hunger Scale	Number/ Frequency of household experiences of hunger	
Treatment Variable		
Urban Gardening Participation	0 = Non-Gardener; 1 = Urban Gardener	
Independent Variables		
Gender	0 = Female; 1= Male	-
Age	Age in Years	+
Household Unemployment	Number of Unemployed Household Members	+
Income per capita	Monthly Household Income per capita	+/-
Number of Social Grants Received	Number of Social Grants Received Monthly	-
Number of Household Members unable to work due to old-age or illness	Number of Household Members unable to work due to old-age or illness	+
Marital Status	1= married/cohabiting; 0 = otherwise	+
Credit Access	Household Access to Credit in the past 12 months 0 = no; 1 = yes	+

Household Employment Dummy	0 = Household member(s) were not generating income from formal/informal employment or agricultural production.; 1 = Household member(s) employed in formal/informal employment and/or agricultural production generating income.	-
Stokvel Dummy	0 = Non Stokvel Membership; 1 = Stokvel Membership	+
Access to Transport Vehicle	0 =no access to transportation vehicle; 1 = access to transportation vehicle	+
Land Value (logged)	Estimated Value of Respondents Land Assets (logged)	+

The variable capturing the gender of the household head does so using the coded responses: 0 = Female; 1= Male. The a priori expected relationship between the gender variable and participation in urban gardening denotes that female household head are more likely to participate. This is informed by empirical research results from Swanepoel et al. (2021) and Kanosvimhira and Tavera (2019) whose results indicate women have higher participation rates in urban gardening activities.

The age variable, captured in years, is expected to be positively correlated to participation in urban gardening. Household with older household heads tend to have more farming experience contributing to higher participation rates (Mcata, 2013). Additionally, evidence point to low participation rates among youths in Sub-Saharan Africa (Onyango, 2010; Maswikaneng et al., 2002; Modibedi et al., 2020).

The household unemployment variable captures the number of household members who were unemployed members of the work force. Higher household unemployment is expected to have a positive relationship with participation in urban gardening. As a result of the Covid-19 Pandemic and ensuing lockdown measure put into place on the March 26th 2020, many income generating opportunities and employed positions were scuppered (IPC, 2021). Research by Palau-Salavador et al. (2019) indicated that due to the loss of employment and income as a result of the 2008 Financial Crisis, many recently laid-off people turned to urban gardening as means to provide fresh produce to their households. Additionally, Mudau (2001) found that

developmental initiatives, such as the extension support offered by Umthathi Training Project Trust, target the most vulnerable houses bound by poverty and high levels of unemployment.

Total household income was compiled by adding all household income streams (wages, livestock and crop production, remittances, social grants and non-agricultural entrepreneurial activities). Per Capita Income was constructed by dividing this figure by the household size and was expected to have a bidirectional effect on participation in urban gardening. Finding in the literature are mixed. Evidence from Atteridgeville township in Pretoria revealed that households participating in urban agriculture did have higher incomes, although the difference was marginal and not significant. On the other hand, Tasfamariam et al. (2018) found the income of participants of the food garden initiative in the urban and peri-urban areas of Gauteng under study to have significantly lower household incomes.

The variable measuring the number of Social Grants received by a household is expected to have a negative effect on the likelihood of participation. This is informed by research by Thornton and Nel (2007) of urban agriculture in Peddie, a nearby town to Makhanda in the Eastern Cape. Thornton and Nel (2007) found that two thirds of households received social grants but critically, that participation in urban gardening was significantly higher among households who did not receive a grant.

A variable denoting the number of household members who were unable to work due to old-age or illness per household was captured. Dependents were. The a priori expectation was a positive relationship with participation in urban gardening. This is informed by results from Modibedi et al. (2020) who posits that older generations, who had higher participation in urban gardening activities were retired and were motivated by keeping physically active.

The dummy variable identifying the marital status of the household head was coded with a 0 if the household head was single or widowed while households headed by married and cohabiting household heads were coded as 1. The expected relationship with participation in gardening activities was positive based of finding from Mupeta et al. (2020) who found that urban gardening participants were more likely to be married compared to non-participants in various areas of Zambia.

Credit Access was measured as a component of the financial capital base of the households. Household were asked if they had accessed a credit facility in the past 12 months with responses recorded as: 0 = No; 1 = Yes. Households who did have access to a credit facility were expected to be more likely to be gardeners. Credit is a determinant of the investment that households put into their households and/or home/community gardens. Ahmed and Mesfin (2017) found that involvement in community co-operatives increased access to finance/credit.

A household employment dummy variable was specified to capture whether a household member or members were engaged in full-time/temporary waged employment, agricultural production for profit and/or non-agricultural entrepreneurial activities. The variable aimed to capture whether the household was engaging their time in gainful, income generating activities (Dummy = 1) or not (Dummy = 0) as an indication of households diversifying their livelihoods and income sources beyond social grant income. This is poignant given the negative impact of the pandemic and lockdown period on employment and income. The expected relationship with participation in urban gardening is negative as employed/economically active households have less time to tend gardens. Khumalo and Sibanda (2019), in research on food security in urban and peri-urban agriculture in Tongaat, eThekwini Municipality, Kwa-Zulu Natal Province, found that participating households had higher unemployment. Additionally, the research found non-participating households to have higher instances of paid employment as well as self-employment pointing to a negative relationship between participation and household employment. Van Averbeke (2007) posits that the decision to participate in gardening activities in Atteridgeville Township in Pretoria was motivated by the prevalence of household unemployment and as a reaction to low cash incomes, poverty and food insecurity.

To capture elements of social capital and the value of leveraging connections to social networks, a variable was constructed capturing whether households held membership in a local Stokvel/savings club (0 = No; 1=Yes). The a priori expected relationship with participation in urban gardening activities was positive. Research by Vibert (2016) points to higher social capital among gardening participants as captured by the proxy of membership in mutual help groups. Among the study participants of Hlakateni Community Garden, membership in stokvels was high as gardeners saved earnings for purchases of food and non-food items at year end.

Access to a transportation vehicle captures an element of the physical capital and asset endowment. Access to transportation was captured in dummy form where: 0 = No Access to a vehicle and 1 = ownership or access via friends and relatives to transportation. The variable was expected to have a positive relationship with participation in urban gardening and collective action. Ownership/access to a vehicle present vital means for gardeners to access markets in the town of Makhanda where produce is sold. Research on Kenyan smallholders and collective action (group participation) by Mutonyi (2019) found there to be a positive relationship between participation and asset holdings. Productive physical assets, such as vehicles and farming equipment/assets, enable the diversification of household income sources by facilitating productivity improvements and ease of access to markets.

A dimension of financial capital endowment was measured by the subjective valuations that respondents made as to the value of their land. The variable Land Value (logged) is expected to be positively correlated with participation in urban gardening. Higher land values generally stem form beneficiation and investment into the property such as starting the cultivation of a garden as mans to beatify the surround of the household and garner fresh, healthy produce from the garden. A notable exclusion from this model is oft seen variable livestock ownership which has been left out due to the urban nature of this food security study. Extension support as a variable was statistically untenable due to it being a perfect predictor of households participating in Urban Gardening. The same goes for years of farming experience as each household who recorded any agricultural experience was in fact participating in urban gardening and thus the variable was deemed untenable.

3.8.2. Propensity score matching

The research design is one of impact evaluation on an outcome variable (various indicators of food security) given selection into a treatment or control group (urban gardeners and non-gardeners), conditional on a set of covariates specified to capture the determinants of the choice to participate or not (Austin, 2009). The causal nature of this question presents a typical conundrum being that of the ‘selection effect’ and unobserved heterogeneity. Guided by the theoretical framework of utility maximization, respondent households are assumed to make the decision to participate rationally based on the costs and benefits derived there from participating in urban gardening. The problem of unobserved heterogeneity however, is that each household derives a different level of utility from participation due to their contrasting

underlying characteristics: some of which are unobserved (Pufahl and Weiss, 2007). The 'selection effect' may be caused when the underlying differences in characteristics (unobserved) are affecting treatment assignment. According to Pufahl and Weiss (2007:2), this constitutes the "classical evaluation problem" in evaluations of impact using counterfactuals which is overcome by applying non-parametric propensity score matching. Outside the field of medicine, the utilization of propensity score matching for impact evaluation of a treatment effect, particularly in econometrics, has risen to relative prominence in recent years – specifically as the tool to overcome selection bias.

The outcome variables of interest cannot be simply observed from the differences between the control and treatment group as the underlying covariates may be influencing the selection of treatment as well as the indicators of food security. This is the selection bias problem is combatted when using PSM by finding observations which can act as controls and share similar covariate patterns (balancing covariates) in order for the impacts of treatment to be isolated in a statistically validated manner (Caliendo and Kopenig, 2005).

As a measurement of impact of treatment (participation in urban gardening), the method of Propensity Score Matching (PSM) was used as it is a non-parametric technique applied in treatment evaluation to estimate average treatment effects (Frölich, 2015). By matching the treatment and the control group observations using PSM, the effect of participation in urban gardening can be observed by looking at the differences in the outcome (Osabohein et al., 2020) variables which in this case are the several food security indicators selected (HDDS, HHS, CSI, rCSI).

Pufahl and Weiss (2009) define a propensity score as the probability of participation of a given household *i,* considering the characteristics of that household ($\mathbf{X} = x_{i)}$.

Thus: $p(\mathbf{X}) \equiv \Pr (P_i = 1 \mid \mathbf{X} = x_{i)}$

The propensity score of a given household is constructed by taking the combined effect that all explanatory variables have in predicting whether that observation will take the value of 1 – i.e. The probability that $P_i = 1$ given the covariates for that observation (X).

Each households' score is a function of the observed covariates where scores above 0.5 imply a likelihood that the household will choose participation in urban gardening: a score below 0.5 implies the contrary (Luellen et al., 2006). To compare the food security outcomes of the treated group and the control group, households with similar scores, which are based on the observed explanatory variables, are matched using a selection of matching algorithms so be explored in Section 2.8.2.1 hereafter.

The necessary steps required for estimating propensity score matching methods are delineated by Caliendo and Kopenig (2005) and are as follows: Estimation of the PS, selecting the matching algorithm, validating the common support restriction, checking the matching quality of the estimation, and finally sensitivity analysis. Adebie et al. (2004) delineate a method for estimating the average treatment effects noting that of the two outcomes, participation and non-participation (in urban gardening in this case), only 1 outcome is observable. Matching estimators will assign the missing potential outcome by taking the average outcomes for observations with covariates with corresponding patterns. If the observed outcome is denoted by Y_i and W_i is the treatment either received =1 or not received =0 then:

$$Yi = Y_i(W_i) = \begin{cases} Y_i(0) & if\ W_i = 0 \\ Y_i\,(1) & if\ W_i = 1 \end{cases}$$

The matching estimators we consider impute the missing potential outcome by using average outcomes for individuals with "similar" values for the covariates. Estimation of the average treatment effect will be performed on each observation in the sample with the results being estimates of the unobserved potential outcome. According to Adebie et al. (2004: 192) "if the decision to take the treatment is 'purely random' for individuals with similar values of the pre-treatment variables or covariates, we could use the average outcome of some similar individuals who were not treated to estimate the untreated outcome". Bekker and Ichino (2002) concur positing that only in the case where exposure to treatment is purely random for observations which have the same propensity score, can bias be said to be eliminated entirely. They add that propensity score matching methods only act to reduce the effects of confounding variables (hidden bias) and do not completely nullify the effects completely. This embodies the first underlying theoretical assumption behind matching estimators and illustrates the fundamentals premise upon which matching estimators are derived. Essentially, matching estimators take each observation and, based off the observable characteristics, searches for

another observation with similar covariates but who opted to receive the alternative treatment – thus matching them (Bekker and Ichino, 2002).

In order to confirm that the matching estimators are identifying and constantly estimating the treatment effect of interest (the selected outcomes), the 2 underlying assumptions need to be considered.

1. The treatment, D, is independent of the outcomes conditional on the measured variables. D is independent of ($Y(0)$, $Y(1)$) conditional on $X = x$. This is the restriction denoting that the choice to receive treatment (participate in urban gardening) needs to be "purely random" for individuals with similar measured covariates. This is also referred to as unconfoundedness or "selection on observables" (Adebie et al., 2004:192).

2. The probability of assignment must be bounded away from 0 and 1. This is an identification assumption meaning that there needs to be observations with similar covariate patterns that opt for the alternative treatment otherwise there would be no matching observation and comparison would be untenable.
   $c < \Pr(W = 1 | X = x) < 1 - c$ for some $c > 0$.

Assumption 1 characterises the balancing property which requires that individuals with congruent propensity scores should also share similar distributions of measurable (and unmeasured) characteristics independent of their treatment status. Thus, only if exposure to treatment is random for any given propensity score, are the treatment and counterfactual units observationally identical on average (Bekker and Ichino, 2002; Ahmed and Mesfin, 2017; Dan-Baki and Aboubé, 2019; Osabohien et al., 2020).

These assumptions require careful consideration and denote that the effect of potentially confounding variables on the covariates should be captured by the model specification. Additionally, the model specification needs to account for the need for counterfactual observations which support the treated observations allowing for valid comparison via the matching process. In the event that either are violated, the estimates of average causal effects are biased (DiPrete and Gangl, 2004). That being said, the total elimination of hidden bias is nigh on unattainable in non-experimental studies (observational experiments) and an attractive feature of propensity score matching is that satisfying the assumptions is not relied upon.

Propensity score matching deals specifically with causal effects on a specific outcome by treating all other variables as having potential to confound impacts. The approach to matching is to reduce the effect of confounding variables by matching these variables (potentially unobserved covariates) to those who did receive the treatment and those who did not. This is the method of covariate balance (DiPrete and Gangl, 2004). As such, the quality of matching will be determined by the extent to which the link between the covariates and selection into the treatment group has been eliminated – i.e. how successful the effects of potentially biasing confounding variables have been eliminated. This method of covariate balance was brought to light by Rubin (1978) who formalised the notion that matching methods need the assignment of observations to the treatment group to be "ignorable", conditional on the measured explanatory variables.

In a review by Stuart (2010) of Dr Paul R Rosenbaum's seminal research into observation studies *Design of Observation Studies (2002),* the author notes the emphasis that is put into the design of studies of this nature (non-experimental studies), in particular the selection of a control group of participants and design dimensions that minimise the effects of unobserved confounding. De Janvry et al. (2010) adds weight to this notion identifying that the biggest difficulty in impact analysis is the identification and selection of the control group also referred to as the counterfactual group. The possibility that unobserved or unobservable characteristics/variables will have a strong impact on selection means that one cannot rely solely on the observables. Two key stages are identified, the first being the task of matching followed by the need to assess the influences of unobserved covariates. Both are addressed by applications of data processes to address and acknowledge the underlying assumptions.

The research design needs to clearly demonstrate that the control group are plausibly comparable with the treatment group in terms of the observables while cognisantly minimizing the effect that unobservables may have on the choice to participate in the community garden (De Janvry et al., 2010). The estimation of the mean impact of participation on the treatments group requires inferring what the impact (on household food security) would have had on the treatment group is they had not received the treatment, being membership in this case (Pufahl and Weiss, 2009).

Bekker and Ichino (2002) present a step-by-step method for estimation of average treatment effect based off propensity scores. Initially the Stata command pscore.ado generates the propensity scores while testing for the balancing property as follows:

A probit model is specified: $\Pr(D_i = 1|\, X_i\,) = \Phi\{h(X_i)\}$

Where Φ is the normal cumulative distribution function; $D_i = \{0,1\}$ shows whether treatment was selected or not; X_i is the combined effects of the pretreatment observables; and $h(X_i)$ is the specification of the probit models' covariates (continuous and categorical only).

The algorithm divides the propensity scores into a user determined number of intervals which are of equal size and where the number of intervals defaults to 5. Tests are run to confirm that the mean propensity scores do not differ between the treated and control units within each interval. In the event that this does not balance, the number of intervals can be increased until all average scores of both groups are equal. For the balancing property to be satisfied, all covariates must be tested to confirm no difference between the two groups in every interval. Where any of the characteristics are different among the treated and control groups with in an interval, the algorithm instructs the user to change the underlying specification of the probit model $[h(X_i)]$ (Bekker and Ichino, 2002).

These steps are contained in the algorithm of the Stata command pscore which has various options attached to the command, one of which is the comsup option (restricts matching to within the common support region). The principle of common support purports that the tests for balancing are only applicable for observations whose propensity scores are no lower than the lowest in the alternative group and no higher than the highest score in the alternative group. As a restriction on matching scores, common support can improve matching quality but also has the effect of potentially eliminating observations which fall outside the common support boundaries (Bekker and Ichino, 2002) and thus for these observations, the ATT cannot be estimated (Caliendo and Kopenig, 2005).

When the propensity scores have been estimated utilising the pscore command on Stata and the balancing property is satisfied, psmatch2 is computed identifying the treatment variable, outcome variable as well as the choice of matching algorithm (Kernel, Nearest Neighbour, Radius).

Once the algorithm is imputed the command executes full Mahalonobis matching which adjusts for pretreatment observable differences between treated and control units. Assuming that observations are independent, have fixed weights, are homoscedastic in terms of the outcome variable within both treated and untreated groups, the command computes approximate standard errors of the treatment effects (Leuven and Sianesi, 2003).

Thereafter, the pstest command takes all covariates and calculates to what degree there is balance between treated and untreated units in terms of the covariates. This simply tests the extent of corresponding balance between any groups – in this case the comparability of the treatment group (urban gardeners) and control group (non-Gardeners). The output consists of several measures of the extent of corresponding balancing and can be performed on the observations before and after matching has occurred. The output statistics of interest include t-tests for equal means within the treatment and control samples done for both pre and post matching. The raw samples (pre-matching) are based off the unweighted regression while the post-matchings are estimated with the automatically constructed or user specified weight variable. Other measures outputted are the standardised percentage bias for both pre and post matching samples as well as the percentage reduction in that bias as result of the imputed pstest Mahalonobis matching procedure. A Pseudo R^2 is also reported form the underlying probit model estimation of the treatment probability based off the propensity scores. The likelihood-ratio is also reported along with its p value showing the joint significance of all the regressors form both before and after matching has taken place. Additionally, bias is reported at its mean and median levels for each covariate.

2.8.2.1 Matching Algorithms

Once propensity scores have been derived off the probit model specified, estimation of the average treatment effect on the treated (ATT) is required. However, given that *p(X)* is a continuous combination of the specified covariates, the probability of finding units which have identical propensity scores is zero and thus several matching methods have been proposed to overcome this hurdle. For the purposes of this research, four matching methods are to be explained and implemented. They are as follows:

Stratification Matching: This method cuts the range of propensity scores into sections such that in each, units from both groups have mean scores which do not differ. The number of blocks can be the same as those imputed by the pscore.ado command. Within each interval the mean outcomes of the two groups is calculated and thus is the ATT made up of the of the average ATT in each interval. The number of units in the treatment group found in each block determines the weighting of the ATT form that block. Where no observation from the alternative group is found, the stratification matching method does not estimate ATT but discards the observation (Bekker and Ichini, 2002).

Nearest Neighbour Matching: This method for matching observations based on their propensity scores is intuitively attractive as it matches each treated unit with a control unit with the nearest propensity score. This method is commonly applied with replacement meaning that any particular control until may be the closest match for multiple control units and is thus permitted to use that control unit in this way to improve matching (Caliendo and Kopenig, 2005). The ATT is derived from averaging the differences between the matched units from the control and treatment groups in terms of the outcome variable. This method does not discard any observations although as a consequence, may end up with rather poor matches in some regions.

Radius Matching: This method specifies a region or neighbourhood within which control and treated observations are matched based on their propensity scores. The treated units are match with an observation which has a propensity score which is within the specified radius. Smaller neighbourhoods or radius may improve the quality of matching as units matches will have propensity scores closer together although matches can also be lost due to there being no control unit within the defined radius.

Kernel Matching: The Kernel method for matching employs all of the control units as matches for each treated unit. The control units are weighted in an inverse proportional manner meaning that for control units whose propensity scores are close to that of the treated unit, a high weighting is given and for control units whose scores are further away from the given treated unit are given small weightings. Thus, are all treated units are matched with a weighted average of all counterfactuals. An advantage of kernel matching is that the variance is lowered due to

all control units being used, however matching quality may be inferior in some cases (Caliendo and Kopenig, 2005).

Following Bekker and Ichino (2002), these matching methods differ in the quality of the matches as well as the number of matches made, however if all four are observed together, a researcher can evaluate the robustness of the estimates.

2.8.3. Sensitivity Analysis

During the initial stage of propensity score matching, estimates of the impacts of treatment on a given outcome variable of interest provides estimates "largely free of bias from an association between treatment status and observable variables" (DiPrete and Gangl, 2004: i). However, matching may not ensure the estimators are robust against hidden bias from confounding variables that concurrently impact on the selected outcome variables as well as whether treatment is received or not. DiPrete and Gangl (2004), present the Rosenbaum bounds approach to solving the problem which computes the extent to which the unobserved variable(s) is affecting the selection into the control of treatment group. This constitutes the assessment of bias and informs whether the results are validated, and robust inference can be made on the matching analysis results.

When variables outside the specified model/unobserved/unmeasured variables are concurrently affecting assignment of an observation into the treatment group as well as affecting the outcome variable, hidden bias is likely to have occurred which would render the matching estimators not robust (Bekker and Caliendo, 2007; Rosenbaum, 2002: Caliendo and Kopenig, 2005). Rosenbaum bounds is proposed as an approach to generate evidence as to the degree of sensitivity to unobserved variables impacting on assignment to the treatment group. In impact evaluations – it has become imperative to test the sensitivity of the estimated treatment effects i.e. to test for hidden bias. In Bekker and Caliendo (2007) they present the probability of treatment/participation as follows:

$$P_i = P(x_i, u_i) = P(D_i = 1 | x_i, u_i) = F(\beta x_{i+} \gamma u_i)$$

Where: x_i are all the observed explanatory variables for that household and u_i *is* the unobserved variables. Critically, γ is the effect that the unobserved variables u_i have on the probability of

participation. As per the above equation, if γ is equal to 0, then γu_i is eliminated and the probability function of participation is derived from only x_i meaning that there is no hidden bias. This is a required condition where $\gamma = 0$ implies that unmeasured variables either have similar impact on selection of treatment or non-treatment or there "no relationship between differences in these potential effects and the assignment process" (DiPrete and Gangl, 2004: 4). Where γ is not equal to zero i.e. hidden bias is present, then two households with identical observed characteristics can have different likelihoods of receiving treatment (Baker and Caliendo, 2007).

The application of Rosenbaum bounds (Stata command: rbounds) computes the average treatment effects on the treated (ATT) with hidden bias present (unobserved heterogeneity – meaning that assignment into the two groups is affected by unobservables) for both groups treated and untreated (Caliendo and Kopenig, 2005). Command rbounds, calculates, measures and compares the differences in outcomes between the groups and then performs Wilcoxon signrank tests generating both upper and lower bound estimations of the levels of statistical significance at given levels of hidden bias (Γ). Γ is expressed as an odds ratio of an individual receiving the alternative treatment assignment due to an unobserved covariate and backs up an assumption of heterogeneighity.

According to DiPrete and Gangl (2004:14), "at each Γ we calculate a hypothetical significance level "p-critical", which represents the bound on the significance level of the treatment effect in the case of endogenous self-selection into treatment status". This means that through comparison of Rosenbaum bounds at differing Γ on the treatment effects, what can be surmised is how strong the influence of the unobservables will need to be for the estimated treatment effects from PSM to have arisen "purely through selection effects" (DiPrete and Gangl, 2004:14). Rosenbaum bounds assumes variable *W* exerts a level of hidden bias and Γ is the odds ratio of an observation reviving the alternative treatment assignment as a result of the confounding variable *W* (conditional on X). Rosenbaum bounds equate to the matching estimators estimated level of significance when the variable *W* does not impact on assignment to treatment (the odds of receiving treatment) and thus (the assignment process) can be deemed random. However, as the potential effect of *W* on treatment assignment (Γ) is assumed to increase, so the estimated effects' confidence interval widens and the level of significance (p value) relating to the impact of treatment assignment on the outcome goes up. Computing

Rosenbaum bounds (rbounds) for each level of association between the confounding variable and the outcome generates the upper and lower bounds for the test of significance on the effect of *W* on the treatment assignment. Specifically, it does so "for the case where *W*'s effect on the outcome is so strong that knowledge of *W* would perfectly predict which of a pair of matched cases would have the higher response regardless of which case received the treatment" (DiPrete and Gangl, 2004: 7).

The application of Rosenbaum bounds is only applicable for matched pairs and allows for determination of whether the strength of the influence of an unobserved variable on treatment assignment and whether it has undermined the implications of matching analysis (Caliendo and Kopenig, 2005). Critically, making inference on the causal effect of one variable on another variable always needs to involve consideration of potential confounding variables and thus is fundamentally uncertain. What Rosenbaum's approach to solving these offers is fair confidence that a causal relationship does exist between treatment and outcome variables, even in the presence of hidden bias.

The limitations of the propensity score method is that when the underlying model is incorrectly specified or when covariates are not measured correctly, a hidden bias may be present which distorts the estimates of the treatment impact. Similar hidden bias is emergent of significant covariates are not included in the model. This disadvantage of propensity score analysis is due to the non-random selection process which can lead to differences between the treatment and control groups which could be mistook for the impact of the treatment (Luellen et al., 2006). What could potentially limit the effectiveness of the propensity score modelling in this study is the relatively small sample size to be used (n=115). According to Luellen et al. (2006) propensity score analysis benefits when sample size is big – although precisely how big the sample needs to be for successful analysis remains unclear.

3.8.4 Empirical literature on PSM

Estimating the Average Treatment Effects on the basis of propensity score matching was similarly used by Sikwela and Mushunje (2013) in their impact evaluation of participation in farmer support programs on income and sustainability in the Amathole Municipality (Eastern Cape), OR Tambo and UMkhanyakude District Municipalities (Kwa-Zulu Natal Province). Results from Swanepeol et al. (2021) in the Western Cape, who also employed propensity score matching to model impact of urban agriculture on food security (ATT), indicate that

participation did not have a statistically significant impact on household dietary diversity scores. In fact, non-gardening households (the control units) tended to be worse off in terms of food access and income leading the authors to conclude that participation in urban agriculture does not improve measure of food access and nutritional diversity.

Applying similar methods of propensity score matching, Mupeta et al. (2020) research the impact of participation on the livelihood and income of urban households in the Kitwe and Lusaka districts in Zambia. Their findings are far more positive in terms of the impact of gardening on household welfare and food security. Robust results are presented using 3 matching algorithms (Kernel, Radius, Nearest Neighbour) which estimate the positive impact of treatment (ATT) on household income to be between 13.7 - 19.1% and statistically significant. The lion's share of this income effects is identified to be from cost saving on food purchases rather than form sales which is in line with the a priori expectation of home gardens being predominantly for home consumption. What must be noted however, is that the proliferation of urban agriculture in the Zambian (approximately 20% of GDP as of 2008) is higher than is observed in South Africa. In seven Ethiopian cities Alemu et al. (2019) similarly applied propensity score matching methods to assess the impacts of permaculture garden interventions on the intake of fruits and vegetables on treated and control units. Their results indicate a significant and positive effect associated with the intervention in terms of dietary diversity inclusive of vegetable and fruit consumption. Another poignant finding of the impact evaluation is that the perceived importance of consumption of fresh fruits and vegetables was significantly higher among the intervention group compared to the control units which bodes well for household food access and diversity of treatment group respondents (Alemu et al., 2019).

CHAPTER 4: DESCRIPTIVE STATISTICS

4.1 Introduction

This chapter makes use of descriptive statistical analysis to elucidate the role that community and home gardens play in contributing to household food security in the context of urban farming in Extension 6, 7, 10 townships and Joza Location in Makhanda, Eastern Cape. Descriptive statistics such as means, frequencies, t-tests and 5-point Likert Scales are employed to characterise household demographics, food security status as well as the different typologies of urban gardener. Employing a sample of Non-Gardening Households (NGs) as a control group (n=55), the analysis looks at Urban Gardening Households (UGs)(n=60), made up of Community Gardeners (CG)(n=24) and Home Gardeners (HG)(n=36) in comparison analysing and statistical differences in the observed variables between the two groups. The key factors investigated include demographical data, income/expenditure and food security status with the aim to determine which variables tested are significantly different between urban gardeners and non-gardeners. Additionally, temporal changes to various food security indicators as well as income and expenditure are presented with data collected from prior to the National Lockdown on March 24th 2020 as well as at the time of the interviews which took place in May-June 2021. Thereafter, the various food security indicators selected for this study are analysed focussing on the comparison between UGs and NGs. These include Household Dietary Diversity Scores, the Household Hunger Scale, Self-Assessment measures of food security as well as the Coping Strategy Index in its full and reduced forms.

4.2 Types of Urban Gardeners and Control Group

Table 4.1 shows that 48% of the respondents were non-gardening households, while 31% were home gardeners and the remaining 20% were community gardeners.

Table 4. 1 Agricultural Status of Households sampled.

Urban Agricultural Status (n=115)		Freq.	Percent
Home Gardener		36	31.3
Community Gardeners	Linomtha Community Garden Co-op	17	14.78
	Extension 7 Community Garden	7	6.1
Urban Gardening Participants		60	52.17
Non-Gardening Households		55	47.83

Source: Own Survey (2021)

A total of 15% were Linomtha garden co-op members, 6% were members of the Extension 7 Community Garden members. This equates to 20% of the sample being community gardeners.

4.3 Household Demographics and Socioeconomic Characteristics

This section describes the characterises of the sample focussing on the comparison of those respondent households who chose to participate in urban agriculture (referred to as Urban Gardeners – UG) and the control group of non-Gardeners (NG). Table 4.2 present the first results of the socioeconomic characteristics of continuous variables.

Table 4. 2 Characteristics of Urban Gardeners and Non-Gardeners

Continuous variables, (n=115)							
Variable	Pooled Sample (n=115)		Non-Gardener (n=55)		Urban Gardeners (n=60)		T-Test
	Mean	Std.	Mean	Std.	Mean	Std.	
Age of household head	58.93	13.89	54.65	14.33	62.85	12.323	3.3***
Education of household head (years spent in school)	7.11	4.16	7.93	3.30	6.37	4.268	2.04**
Household Size	4.2	1.713	4.11	1.950	4.28	1.474	0.54
Income Per Capita in Rands	1043.29	1332.94	912.78	970.86	1162.93	1593.7	1.01
Value of Land Assets (logged Rand value)	8.31	5.39	7.52	5.62	9.04	5.115	1.51*
Number of Household Members unable to work due to old-age or illness	0.65	0.71	0.44	0.57	0.85	0.78	3.23***
Household Unemployment	1.88	1.43	1.55	1.12	2.18	1.62	2.44***
Number of social grants received	1.92	1.39	1.89	1.71	1.95	1.03	0.23

Source: Own Survey (2021)

4.3.1 Age

Of the 115 respondent households, the average age of the household head was 58.93 years old (Standard Deviation = 13.89). A statistically significant difference (1% level of significance) in age is observed between NGs who averaged 54.65y ears old (Std.=14.33) and Urban Gardeners who averaged 62.85 years old (Std. 12.32). This is somewhat explained by the fact that a higher percentage of UGs were led by a retiree (23.33%) compared to only 16.36% of

NG households. In Sub-Saharan African studies of agriculture, it is commonly found that older generations tend to tend gardens in the urban and rural spheres (Maswikaneng et al., 2002; Modibedi et al., 2020). Additional information from the FGD held with Linomtha Community Garden Co-operative (Co-op) members points to a generational divide exiting between older and younger generations. The Linomtha Co-op was made up of almost exclusively of elderly local residents of Extension 7 who spoke of the unwillingness of the young generation to invest their time and resources into agricultural exploits. According to the elders in the co-op during the FGD held, the youth want a '*proper job'* which pays a wage. This mirrors findings from Vibert (2018:264) who presented the notion as the "the yearning of younger people" for waged labour.

4.3.2 Level of Education

The mean educational years is 7.1 (Standard Deviation = 4.16) implying that on average the head of a household in the sample area (Makhanda's townships) only had achieved primary education. Mean educational years was sizably lower among UGs (6.37yrs) compared to households who did not garden (NG) who averaged 7.93 years of formal education. This is remarkably similar to result from Onyango (2012) who found that most urban gardeners in South Johannesburg only had primary school education and that those with more education years were less willing to participate. The statistical difference between the Education of UG and NG was found to be significant at the 5% level of significance (Table 4.2). To further break down the level of education, Table 4.3 show that a total of 13.91% of the respondents had zero years of education while 35.65% had completed no more than primary education (7 years). Education has been found to be positively correlated with diversification of income sources leading to improved food security (Salah, 2019) as well as market participation among small-scale farmers (Montshwe, 2006).

Table 4. 3 Level of Education and Urban Gardening, %

Category	Pooled Sample (n=115)	Urban Gardening	Non-Gardening
No formal Education (0 yrs.)	13.91	16.67	10.91
Less than Primary Education (<7yrs)	35.65	45	25.45
Completed primary but not NSC (7<EDU<12)	32,17	21.67	43.64
NSC achieved (≥12yrs.)	18.26	16.67	20

Source: Own Survey (2021)

Moreover, 32.17% had completed less than a National Senior Certificate (NSC = 12 years) but more than primary education. Only 18.26% of the respondent Household Heads had completed a Nation Senior Certificate and beyond.

4.3.3 Household Size

Household size varied between 1 – 10 per domicile. The average household size was 4.2 members (Std. 1.71) as shown in Table 4.2. Household size did not vary greatly between UGs and NGs with the former averaging marginally higher (4.28 household members) than the latter (4.11 household members) and the difference not statistically significant (Table 4.2). According to Statistics South Africa (2019), 61.5% of Eastern Cape Households had between 2 and 5 members. Households in rural South Africa tend to have more members than urban households - the Eastern Cape Province is constituted by more rural compared to urban areas.

4.3.4 Household Income per capita and Total Income

Although UGs do have slightly higher per capita income (R1162.93) compared to NGs (R912.78), the difference is not significant. While the pooled sample mean is R1043.29 (Std. = 1332.94), the wide range of incomes is illustrated when observing the high standard deviations for both UGs (1593.7) and NGs (970.86) which is larger than their respective per capita income levels.

Table 4. 4: Household Income and Social Grant Income

All income in Rands		Pooled Sample		Urban Gardeners		Non-gardeners		T-test
Variable (Continuous)		Mean	Std.	Mean	Std.	Mean	Std.	
Total Household Income		3889.15	5511.2	4478.6	7171.6	3246.11	2668.35	1.2
Social Grant Income		1912.61	1345	2198.67	1226.17	1600.55	1409.33	2.43***
Income from off-farm activities		1976.54	5695.31	2279.93	7502.11	1645.54	2602	0.60
		Pooled Sample		Urban Gardeners		Non-gardeners		Chi Square
Variable (Dummy)				Percent		Percent		
Social Grant	No	12.17		16.36		8.33		1.31*
	Yes	87.83		83.64		91.67		
***,**,*: Chi Square significant at the 1%, 5% and 10% levels of significance.								

Source: Own Survey (2021)

As can be seen in Table 4.3, the mean total household income reported by Urban Gardeners of R4478.6 (Std. 7171.6) was sizably but not significantly higher than the mean household income reported by NGs – R3246.11 (Std. 2668.35). The difference in range and volatility of income data between the two groups is notable with the income of UGs ranging between R0 – R55 000 while the household income reported by NGs only ranged between R0 – R11620. The combined average household income of the entire sample was found to be R3889.15 (Std. 5511.2). This result is different to the findings of Swanepoel et al. (2021) who found that in several informal settlements in the Western Cape, household income was slightly higher among household who did not participation in urban gardening activities. This may attribute to more favorable economic conditions in the Western Cape Province in terms of employment opportunities.

4.3.5 Household Physical Asset Value

To identify the nature of the access household had in terms of physical capital – a list of commonly found assets taken from the literature was presented to the respondents. They then indicated whether they had: No Access; Accessed the asset through the Umthathi Training Project Trust; Accessed the asset elsewhere i.e. a neighbour, family member or friend; Hired the asset; or Owned the asset identified. The respondents' subjective valuation of the total

physical asset endowment does not differ greatly for UGs (R194048) and NGs (R194381). Results indicate high levels of Land ownership (76.52%) which was the main contribution to overall asset endowment even though plots remain relatively small at an estimated 250m^2 inclusive of an average dwelling of 30m^2 for RDP houses (Moola et al., 2011).

Ownership of a cell phone(s) within the households was also high with 90% of households owning mobile phones. Ownership and access to a private car through relatives/friends/neighbours was extremely low (<10%) with 5% having access to bakkies and 2.6% accessing a truck. According to Pote (2008), production assets (vehicles for market transport) play a vital role in lowering transactions costs and increasing commercial viability/profitability. During the FDG held, the community gardeners specifically rued the lack of access to transportation to market which hindered their ability to make larger sales in town. The urban township existence is characterised by a continuous struggle for mobility and the costs incurred on transport with a round trip from Extension 7 into town costing R25 – a legacy of the apartheid land planning which to this day contains the opportunities of low-income South Africans living in township and inform settlement areas.

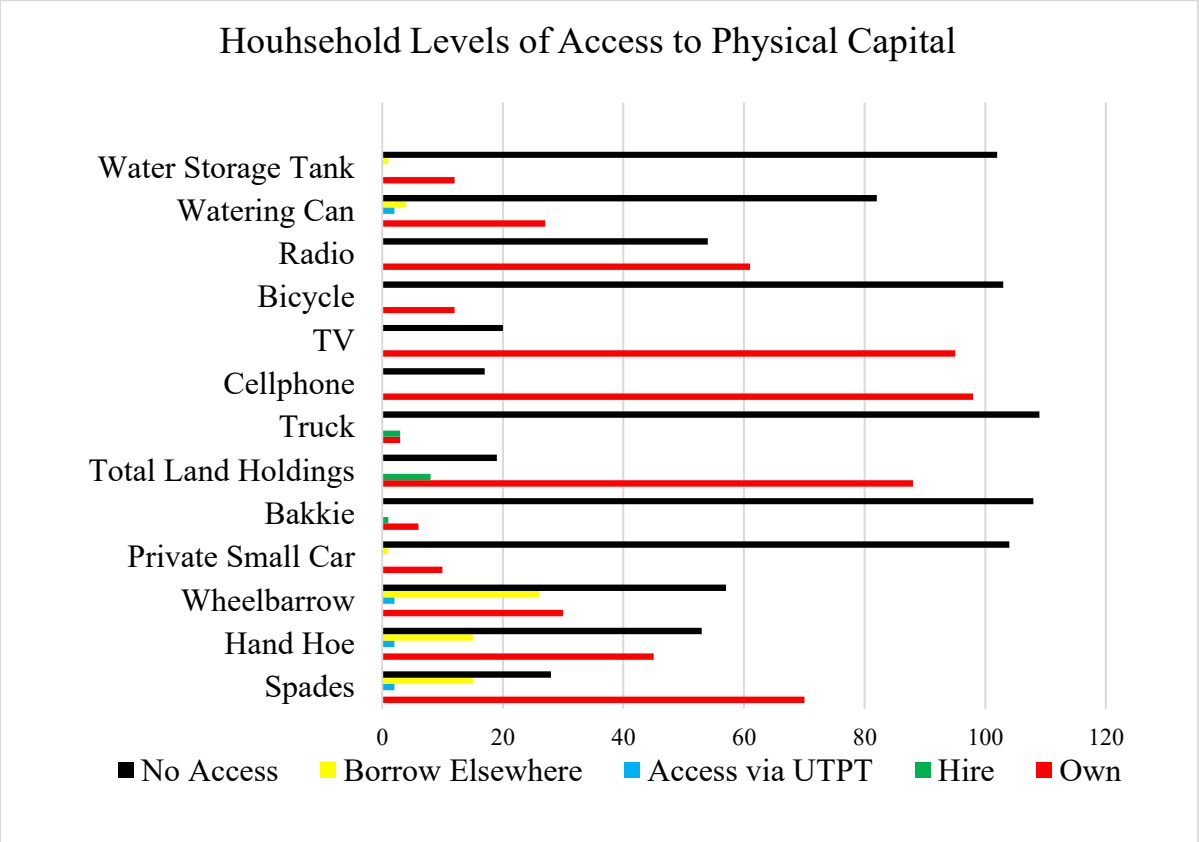


Figure 4. 1: Access to Physical Capital Assets

Very low levels of access were recorded for physical capital assets used for urban cultivation like water storage tanks and watering cans as can be observed in Figure 4.1. Items which had the highest prevalence of access by borrowing from other community members were predominantly agricultural assets of relatively low value (spades, wheelbarrows, hand hoes). Low access to agricultural tools were reported as a major constraint by the Linomtha Community Garden members whom had their tool shed and all its contents stolen in the past. The strong sense of unity within the group and the close-knit nature of their relationships and lived experiences is embodied as a member stated: "*We lend gardening tools to each other as others don't have them"* in the FGD held.

4.3.6 Household Members unable to work due to old-age or illness

This variable quantifies the number of household members that were destitute or dependent household members. That is to say, how many members of the household were unable to work due to old age or illness. As can be seen in Table 4.2, the mean dependency ratio was significantly higher in gardening households with almost a quarter (0.23: Std. = 0.25) of the households, on average, being dependent on the households. The number of dependent for NGs was half that of UGs with 12% of the household members, on average, dependent on the household (Std. = 0.19). The difference was highly significant at the 1% level implying that UGs have significantly higher dependency ratios compared to households who do not garden. More than half (52%) of the houses had at least one household member who was unable to work due to old-age or illness. 40% had 1 household member unable to work while only 12% had 2 and 3 destitute members in the household. Information in Section 4.3.1 which describes a positive relationship between participation and age provides crucial context. In many cases, elderly household members, although unable to work a formal job anymore, engaged in gardening activities to the benefit of their households' intake of healthy, fresh vegetables. As such, household dependents may not be a burden to their households but rather a positive force for sustaining household food security.

4.3.7 Number of Unemployed household members

This variable serves to monitor the link between unemployment rates and participation in urban gardening. The overall mean (pooled sample) was 1.88 (Std. = 1.43) implying that almost 2 members in each household were unemployed, on average. While NGs had a mean number of

unemployed individuals of 1.55 (Std.= 1.12), urban gardening households had significantly more unemployed members with 2.18 on average (Std. = 1.62). The difference is statistically significant at the 1% level indicative of s strong link between the number of unemployed individuals in a given household and the propensity to participate in urban gardening activities. Results can be seen in Table 4.2.

4.3.8 Number of Social Grants Received and Grant Income

The prevalence of Government social grants in low-income households in South Africa is notoriously high (Kasumba and Morongwe, 2017; Thornton and Nel, 2007). Shown in Table 4.2, it can be seen that UG households received a slightly higher number of social grants of 1.95 (Std. = 1.03) compared to NG households who received marginally fewer on average at 1.891 (Std. = 1.71).

Table 4.8 shows that social grant income was significantly (1% level of significance) higher among UGs at R2198.67 (Std. 1226.17) compared to NGs whose mean social grant income was R1600.55 (Std. 1409.33). Furthermore, income generated from off-farm activities (e.g. permanent, and part-time employment/non-agricultural entrepreneurial enterprise) was higher among UGs (R2279.93: Std.7502.113) compared to NGs (R1645.54: Std. 2601.997) although not significantly so. As can be seen in Table 4.7, among the UGs 91.67% did receive at least one grant while 8.33% did not receive a state transfer. For Non-Gardeners the prevalence of social grants was only slightly lower with 83.64% recipients and 16.36% whom did not receive a grant. Only 12.17% of the households did not receive a grant of any kind with 87.83% receiving a grant or multiple grants overall. A maximum of 6 social grants was received by one of the respondent households. A total of 222 grants were captured in the dataset where n=115. On average each household sampled were receiving just less than 2 grants. Old age and childcare grants make up the vast majority of grants received. Observing reported social grant income as well as income generated from all sources *other* than social grants illustrates the dire need for income generating opportunities and the general lack of opportunities for waged labour.

More than half (54%) of the respondent households “Never” spend any social grant money on agricultural inputs. On the other hand, 32% and 14% spend grant money “Sometimes” and “Always” on agricultural inputs. Just over one third of the households had received Covid-19 Grants during the lockdown period. forecasts indicating that the SA economy will continue to

shed jobs bodes very badly for household income which, as can be observed is already under immense pressure (IPC, 2020).

4.3.9 Agricultural Experience and Community Garden Membership

Among the control group of non-gardeners, agricultural experience was non-existent. However, among the combined sample of home and community gardeners, the mean years of farming experience reported was 10.05 years (Std. = 1.30). Home gardeners had on average tended to their home gardens for 9.67 years (Std. = 1.40) while the length of membership in the community gardens ranged between 0.2 – 30 years with the mean length of membership being 6.31 years and a standard deviation of 1.44. Urban Gardeners are posited as migrating to urban areas with agricultural experience – that those who participate in urban gardening do so with years of experience usually from rural areas. This is a salience hypothesis particularly in the South African context given the rapidly increase in urbanisation in the post-Apartheid era (Drimie et al., 2013; Bisaga, 2019). Results are presented in Table 4.5 below.

Table 4. 5: Farming Experience, years of home gardening and community garden membership

	Farming Experience (n=60)		Years of Home Gardening (n=36)		Community Garden Membership (n=24)	
Years of Agricultural Experience and Community Garden Membership	Mean	Std.	Mean	Std.	Mean	Std.
	10.05	1.303	9.67	1.403	6.31	1.44

Source: Own Survey (2021)

The following results presents the categorical socioeconomic characteristic of urban farmers compared to non-urban gardens variables as shown in Table 4.6.

Table 4. 6: Categorical variables, % (n=115)

Variable	Category	Pooled sample	Non-Gardeners (n=55)	Urban Gardeners (n=60)	Chi-test
Gender	Female headed	57.39	67.27	48.33	4.21**
	Male headed	42.61	32.73	51.67	
Access to credit	No	82.61	83.64	81.67	0.08
	Yes	17.39	16.36	18.33	
Livestock	No	88.7	92.73	85	1.71
	Yes	11.3	7.27	15	
Government extension	No	95.65	100	91.67	4.79**
	Yes	4.35	0	8.23	
Social Capital (Stokvel Membership)	No	19.13	85.45	76.66	1.43
	Yes	80.87	14.45	23.33	
Marital Status	Single	49.57	63.64	36.67	8.35***
	Married/Cohabiting	50.43	36.36	63.33	
Access to Private Transport Vehicle	No	84.35	83.64	85	0.04
	Yes	15.65	16.36	15	
Off-Farm Activity Dummy	No	46.09	54.55	38.33	3.04*
	Yes	53.91	45.45	61.67	
*, **, *** : Chi Square significant at the 1%, 5% and 10% levels of significance					

Source: Own Survey (2021)

4.3.10 Gender

Households headed by men were participating in urban gardening significantly more than female headed households (significant at the 5% level). Of the pooled sample of households, female household heads dominated comprising 57% compared to 43% who were headed by men. 67.27% of the NGs were headed by females with the remaining 32.73% headed by males. Of the UGs just over half were headed by Males (51.67%) while females led 48.33% of Urban Gardening Households (Table 4.6). It must be noted that households are traditionally led by the patriarch of the family (thus recorded as the household head), however observations from the enumerators and head researcher reveal that, although headed by men, women were responsible for household production and thus were far more likely to be the member of the household who tended the home garden. Indeed, other research by Van Veenhuizen (2006) posits that pparticipation in urban food production is higher among women. This contrary result may also reflect the changing demographics of the household in which the jobs sought by men

are harder to come by and thus many remain at home while the women of the house gain low-skilled or employment in the domestic sphere which are easier to come by.

Table 4. 7: Relationship between Gender and Education and Income

Variable	Education		Income	
	Mean	Std.	Mean	Std.
Male Headed	8.04	3.791	4800.12	7691.59
Female Headed	6.42	4.311	3212.82	2914.13
T-test	-2.092**		-1.54*	
*, **,*** : T-test significant at the 1%, 5% and 10% levels of significance				

Source: Own Survey (2021)

Taking a closer look at the gendered dynamics of the households under study (Table 4.7), female headed households exhibited average educational years (6.42 years) a full 20 months lower than the average education of a male household head (8.04 years). A p-value of 0.02 affirms this showing that the education of female household heads was significantly lower than the education of male household heads at the 1 % level of significance. Grouped by the gender of the household head, a large disparity can be observed in terms of the household total income. The difference between mean income of male and female headed households differed by R1587.50c with male headed households averaging R4800.12 while female headed homes generate average income amounting to R3212.82. Hypothesis testing reveals that the income of households headed by males is higher than those headed by women ($p = 0.0636$). This is consistent with van Avebeke (2007) who similarly found urban households headed by females had lower income in Atteridgeville Township in Pretoria.

4.3.11 Access to Credit access

A very low portion of households had made use of a credit facility of any form. Urban gardeners had slightly higher access to credit with 18.33% compared to 16.36% having made use of a credit facility among the NGs. Credit is often posited as having positive impacts on the uptake of productivity enhancing agricultural equipment and marketing among small-scale and community gardeners in the rural sphere (Sikwela, 2013). However, due to the financial constraints and lack of collateral among the sampled households as well as the low uptake of commercial community and individual urban farming in the low-income township setting of South Africa – this appears not to be the case. Of the 17% of all respondents who did access

credit, 65% accessed funds through a formal financial institution while 30 % used a local moneylender (loan shark) to access funds.

4.3.12 Livestock

Gardening households had higher ownership of livestock with 15% compared to the 7.27% of NGs (Table 4.5). Such low ownership of livestock is predominantly due to small plot sizes in all the townships surveyed where cows must be put to pasture on the urban fringe at the expense of time spend by the owner, family member thereof or hired shepherd. Cattle owners have no option but to keep their cattle in their yards at night for security reasons – turning their yard into a cow pen. A community gardener revealed that this is also done to collect the manure in order to maintain the health and productivity of the soil – an ongoing struggle and agricultural constraint. While 89% of respondents did not own livestock, of the 13 who did (11%), income varied greatly between a minimum asset value of R500 and a maximum livestock asset value of R144000. In this case, the respondent owned 12 healthy cows which were subjectively value at R12000 each. Of the livestock owned, cattle and chickens were most common with 4.34% and 6.1% households owning cows and chickens respectively. 30% of the livestock owners did so for consumption while almost 40% did so for the sale of their livestock. The remaining livestock owners did so either as a store of wealth or for cultural reasons.

4.3.13 Social Capital

Social capital and networking were gaged by enquiring if a household member was a part of a saving group referred to as a Stokvel. Households who participate in urban gardening were found to have a higher involvement in Stokvels with 23.33% of UGs holding membership compared to14.45 of NGs. The difference is not statistically significant. Table 4.8 indicates that 30% of UGs were not a part of another social organisation compared to NGs (45.45%). Overall membership in Savings Groups was low however higher among NGs (7.27%) compared to UGs (1.67). Burial Scheme membership was the highest in both groups as 41.82% (34.55% + 7.27%) of NGs and 61.67% (40% + 21.67%) of UGs were members. Notable, the proportion of UGs whom were a part of both Savings Groups and Burial Schemes was high as 21.67% while only 7.27% of NGs were in both.

Table 4. 8: Social Capital

Social Association (%)	Non-Gardeners	Urban Gardeners
None	45.45	30
Stokvel (Savings Group)	7.27	1.67
Religious/Church Group	5.45	6.67
Burial Scheme (only)	34.55	40
Savings Group & Burial Scheme	7.27	21.67

Source: Own Survey (2021)

4.3.14 Martial Status

The marital status of the entire sample (n=115) were as follows: 30% were single, 45% were married, 16% were widowed with only 4% and 5% being divorced or cohabiting respectively (Figure 4.2). Households participating in urban gardening (UGs) were prediminatly and significantly (1% level of significance) more likely to be led by a married or cohabiting household head with 63.33% falling in this category. Only 36.67% of the UGs were led by Single or Widowed household heads. The contrary is true for NGs where 63.64% were headed by Single/Widowed household members with the remaining 36.36% headed by married and cohabiting members.

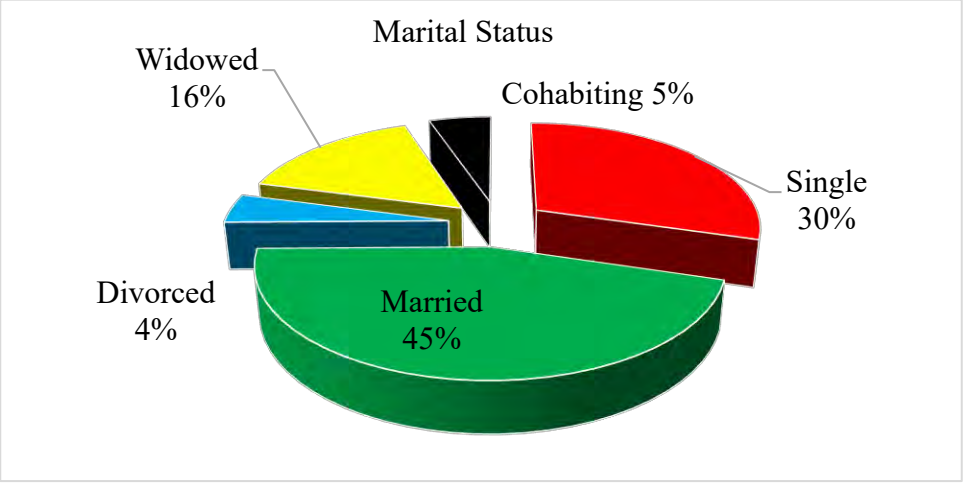


Figure 4. 2: Marital Status

4.3.15 Access to Transport Vehicle

The dummy variable captures whether the respondents had no access at all (code = 0) or some level of access through borrowing, hiring or owning a private vehicle (code = 1). Non-gardeners had slightly higher access to private transport (16.36%) compared to UGs (15%) although on the whole, access was very low with 84.35% of respondents having no access at all (Table 4.5).

4.3.16 Off-farm Activity

Table 4.8 illustrates that UGs were statistically more likely, at the 10% level of significance, to be generating income through off-farm activities (Permanent, Temporary, Non-agricultural entrepreneurial activities). While 61.67% of UGs were generating income from activities non-related to agricultural production or social grant transfer, only 45.45% of NGs were doing so.

Survey results concerning the primary employment status reveal that only 10% of the UGs were full-time gardeners amounting to 5.22% of the full sample of respondents (Table 4.9). This reflects the reality that even though there were 24 community gardeners (Table 4.1), most of them were either bound by household responsibilities (household production/childcare) or were handicapped by ailments related to their health and old age and thus did not consider themselves full-time gardeners as revealed in the FGD held. Of the NGs, 10.91% and 12.73% had stable waged and part-time employment while for UGs only 3.33% and 13.33% were employed on a full-time and part-time basis. This reflects the severely high levels of unemployment in the region (Eastern Cape Socio Economic Consultative Council, 2017) and the subsequent lack of income through wages that are paid out. Furthermore, more than half of the entire sample of households were headed by someone unemployed (54.78%) with half (50%) of UGs were unemployed and 60% of NGs also unemployed. As corroborated by the high mean age among UGs compared to NGs respondents (Table 4.2), there were more retired household heads among the UGs (23.33%) in comparison to NGs of which only 16.36 had retired.

Table 4. 9: Primary Employment Status in Percentage

Status	Pooled Sample	Non-Gardeners (n=55)	Urban Gardeners (n=60)
Full-Time Gardeners	5.22	-	10
Stable Waged Employment	6.96	10.91	3.33
Part-Time Employment	13.04	12.73	13.33
Retired	20	16.36	23.33
Unemployed	54.78	60	50

Source: Own Survey (2021)

4.4 Community Gardens: Agricultural Conditions

Communal land tenure is a defining characteristic of any community garden – and the security of that land tenure is a vitally important factor determining the level of investment by gardeners into the land. 42% of the community gardeners felt that they had secure land tenure on the communal plots while 37% had some anxiety around land tenure security and 20% experienced high anxiety over the security of their land tenure (Table 10). Notably, the 20% of community gardeners who did experience high anxiety over the security of their land tenure were all from the Linomtha Community Garden Co-op (UTPT). There were multiple complaints expressed against the NGO. Particularly with regards to land security, the FGD brought information to light which painted a bleak picture of the cooperative capabilities of the NGO. Land was "allocated" to new entrants by supporting NGO UTPT with no forewarning – land which was tirelessly worked on to bring about productive conditions and promptly taken away with no communication. This may be indicative of the dramatically heightened levels of anxiety reported by the Linomtha members. At the Extension 7 community garden – no such organisation is directly involved. There is no formal co-op as of yet – but sentiment over land security is much more positive. Asked whether the Umthathi Training Project Trust was vitally important in maintaining the community garden into the future, most farmers posited the NGO as 'important' (54%) while 29% through the NGO was not important.

Table 4. 10: Community Garden Biophysical Conditions, % (n=24)

Security of Communal Land Tenure	**Secure**	**Some Anxiety**	**High Anxiety**
	41.67	37.50	20.83
Soil Quality	Poor	Average	Good
	41.67	58.33	0
Agricultural Constraints	Often True	Occasionally True	Never True
Insufficient Rainfall	50	50	0
Water Availability	58.33	41.67	0
Soil Erosion	12.50	41.67	45.83
Crop Theft	4.17	75	20.83
No Access to Tools	33.33	50	16.67
Lack if Finance Constrains Productivity of Garden	41.67	54.17	4.17

Source: Own Survey (2021)

The sentiment of the community gardens with regards to the quality of the soil within their respective communal land tracts was rather negative as 41.67% reported poor soil quality and 58.33% reported average soil quality. Notably, none of the community gardens reported 'good' quality soils. Soil erosion constrains the community gardeners' productivity and to that effect just more than half reported soil erosion to 'often' (12.50%) and 'occasionally true' (41.67%). The prevalence of erosion appears moderate as 45.83% of the community gardeners reported that soil erosion was never a constraint to agricultural production. 75% of the community gardeners agreed that crop theft was 'sometimes' a constraint pointing to a persistent problem of crop and infrastructural destruction and theft. This was corroborated through the FGD and in conversation with the community gardeners outside the formal interview process. Only 16.67% of the 24 community gardeners did not experience any constraints with regard to accessing tools/equipment for farming while a further 12 farmers (50%) stated that access to tools was 'sometimes' a constraint. The remaining 33.33% felt that constrained access to tools was 'often true'. Asked whether financial constraints were inhibiting farmers from purchasing productivity enhancing inputs, 54.17% stated the aforementioned constraints were 'sometimes true' while a full

41.67% stated that resource constraints were ‘often’ hindering improvements in terms of productivity. Water security is seemingly a major concern and to that effect the questionnaire revealed that 70.83% used the onsite water source (small rainfed dam within the confines of the community garden itself).

Figure 4. 3: View of stream feeding Linomtha Community Garden Onsite Water Source (Photograph by: G Bruwer)

Water availability was revealed to be the most prominent constraint with 58.33% revealing it to ‘often’ being a problem and 41.67%, that it was ‘sometimes’ a problem. In the FGD community gardeners spoke of how the issue of water availability and subsequent cost to their gardens contributes to their experience of poverty. A gardeners went as far as saying that in the dry months, “*we find gardening useless because there is no water to water our crops”*. Key informant interviews, transect walks as well as the structured a FGD additionally revealed the onsite water source to be ridden with contaminants leading to severe algae build-up which hampered access. Figure 4.3 shows the extent of the pollution that plagues the river which feeds directly into the Linomtha Community Garden. The fence appearing in the top left quadrant of the image is the Perimeter/Security fence surrounding the land allocated to the Co-op as well as Umthathi Training Project Trust.

4.5 Reasons for Home Gardening

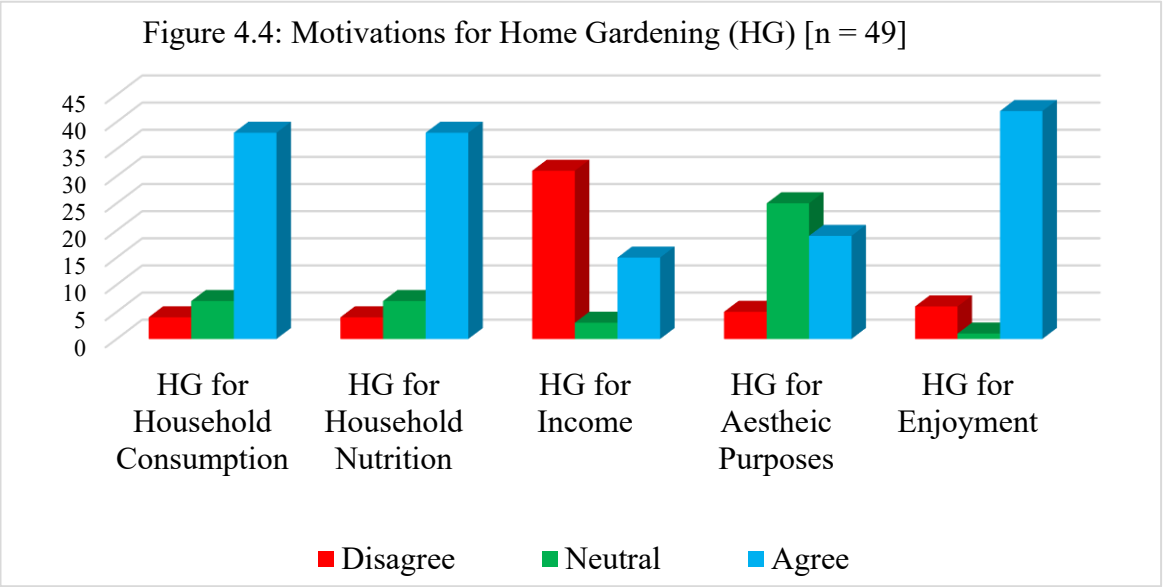


Figure 4. 4: Motivation for home gardening

Using a 5-point Likert scale data was collected pertaining to the main reasons behind participating in home gardening. Participants were asked whether they (1) Strongly disagree; (2) Disagree; (3) Remain neutral; (4) Agree; or (5) Strongly Agree. Figure 4 illustrates that 92% of home gardeners agreed that the garden was for home consumption with as much as 77% strongly agreeing. Asked whether their home garden was for the improvement of household nutrition similar results were found (92%). Only a third of home gardeners were motivated by generating income while just shy of 2/3rds disagreed (53% strongly so). Asked whether aesthetic improvements to the household and surroundings were reason for gardening, opinion was split. Half of the gardeners remained neutral with approximately 35% strongly agreeing. As to whether participation in gardening was for enjoyment, an overwhelming majority agreed (29%) and strongly agreed (57%) with only 12% disagreeing. These results are in line with empirical data which characterises home gardens as predominantly non-commercial ventures (Kanosvamhira and Tavera, 2019; Guidart et al., 2012; Reuther and Dewar, 2005).

Home gardeners were further asked if they wanted to expand land size under production. Of the 49 home gardeners, 71.43 % wished to expand the size of their home garden. However, the

reasons given for not doing so were land availability (65%) and possessing a lack of resources to expand (19%).

Table 4. 11: Reasons for NOT expanding Home Garden

Reason:	Percent (%)
Land Availability	64.86
Time Constraints	2.70
Lack of Resources	18.92
Water Availability	5.41
Other	8.11

Source: Own Survey (2021)

Interestingly water availability and time constraints with regards to their home gardens did not feature (Table 4.11). An attempt at uncovering the level if extension support experienced by home gardeners – 94% had had not extension support.

4.6. Household Water Security: Home gardens and Domestic Consumption

Of the households surveyed, 95% had access to running water on their property. The quality of the municipal water supply, especially for Makhanda East is well-known to be contaminated (e-coli bacteria, sewage) and undrinkable (Kretzmann et al., 2021; MacClennan, 2019; Nowicki, 2018). The municipality expects each and every household in the location to access safe drinking water by some other means – purchased, the local spring, a public tap or otherwise. And yet, a full 2/3rds of the households consumed household tap water. Only 5% had enough access to the spring to use it – a further 22% of the households purchased water for drinking supplementing it with tap water. For general household use, 92% used the household tap. 44% of home gardeners 'Always' experienced issues of waster insecurity for their home garden while 53% experiences issues only during the dry months. On average home gardeners reported that in the last 30-day period, they experience 15 days (Std. 6.509) although the survey took place during the winter months and one can expect the issue of water insecurity to get worse during the summer months.

4.7. Crop Selection

Cabbage and beetroot were the dominant crops planted in the communal land with 25% each. Other common crops onions/spring onions which was planted by 16.67% of the community gardeners. For home gardeners, spinach was the most common crop grown in home gardens with 75% of home gardeners having planted the leafy vegetable as their primary or secondary backyard crop.

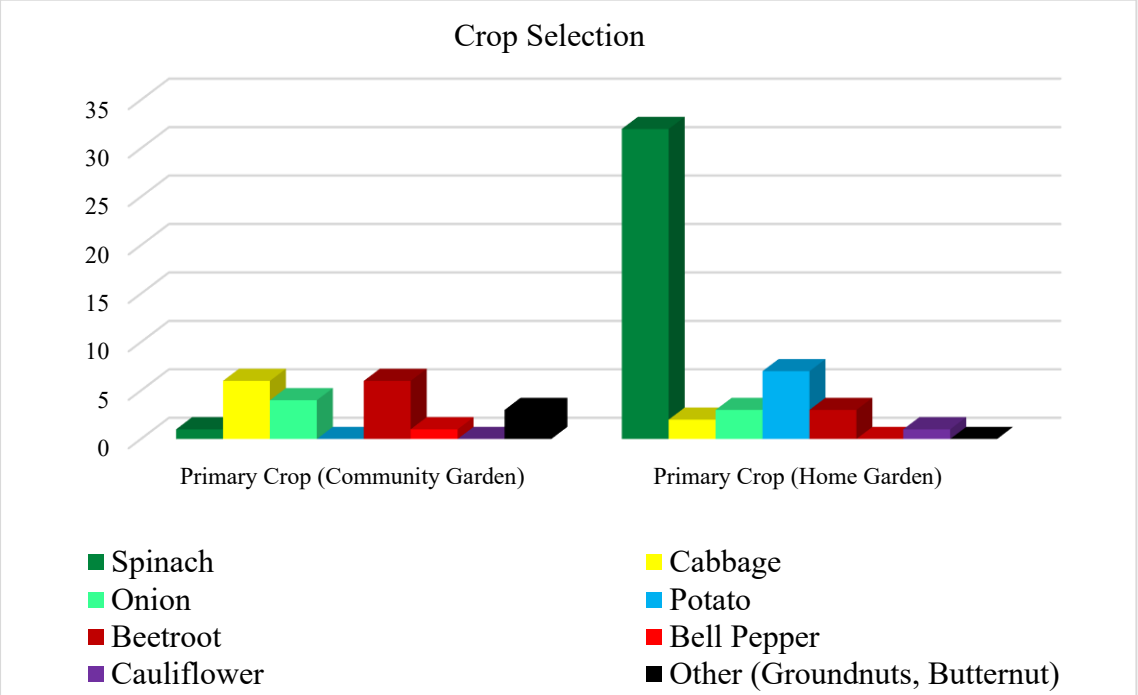


Figure 4.5: Community and Home Garden Crop Selection

Other dominant features were cabbage and beetroot (both 25% primary/secondary crop) as well as onion/spring onion (30%) and potato (just shy of 20%). Results appear in Figure 4.5.

4.7.1 Changes to Household Income, Food and Non-Food Income Over Time

Households were asked to express their household incomes, food spending and non-food spending in the month prior to the National Lockdown instituted on the 24th of March 2020 in addition to in the month prior to their interview (May-July 2021). Monitoring temporal changes to income and expenditure on food and non-food purchases gives an indication of the whether households in the sample area are worse or better off in the current time period compared to

the time period before the National lockdown was instituted on the 24th of March 2020. Additionally, by comparing these metrics between UGs and NGs, one can get a sense for whether there is correlation between participation and income and expenditure which are important for supporting food security. Table 4.12 illustrates that all measures are higher among urban gardeners compared to non-gardeners. However, correlation does not amount to causation. The causal relationship between participation in urban gardening and food security outcome variables (while controlling for underlying household characteristics) are undertaken using Propensity Score Matching methods as presented in Chapter 5.

Table 4. 12: The Impact of Lockdown on Income and Expenditure

	Pooled Sample		T test	Urban Gardeners		Non-Gardeners	
Variable	Mean	Std.		Mean	Std.	Mean	Std.
Income pre-lockdown	3958.65	5802.50	1.451*	4486.58	7635.78	3382.73	2593.78
Income post-lockdown	3666	5433.46		4101.41	7139.62	3191	2488.1
Food Spending pre-lockdown	1250.44	744.46	-0.621	1293.33	717.31	1202.78	777.48
Food Spending post-lockdown	1278.95	803.56		1345	781.23	1205.56	828.77
Non-food Spending pre-lockdown	542.18	1154.03	-1.208	623.36	1556.39	451.63	350.96
Non-food Spending post-lockdown	594.14	1247.84		711.03	1671.06	463.75	417.26
*, **, ***, T-statistic significant at the 1%, 5% and 10% levels of significance.							

Source: Own Survey (2021)

Reported household income dropped from an average of R3945.65 (Std. 5802.50) in the month prior to the Nation lockdown to R3666 (5433.46) in the month before the survey was administered (May 2021). The difference in pre- and post- lockdown income is statistically significant at the 10% level with a type 1 error rate of 7.47%. Mean Post-Lockdown Food spending (May 2021) was also not statistically different to food spending prior to the National lockdown. Rapid food price inflation (NAMC, 2021) necessitated an increase in food expenditure of, on average R28.50c per household per month. A similar trend is observed in terms of Non-food expenditure with Post-Lockdown non-food spending (R594.14c) on average

R51.95c higher than pre-lockdown period (R542.18c). Mean Food- and Non-Food-spending were found not to be statistically different.

4.7.2 Changes to Community and Home Garden Plot Sizes Cultivated

Changes to garden production intensity was also garnered using plot size as a proxy. Gardeners where asked to reveal their home and/or community plot sizes both prior to the Nation Lockdown (March 24th 2021) and at the time of their interviews between 13 and 14 months later (May-June 2021). Table 4.13 shows that the size of community gardeners' plots increased on average during the time period; February 2020 (25m^2) – March 2021 (26.58m^2). A paired t test reveals the increase in community garden size to be statistically significant at the 10% level of significance (P Value = 0.10). A paired t test was performed on the mean size of home gardeners' cultivated areas before and after the Lockdown period revealing that the pre-lockdown mean area (12.7m^2) is statistically smaller than post-lockdown cultivated area (13.2m^2) with a type one statistical error rate of 7.1% (p=0.07). Home gardens were on average approximately half the size of the community garden plots. Information from the FGD, key informant and household interviews attest to this significant increase in production intensity i.e., plot size, to be due to experiences of worsening household food security as well as household members being forced to remain at home due to the mobility restrictions imposed by the National Lockdown.

Table 4. 13: Changes to Community and Home Garden Sizes Cultivated

Land Size in M^2	Mean (m^2)	Std.	T-test
Community Garden Plot Size ~ PRE-lockdown	25	32.646	1.35* (0.10)
Community Garden Plot Size ~ POST lockdown	26.58	31.877	
Difference	1.58	5.748	
	Mean (m^2)	Std.	
Home Garden Plot Size ~ PRE-lockdown	12.70	11.39	1.50* (0.07)
Home Garden Plot Size ~ POST lockdown	13.19	11.24	
Difference	0.49	2.25	
***, **, *: T-test significant at the 1%, 5% and 10% levels of significance. P value in brackets			

Source: Own Survey (2021)

4.8 Changes to Market Access of Commercially minded Community Gardeners: March 24th 2020 – May-June 2021

The section of questions related to market access was exclusively answered by community gardeners who were motivated by crop sales and not solely home consumption for subsistence. Of the sample of 115, this group of commercially orientated community gardeners only consisted of 10 gardeners. Results are seen in Table 4.14.

Table 4. 14: Market Access Question, %: Source: Own Survey (2021)

Commercially Minded Community Gardeners (n=10)	Poor	Average	Good
Rate you level of Market Access	30	50	20
	Disagree	Neutral	Agree
I receive low prices	10	10	80
I struggle to access vital market information	20	10	70
I market my produce with trusted/established market connections which I have made	10	30	60
I struggle to make individual sales of my crops	40	10	50
Changes to Market Access March 24th 2020 – May-June 2021	Decreased	Unchanged	Increased
Since the onset of the lockdown period demand for produce has...	40	10	50
Since the onset of the lockdown period, prices received for produce have...	20	50	30
Since the onset of the lockdown period, the price of inputs (e.g. compost) has...	0	50	50

Of the 24 community gardeners, 42% were commercially orientated of which 50% considered their level of market access to be 'average' while 20% had 'good' and 'very good' market access which can possibly attributed to those initials and their market connections they nurture individually. Results indicate that 50% of gardeners sold to friends and neighbours while only 1 community gardener sold to local shops, shops in town and to stall holders respectively. Most of the commercially minded gardeners (80%) felt that they received low prices for their produce with only 10% felt that they did receive good prices on their produce. A similar trend is observed with regards to the struggle farmers go through to receive vital market information with 70% agreeing. A total of 60% agreed that they market their produce with trusted and

established market connection which they themselves had developed and maintained. Asked whether they struggle to sell their individual crops, sentiment was balanced as 40% disagreed and 50% in agreement.

A total of 3 questions were designed specifically investigated the changes that the lockdown period precipitated with regard to the market access (Table 4.14). Gardner's were asked to reveal whether demand for produce increased/decreased since the onset of the lockdown. Results are mixed. A total of 40% felt that demand had decreased while 50% felt that they had increased – the remaining gardener responded that demand had not changed. The majority of community gardeners farming for commercial exploits felt that their prices received on their produce had remined unchanged. As for agricultural inputs and the impact the lockdown has had on prices, half felt that prices had remined unchanged while 40% felt that they increased and a further 1 gardener posited that they had significantly increased. This can be somewhat attributed to the price inflation experienced in commodity markets during the lockdown period starting on 24th March 2020 (IPC, 2021).

4.9 Cooperative dynamics – Social Network/Collective action

4.9.1 Perception of Co-operative Dynamics

A series of question designed to investigate the community gardeners' perception of the co-operatives internal dynamics were posed as shown in in Table 14. The results are striking and appear contrary to research studies which found conflict to be rife in community garden collectives in varying contexts both rural and urban (Mashinini, 2001; Olivier and Heinecken, 2017; Shisanya and Handriks, 2000).

Table 4. 15: Perception of Garden Co-op Social Dynamics, % (n=23)

			Disagree	Neutral	Agree
There is a feeling of togetherness/cohesion among members			4.35	4.35	91.3
There is often conflict in the co-op			73.91	17.39	8.70
I share information/knowledge/farming techniques freely			13.04	4.35	82.61
I am treated with respect/fairness within the co-op and am free to speak openly during meetings			4.35	0	95.65
I trust the co-op leadership and other members			0	17.39	82.61
All co-op members contribute equally to decision making			0	17.39	82.61
UTPT actively promotes collective action, cohesion and integration between members			13.04	17.39	69.57
			Poor	Average	Good
Rate the Community Garden Policies			4.17	66.67	29.17
Importance of UTPT to Community Garden	Not Important at all	Not vitally Important	Neutral	Important	Vitally Important
	25	4.17	16.67	29.17	25

Source: Own Survey (2021)

More than 90% of the CGs agreed (30%) and strongly agreed (61%) that: 'There is a feeling of togetherness/cohesion among the members of the co-op'. Internal conflict in agricultural co-op is a common shortcoming (the problem of freeriding) of the organisation structure it embodies. However, 73.91% of the CGs disagreed that there was often conflict in the co-op. Asked whether they had trust in the co-ops leadership to achieve the groups goals and/or help with co-op challenges, more than half (54%) answered affirmatively – 30% remained neutral in response and the remainder did not trust the leadership to achieve their group objectives. More than 80% of the CGs shared information and agricultural techniques freely with other co-op members. 95.65% (all but 1 community gardener) felt that they were treated with respect and fairness within the co-op and were free to talk openly during co-op meetings. Not a single CGs felt that they expressly distrusted the co-op leadership and other members or that they were not treated as equals with the regards to communal decision making. This level of collective decision making and cohesion within the group promotes sustainable management of community gardens (Mashinini, 2001).

Asked how important Umthathi Training Project Trust (NGO operating in tandem with the gardeners) was to the sustainability of the community gardens, more than half (54.17%) perceived the NGO's involvement to be important of vitally important. However, almost a third (29.17%) of the community gardeners felt that they could maintain the gardens by themselves and that UTPT was not important alt all for the maintenance and management of the communal gardens.

4.9.2 Community Garden Cooperative Policies, Involvement in Collective Decision Making

Only one CG felt that the general policies and rules of the co-op were 'poor' while two thirds felt that they could be improved and the remaining 29.17% thought that they were 'good' (Table 4.15 above). Notable is that of the 17 community gardeners at Linomtha Community Garden, 13 felt that the policies could be improved which dominate the overall statistic. The extension 7 garden had only 7 members 1 of which felt the policies and rules were 'poor', 3 felt they could be improved and 3 felt they were good. All 24 wished to remain members of the Linomtha and Extension 7 Community Garden co-operatives. Of the 24 community gardeners 20.83% were committee members at one of the two gardens while the rest were general members. This speaks to the seemingly non-hierarchical structure of the community gardens. This is a feature of the community garden organisation structure alongside the tenants of communal land tenure (Mashinini, 2001), marketing (Roberts and Shackleton, 2018), transactions costs and risk sharing (Houessou et al., 2019).

The results show that 29.17% were introduced to UTPT by another member while 33.33% were introduced by relives/friends and 29.17% approached UTPT or Extension 7 community garden as a local. This speaks to the localized nature of Linomtha and Extension 7 community gardens as exclusively those living in close proximity to the communal land were motivated to involve themselves. A third of the community gardeners were never involved in co-op decision making while 29.17% were always involved. The remained involved themselves 'sometimes' (16.67%) and 'for most decisions' (28.83%). 2/3rds of the CGs were 'satisfied' (36.35%) and 'very satisfied' (31.82%) with their level of participation in decision making while only 9.1% of CGs were dissatisfied. 52.17% of the CGs had attended a co-op meeting in the 30 days prior

to their interview. As per the frequency of community garden co-op meetings: 50% attended 'monthly'; the remainder attended meetings 'only when required'.

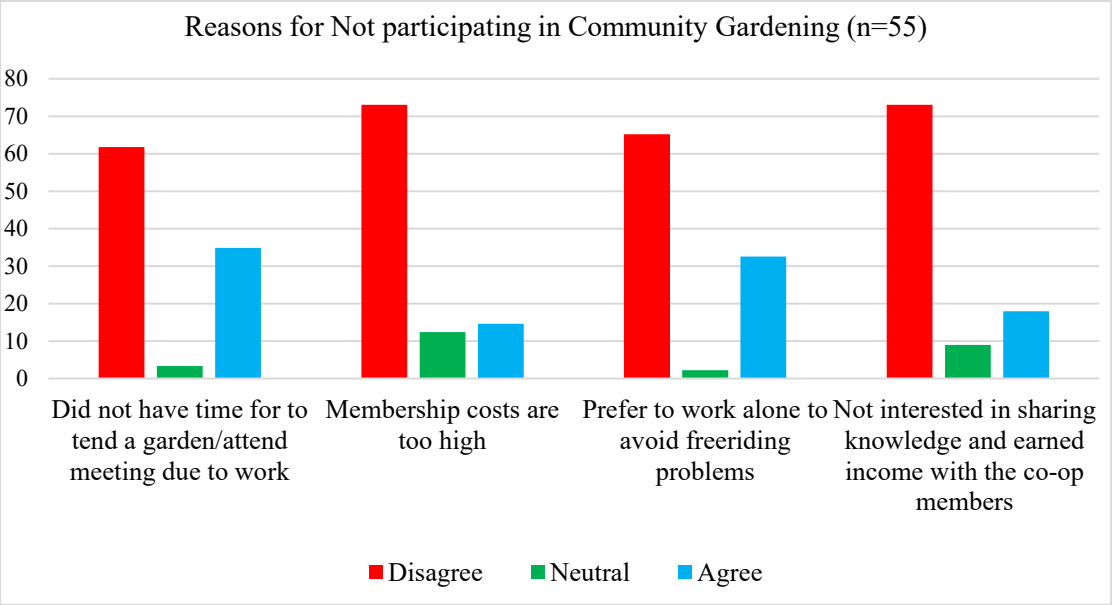


Figure 4. 6: Reasons for Not participating in Community Gardening

All households who were not members of either of the two community gardens (Linomtha Community Garden and Extension 7 Community Garden) were asked a series of 4 questions designed to investigate the reasons and motivations behind the households' decision against community gardening. Interestingly, as depicted in the Figure 4.6, the vast majority of NGs strongly disagreed and disagreed that the aforementioned reasons motivated their decision. Responses are clearly skewed towards Disagreement. It appears that neither of the motivations provided by the questionnaire garnered agreement. The skewness of the responses in Figure 4.6 do not elucidate any dominant motivations for remaining a NGs. However, Figure 7, provides vital perspective regarding this peculiar result.

However, the NGs were asked to identify their level of knowledge and familiarity with the Community Gardens and the Umthathi Project Training Trust as well as their willingness to join the garden. Results indicate that 64% of the households had no prior knowledge of UTPT – a striking result considering close proximity of the NGO to many of the households in Extension 7 Township. 15.73% of the households had 'Some knowledge – not considered joining' while an additional 13.5% had good prior knowledge of UTPT and had considered joining. Just shy of 7% had intimate knowledge of the NGO as they were former members. It can thus be surmised that the results depicted in Figure 6 must be viewed alongside Figure 4.7

and the fact that 64% of NGH had not heard of Umthathi Training Project Trust and did not know of their connection to Linomtha Community Garden.

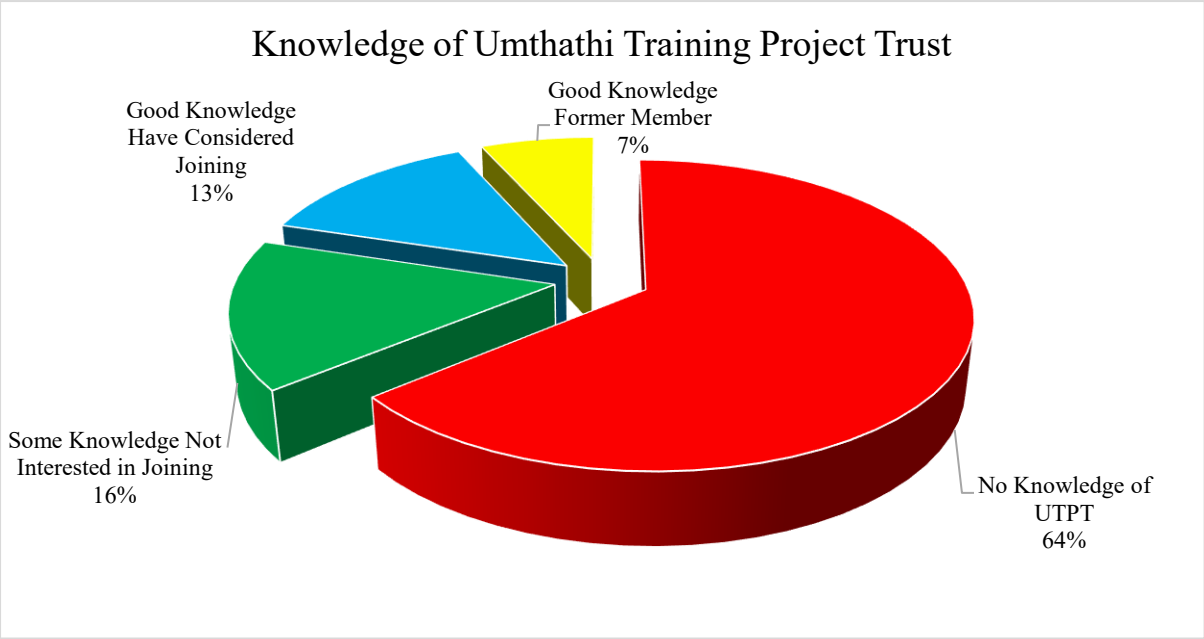


Figure 4. 7: Relationship of Control Group with Umthathi Training Project Trust

4.10 Food Security Indicators

Section 4.11 presents descriptive analysis of the food security indicators selected for this study. For the various indicators, significance testing was performed between UGs and NGs elucidating differences in food security between the those who participated in gardening and those who did not. Additionally. In Sections 4.11.2 and 4.11.3, Household Hunger Scale values and Self-assessment of Food security responses are presented for the time period prior to the Lockdown and at the time of the interviews. Significance testing is performed analysing whether these measured of food security significantly changed in the two time periods.

4.10.1 Household Dietary Diversity Scale

Table 4. 16: Dietary Diversity Scores and Food Security Classification

Food Security Indicators	Pooled Sample (n=115)		Non-Gardeners (n=55)		Urban Gardeners (n=60)		T-test
Variable	Mean	Std	Mean	Std	Mean	Std	-1.85**
HDDS	7.13	2.56	6.67	2.82	7.55	2.25	
Dichotomous Food Security Indicator based on HDD scores distributed around the mean.							
Group	%						
Food Insecure (<Mean)	56.52		63.63		50		
Food Secure (>Mean)	43.48		36.36		50		

Source: Own Survey (2021)

The Household Dietary Diversity Scores of the respondent households reflects the number of food groups consumed by that household on the day of the interview and the previous day (Maxwell et al., 2014:108; Peng and Barry, 2019). The average HDDS was 7.13 (0 .2390) as presented in Table 4.16. The mean scores of NGs (6.67) was significantly lower than the mean score of GHs (7.55) - the difference being 0.88 on average and significant at the 5% level of significance with a Type 1 Statistical error rate of 3.3%. Interpretation of the Household DD Scores differ from context to context. A large part of this has do with the setting of a threshold value (number of food groups consumed in the 24 hours prior to the interview) with which to classify households as either Food Secure (above) or Food Insecure (below) based of the DD score. Rajendran (2012) and Khumalo and Sibanda's (2019) posit the use of the mean DD score as threshold which, in this case is a score of 7.13. Thus, households are classified into two groups as aforementioned. Classified according to the mean, 56.52% of the respondent households are 'Food Insecure' and 43.48% are 'Food Secure'.

HDDS scores constructed by Swanelpoel and van Niekerk (2018) in informal sentiments in Cape Town Metropole reveal that HDDS scores were significantly higher in the research areas. Mitchells Plain (11.7) and Gugulethu (11.1) had the higher scores within the sample area while Bonteheuwel has a lower average HDDS of 9.3 (Swanepoel and Van Niekerk, 2018). This reflects the lower levels of food security and dietary diversity experienced in Extensions 6, 7 and Joza Locations in Makhanda East, Eastern Cape as compared to the Western Cape township settlements aforementioned.

4.10.2 Household Hunger Scale

Table 4. 17: Household Hunger Scale and the impact of the Lockdown Period

Food Security Indicators	Pooled Sample (n=115)		Non-Gardeners (n=55)		Urban Gardeners (n=60)		T-test
Variable	Mean	Std.	Mean	Std.	Mean	Std.	
Household Hunger Scale Pre-Lockdown	1.10	2.02	1.18	2.11	1.03	1.94	-3.60***
Household Hunger Scale Post-Lockdown	1.45	2.16	1.49	2.24	1.42	2.10	

Source: Own Survey (2021)

The Household Hunger Scale (HHS) results are presented in Table 4.17. It partially utilised the data contained within the HFIAS using the responses from Questions 7, 8 and 9 to construct a scale which aims to reflect the most severe aspects of food access and insufficiency (Maxwell et al., 2013). The mean HHS for NGs was 1.18 (Std. 2.11) pre-lockdown increasing to 1.49 (Std. 2.24) – notable the standard deviation also increasing. For UGs, HHS values were lower in both periods with a pre-lockdown mean of 1.03 (Std. 1.93) and post-lockdown mean of 1.42 (Std. 2.10). The combined mean value pre-lockdown of 1.104 was found to have significantly increased compared to the post-lockdown combined mean of 1.45 at the 1% level of significance. Thus, Household Hunger has significantly increased in all respondent households although both values classified as representative of "Little or No Household Hunger" as discussed below. The most extreme form of food insecurity (hunger) can thus be said not to be evident, on average, within the study area.

Table 4. 18: Food Security Classification as per the Household Hunger Scale

Classification	HHS range	%
Little or No Household Hunger	0-1	65.22
Moderate Household Hunger	2-3	20.00
Severe Household Hunger	4-6	14.78

Source: Own Survey (2021)

Deitcher et al. (2010) classified households as either experiencing Little/No hunger (score of 0-1), Moderate Hunger (2-3), and Severe Hunger (4-6). According to that classification, 65.33% of the sampled households experienced little/no household hunger while 20% experienced moderate household hunger (Table 4.18). 14.78% experienced severe levels of household hunger meaning that there was dire food insufficiency as indicated by the occurrence of a time when: no food was available at all in the household, household members went to bed hungry: and/or went an entire day without eating.

4.10.3 Self- Assessment of Household Food Security

Table 4. 19: Self-Assessment of Food Security Indicator

Self-Assessment of Food Security	Pooled Sample (n=115)		Non-Gardeners (n=55)		Urban Gardeners (n=60)		T test
	Mean	Std.	Mean	Std.	Mean	Std.	
Current Self-Assessment of Food	3.65	1.07	2.16	0.88	2	0.92	0.97
Sell-Assessment	%		%	-	%	-	
Food Secure	26.96	-	21.82	-	31.67	-	
Mildly Food Insecure	47.83	-	49.09	-	46.67	-	
Moderately Food Insecure	15.65	-	20	-	11.67	-	
Severely Food Insecure	9.57	-	9.09	-	10	-	
How does current household Food Security compare to household Food Security from previous							
Comparison of Self-Assessment of FS to previous years	Mean	Std.	Mean	Std.	Mean	Std.	
	2.08	0.9	3.76	1.02	3.55	1.111	1.07
			%	-	%	-	
Significantly	25.22		25.45	-	25	-	
Worsened	33.04		38.18	-	28.33	-	
Unchanged	25.22		27.27	-	23.33	-	
Improved	14.78		5.45	-	23.33	-	
Significantly	1.74		3.64	-	0	-	
*, **, *** : t-statistic significant at the 1%, 5% and 10% levels of significance							

Source: Own Survey (2021)

The response ‘Mildly food insecure’ dominates (47.8%) the self-assessment of food security at the household level looking at the whole sample. Roughly a quarter of the households considered themselves ‘moderately’ (15.65%) or ‘severely’ (9.57%) food insecure. 26.96% of the respondent households considered themselves food secure. Comparing UGs to NGs (Table 4.19) shows that while only 21.82% of NGs considered themselves food secure, 21.67% of UGs classified themselves as such. Just under half (49.09%) of NGs and 46.67% of UGs considered themselves to be ‘Mildly food insecure’ while 20% and 11.67% were ‘Moderately Food Insecure’. Those who considered themselves ‘Severely food insecure’ were 9.09% NGs and 10% UGs. The distribution of these self-assessments paints UGs as slightly better off in terms of food security.

4.10.4 Coping Strategy Index

Table 4. 20: Full Coping Strategy Index and Reduced Coping Strategy Index

Variable	Pooled Sample (n=115)		Non-Gardeners (n=55)		Urban Gardeners (n=60)		T test
	Mean	Std.	Mean	Std.	Mean	Std.	
Full CSI	6.62	5.67	6.87	6.09	6.38	5.29	0.46
Reduced CSI	5.88	4.52	6.22	5.03	5.58	4.01	0.75

Source: Own Survey (2021)

Both the full Coping Strategy Index (CPI) and Reduced Coping Strategy Index (rCPI) measure the frequency of the application of behaviours which increase in frequency when a household approach heightened levels of food insecurity (Maxwell and Caldwell, 2008; Kruger et al., 2008). The mean value of the full CPI for all respondent households was 6.617 (Std. 0.53) with the reduced CPI having a mean value of 5.89 (Std. 0.42). Testing reveals no significant difference in both the CPI and rCPI values between UGs and NGs. Table 4.20 however shows that NGs do exhibit a slightly higher index value implying that, although not significantly so, UGs do exhibit slightly lower index values meaning that the likelihood of exhibiting the pre-determined coping strategies is slightly higher in households who are not involved in urban gardening.

T-tests for significance were performed on the individual coping strategies in order to surmise any significant differences between the application and frequency of coping strategies applied by urban gardeners compared to non-gardeners. The frequency codes, as explained to

respondent during the survey are: Never=0; Hardly at all (<1 time/week) =1; Once in a while (1-2 times/week) =2; Often (3-6 times/week) =3; and Every day=4.

Table 4. 21: Frequency of Coping Strategies applied during Food Shortages

Coping Strategy	Pooled Sample (n=115)		Non-Gardeners (n=55)		Urban Gardeners (n=60)		T test
	Mean	Std.	Mean	Std.	Mean	Std.	
Rely on less preferred and less expensive foods	1.82	1.14	1.82	1.14	1.82	1.14	0.01
Borrow food from a friend or relative	0.65	1.02	0.82	1.20	0.5	0.79	1.69**
Purchase food on credit	0.15	0.53	0.18	0.58	0.12	0.49	0.65
Gather wild food, hunt, or harvest immature crops	0.15	0.57	0.04	0.27	0.25	0.7	-2.05**
Consume seed stock held for next season	0.14	0.44	0	0	0.27	0.58	-3.42***
Send children to eat with neighbors	0.19	0.67	0.35	0.91	0.05	0.29	2.40***
Send household members to beg	0.15	0.52	0.16	0.57	0.13	0.47	0.31
Limit portion size at mealtimes	1.4	1.19	1.42	1.20	1.47	1.2	-0.22
Restrict consumption by adults in order for small children to eat	.66	1.15	0.67	1.12	0.65	1.19	0.11
Reduce number of meals eaten in a day	1.31	1.27	1.49	1.30	1.15	1.22	1.45*
Skip entire days without eating	0.10	0.52	0.09	0.44	0.12	0.59	-0.26

Significantly different responses were found for the UGs compared to NGs for 5 of the coping strategies. The mean frequency of borrowing food from relatives or friends was found to be significantly higher in NGs (mean = 0.82 Std Dev = 1.20) compared to the UGs (mean = 0.5 Std Dev = 0.79) at the 5% level of significance. On average Non-Gardeners also sent household children to eat at neighbors/relatives significantly more frequently (mean 0.35 Std Dev = 0.91) compared to UGs (mean = 0.05 Std Dev 0.29), a result significant at the 1% level. Additionally, NGs also reduced the number of meals eaten in a day due to food shortages significantly (10%

level of significance) more often (mean = 1.49 Std Dev = 1.30) compared to gardening households (mean = 1.15 Std Dev = 1.22).
Significant negative results were found for gathering wild food and consuming seed stock held for the following year.

The nature of the specific coping strategies was closely related to knowledge of wild foods or having a garden (collecting seed stock/consuming immature crops) and thus the proliferation of these strategies was understandable low or even non-existent in the case of consuming seed stock. The mean frequency of household gathering wild food, hunting or harvesting immature crops was significantly lower among non-gardening households (mean 0.04 Std Dev = 0.27) compared to the mean frequency of this coping strategy being applied by gardening households (mean = 0.25 Std Dev = 0.72). Chakona and Shackleton (2017) investigated the importance of the consumption of wild foods finding that consumption of wild foods acted as a "safety net" for the most food insecure households whom had on average lower dietary diversity and a lower wealth index (Chakona and Shackleton, 2017:92). They call for the promotion of the collection of wild foods such as wild vegetables as a way to combat food insecurity and malnutrition by expanding dietary diversity and in so doing reducing the reliance on purchased foods – the prices of which are ever increasing in the South African context.

Within the Linomtha Community Garden's tract of land, several members often were seen collecting *imifuno* (isiXhosa for vegetable/herb) from the areas outside the cultivated plots. From key informant interviews with the local extension officer, several wild crops were identified. Two different types of nettles named *ihlaba* and *irhawu* in addition to a green leafy vegetable called *umsobosobo* were harvested. The combination of these wild crops cooked together with the local stable food of *ipapa* (porridge made of ground maize) is commonly prepared and referred to in its combination as *isgwamba*. This is a good example of how this wild food supplemented the food and nutrient intake of gardening households whom had the knowledge of its location at no cost to the environment.

4.11 Summary of Descriptive Statistics

This chapter presented a comprehensive descriptive statistical analysis of household demographics and socioeconomic characteristics of the sample focusing on significant differences between urban gardening participant and non-gardening households. Compared to

non-gardeners, urban gardening households had significantly older household heads with lower years of education as well as significantly higher numbers of household dependents and unemployed members. Interestingly, male headed households were participating in urban gardening significantly more than female headed household. Among gardening participants, the incidence of households engaging in off-farm activities was significantly higher than in non-gardening households. Very low instances of gardening activities being the primary occupation of participant was observed. Rather, households engaged in home gardening for household consumption, nutrition and enjoyment. Land and water availability were primary constraints to expanding home gardens and increasing the productivity of community gardens while accessing gardening equipment and financial capital also featured prominently. Household Dietary Diversity Scores were significantly higher among UGs (7.55) compared to NGs (6.67) and a lower percentage of gardening households fell below the mean HDDS of 7.13.

The Household Hunger Scale data was collected for both pre and post lockdown time periods with results indicating no statistical difference between NG and UGs scores although mean score were lower in GHs. However, the Household Hunger Scale pooled sample mean did significantly increase between the two time periods from 1.1 to 1.45 at the 1% level of significance reflecting the worsening food security situation of the survey recipients as a result of the Covid-19 pandemic and national lockdown period. This is in line with data presented by the IPC (2021) which forecasted the number of severely food insecure households to drastically increase because of the Covid-19 Pandemic and National Lockdown period. The Self-Assessment of Food Security Indicator results reflected a positive effect associated with gardening on food security as more gardening households considered themselves food secure (31.67%) compared to NGs (21.82%). Additionally, 63.63% of NGs considered their household food security to have worsened which compares favorably to the 53.33% of gardeners who felt that way. Both results, however, clearly show how the food security of both UGs and NGs has generally deteriorated quite significantly since the onset of the National Lockdown instituted on March 24th 2020.

Chapter 5 present the empirical findings from the probit model, average effects model and propensity score matching method which examined the determinants of being an UGas well as the impact that participation has on the outcome variables (food security indicators).

CHAPTER 5: RESULTS AND DISCUSSION

5.1 Introduction

The empirical results of the probit model and average marginal effects are presented in Chapter 5. Section 5.1 followed by the analysis of the propensity score matching method (Section 5.2). The probit model and average marginal effects models the probability that respondent households choose to participate in urban gardening. Analysis and interpretation of the significant determinants of participation are given. The propensity score matching results relate to the selected outcome variables (Section 3.5) which are the Household Dietary Diversity Score, Full and Reduced Coping Strategies Index as well as Household Hunger Scale. Section 5.2 provides analysis of the proposed causal link between participation in urban gardening and improved outcomes in terms of the indicators of food security. Section 5.2.2 present the analysis of the results' sensitivity to hidden bias using Rosenbaum bounds. Section 5.3 discusses the relevance of these results citing relevant literature.

5.2 Results on factors influencing participation in urban gardening: Probit Model

The probit regression models the likelihood of a respondent household choosing to participate in urban gardening activities based of the covariates selected from the relevant literature. Table 5.1 shows the variance inflation factors associated with participation in urban gardening. Through observation of the mean Variance Inflation Factor (VIF) (1.35) of the explanatory variables, multicollinearity is assessed and confirmed not to be an issue. According to Tay (2017), as a selection criterion for regression modeling, the VIF indicates strong multicollinearity when values are above 5.

Table 5. 1: **Variance Inflation Factors for Dependent Variables**

Variable	VIF	1/VIF
Number of Dependents	1.78	0.562162
Age	1.65	0.605130
Income per capita	1.61	0.620694
Earned Income	1.43	0.698475
Social Grants (number)	1.37	0.729069
Marital Status	1.31	0.764427
Household Unemployment	1.26	0.792775
Access to Transport	1.22	0.822883
Gender	1.18	0.845879
Land Value (logged)	1.16	0.860087
Access to Credit	1.16	0.861374
Stokvel Membership	1.09	0.915534
Mean VIF	1.35	

Source: Own Estimation (2021)

Additionally, correlational coefficients were computed between all explanatory variables. None of the coefficients breach the suggested threshold of between 0.6-0.8 which would indicate strong correlational influence between explanatory variables rendering them dependent on one another (Tay, 2017). The full table of correlation coefficients presented in Appendix A. The chi-square statistic is highly significant at the 1% level implying that the model specification fits the data well as shown in Table 5.2. The R^2 of 0.2537 amounts to decent explanatory power of the model due to it being cross-sectional in nature. The value of the R^2 can be expected to be higher when time series is used as the variance of the data is usually higher in cross sectional datasets (Sanchez and Maroney, 2015).

Significant covariates include the gender (10% level) and age (5% level) of the household head as well as the number of unemployed household members (1% level), household dependents (5% level) and social grants received (5% level). Moreover, the dummy variable for household employment is significant at 10% level which was set to 0 if the households' income was measured at R0 or consisted of entirely social grant transfers and. The dummy was set to 1 if a

household member was employed or self-employed (Permanent/Temporary employment; crop and livestock production; or non-agricultural entrepreneurial efforts). The remaining independent variables, although important, were insignificant determinants of urban gardening. The Table 5.2 shows the probit regression model coefficients and standard errors as well as the marginal effects results.

Table 5. 2: Probit Regression Model

Urban Garden Participation	Probit Model		Marginal Effects	
			dy/dx	Delta-method
	Coefficient	Std. err.	Coefficient	Std. err.
Gender	0.527*	0.298	0.153*	0.083
Age	0.0344**	0.013	0.010***	0.004
Number of Unemployed Household Members	0.349***	0.122	0.101***	0.032
Income per capita	0.0002	0.0001	0.0001	0.00003
Number of Social Grants Received	-0.269**	0.121	-0.078**	0.033
Number of Household Members unable to work due to old-age or illness	0.587**	0.271	0.170**	0.074
Marital Status	0.278	0.290	0.081	0.083
Credit Access	-0.269	0.395	-0.078	0.114
Household Employment Dummy	0.548*	0.325	0.159*	0.091
Savings Group/Stokvel Dummy	0.363	0.348	0.105	0.099
Access to Transport Vehicle	-0.443	0.418	-0.129	0.120
Land Value (logged)	-0.006	0.026	-0.002	0.008
_cons	-3.193	0.820		
Number of observations	115			
LR chi2(12)	40.39			
Prob > chi2	0.0001			
Log likelihood	-59.409444			
Pseudo R2	0.2537			
Variance Inflation Factor	1.35			

*, **, *** indicate significance at the 10%, 5% and 1% levels of significance.

Source: Own Estimation (2021)

Male headed households are 15.3% points more likely to participate in urban hardening, a result which is significant at the 10% level. This is contrary to expectation, which posits that women are more likely to head a household which chooses to participate in urban gardening (Swanepoel et al., 2021; Kanosvimhira and Tavera, 2019). However, as per the traditional nucleal family structure typical of the households under survey, it is likely that, even where men did head the household, that the head female in the household would still tend the garden. This is due to homestead and backyard gardening falling under the purview of household production and is thus traditionally the responsibility of women in the household.

The age of the household head is found to be positively correlated with the likelihood of participating in Urban Gardening. Significant at the 5% level, for every year older the household head was, the probability of participation in urban gardening increases by 1% point. This result conforms to a priori economic expectation as informed by the literature (Onyango, 2010; Maswikaneng et al., 2002; Modibedi et al., 2020) as well as key informal interviews and the FGD which was facilitated between the community gardeners. Linomtha Garden Co-op members spoke of the unwillingness of younger generations to invest their time in the physical labour required for a garden to be maintained – and that they lacked the perseverance and patience to be successful as community gardeners. This is in line with the findings of Vibert (2018) who found a negative perception of urban gardening activities from younger generations in the Hlakateni Gardens, Gauteng Province.

Moreover, the results indicated that household unemployment is highly significant at the 1% level of statistical significance. The variable denotes the total number of household members who were a part of the labour force but remained unemployed. For every additional household member without employment, the probability of that household participating in urban gardening increases by 10.1% points. This result somewhat corroborates the literature which connects the concurrent increase in urban gardening and unemployment as a result of economic shocks such as war, drought, natural disasters, and pandemic (Niles et al., 2021; Dissanayake and Dilini, 2020; Lal, 2020). Research out of Valencia, Spain after the 2008 Financial Crisis, found evidence that citizens dealt with sharp increases in commodity costs and the loss of income by choosing to participate in community and home food production (Palau-Salavador et al., 2019), – this is found to be one of the many coping mechanisms employed by urban low-income residents to combat unemployment. An example of the historical link between

economic shocks and the increased proliferation of urban gardening is presented by Endres and Endres (2009). In the United States, the severe economic and social conditions of the War precipitated exponential increases to urban food production to the point where 40% of fresh produce was grown in what have been come to be known as Victory Gardens (Endres and Endres, 2009). In the Eastern Cape as well as nationally, the Lockdown and ensuing economic downturn precipitated a large loss of jobs, the impact of which was compounded by households having to remain at home. This was enforced by the National Lockdown which was instituted by the South African Government to prevent huge loss of life and slow the spread of the virus. This is particularly impactful in the Eastern Cape which is regarded as the poorest province in South Africa where employment opportunities are scarce.

Furthermore, the results indicated that the number of household members unable to work due to old-age or illness has a significant impact on the probability of a household participating in urban gardening. The coefficient is positive and significant at the 5% level and illustrates that the probability of a household participating in urban gardening increases by 17% points for every additional household member who cannot work and is thus classed as a dependent. This conforms to expectation corroborating Modibedi et al. (2020) who posited that elderly and retired gardeners chose to cultivate a garden to keep physically active. This is a poignant result given the strong correlation between age and participation in UG, which indicates that the elderly are more likely to take part in gardening activities. Particularly when low-income, generally black members of the labour force are rendered unable to fulfil the duties of a formal or physically intensive job, it appears as though there is a tendency to turn to gardening as means to provide some healthy produce for others, particularly children, as well as to pass the time and beautify their homesteads where they now spend the majority of their time (Focs Group Discussion, 2021).

The number of social grants received by a household (monthly) was found to be a significant determinant of the choice to participate in urban gardening. As expected, the coefficient is significant and negative implying that the more social grants a household receives, the lower the probability of that household choosing participation. Significant at the 5% level of statistical significance, for every additional social grant that a household receives, the probability of participation in urban gardening deceases by 7.8% points. This is in line with findings from Peddie in the Eastern Cape by Thornton and Nel (2007) who posit a negative correlation between participation in urban gardening activities and whether households were

recipients of social grants. In their study, the poorest households who did not receive grants were more likely to take up gardening to combat the lack of income for food purchases. Although Thornton and Nel (2007) conclude there to be level of dependency on social grants which constrains the development of urban agriculture, Sinyolo (2016) refutes these claims of a social grant reliance positing that unemployed South African, whether they receive grants or not, had positive attitudes with regards to work and that there is no clear evidence to support a dependency syndrome.

The employment dummy variable took the value of 0 if no member of the household was formally or otherwise employed in entrepreneurial or agricultural production. The dummy took the value of 1 if they did generate income from one of the aforementioned income channels. The marginal effect coefficient is positive and significant at the 10% level implying a positive association between participation in urban gardening and the ability of that household to generate income from waged labour, crop sales and/or other entrepreneurial activities. Households who had a member(s) who were gainfully employed were, on average, 15.9% points more likely to participate in urban gardening. This result is contrary to results from Khumalo and Sibanda (2019) who found the prevalence of paid employment and entrepreneurial self-employment to be higher in households who did not participate in urban gardening activities. Contrary to the expectation that employed households were constrained in terms of the time they had free to cultivate a garden, paid employment and/or self-employment (diversified income sources and livelihood strategies) increased the likelihood of gardening. This is most likely due to unemployed households needing all disposable income to live a dignified life and combat food shortages through food purchases and not household production.

5.3.1 PSM Results: Matching quality and sensitivity testing

Table 5. 3: Matching test quality for covariates

After Nearest Neighbour	Means				
Variable	Urban Gardeners	Non-Gardeners	% bias	% bias reduction	P-value of equality of mean
Gender	0.355	0.432	-15.8	59.1	0.540
Age	58.548	58.29	1.9	96.9	0.938
Number of Unemployed Household Members	1.613	1.639	-1.9	96.0	0.931
Income per capita	1003.6	1086	-6.2	67.1	0.767
Number of Social Grants Received	1.936	2.161	-16.0	-282.1	0.561
Number of Household Members unable to work due to old-age or illness	0.516	0.555	-5.7	90.6	0.785
Marital Status	0.419	0.419	0.0	100.0	1.000
Credit Access	0.129	0.142	-3.4	34.5	0.884
Household Employment Dummy	0.548	0.490	11.7	64.2	0.654
Savings Group/Stokvel Dummy	0.226	0.206	4.9	78.0	0.856
Access to Transport Vehicle	0.161	0.129	8.8	-136.6	0.724
Land Value (logged)	8.401	7.984	7.8	72.4	0.764

Table 5.3 presents results for the quality of matching between the treated and untreated observations are presented. Results are computed using the "pstest" command with the additional option specifying output to include both the matched and unmatched samples. The table reveals that, after matching has taken place using the Nearest Neighbour option attached to the "Psmatch2" command, there is no significant statistical differences between the treated and control units. All P-values for the equality of means are insignificant after matching

implying that there is no statistical difference in covariates between the two groups after matching. This can be corroborated by Table 5.3 in which the standardized differences (% bias) between the means values of the explanatory variables in the two groups are given. All values of the standardized differences are below 20% which indicates that the balancing condition is sufficiently satisfied (Phakathi et al., 2021). All the P-values for the equality of means are insignificant after matching implying that there is no statistical difference between the two groups after matching.

Testing the matching quality between the treated sample of UG and the control sample of NGs was performed. This requires the use of the Stata command "Psmatch2" which tests that the two groups are not altered by the matching process (Leuven and Sianesi, 2003). Table 5.4 below present the summary results on matching quality for all algorithms employed in the study. The results confirms that there is no statistical difference between the control and treated group in terms of their characteristics for the three matching algorithms being Kernel, Radius and Nearest Neighbour.

Table 5. 4: Summary of quality-matching test for selected algorithms

Algorithms	Sample	Pseudo R^2	Wald Chi-Square (p values)	Mean Standardised Bias	Median Standardised Bias
Kernel Matching	Unmatched	0.254	40.39 (0.000)	31.4	30.4
	Matched	0.015	1.29 (1.000)	5.1	3.9
Radius Matching	Unmatched	0.254	40.39 (0.000)	31.4	30.4
	Matched	0.166	10.10 (0.608)	18.9	14.6
Nearest Neighbour	Unmatched	0.254	40.39 (0.000)	30.4	30.4
	Matched	0.026	2.23 (0.999)	7.0	6

This follows the procedure performed by Phakathi et al. (2021) in ensuring good quality matching between control and treated units and no statistical differences in the distribution of the covariates before and after matching. Similar to Phakathi et al. (2021), the pseudo R^2 measures are relatively higher on the unmatched sample compared to after matching across all three algorithms. This indicates that there are no statistically significant differences between the treated and control observations after matching has been performed in terms of the

distribution of the covariates. Caliendo and Kopenig (2005) corroborate this stating that the test for joint significance of the covariates should not be rejected before matching but should be rejected after matching. This can be observed in Table 5.4. to hold true. A further indication of whether the balancing property is satisfied is observed by the mean and median standardized bias. According to Austin (2009), the mean standardized bias must be initially high prior to matching and then drastically reduced after matching. The author posits that this indicates that once observations are matched based on their propensity scores, the mean and prevalence of underlying covariates have been made to be highly similar between the control and treatment observations.

The results in Table 5.4 show that across all three matching algorithms, both mean and median standardised bias have been substantially reduced after matching confirming that the covariates of the two groups, on average, are now balanced after matching. As a test of the similarity of the distribution of the underlying baseline covariates across the two groups based off their propensity scores, these "balancing diagnostic serve as a test of whether the propensity-score model has been adequately specified" (Austin, 2009:3103). Given the results of the testing which revealed mean bias to be lower than 0.20 across all three algorithms, it can be confirmed that the model has been satisfactorily specified. Furthermore, the Wald chi-square for joint significance of the covariates in not significant across the three algorithms (p=0.000 for all three) pre -matching, while after matching, the test for joint significance was strongly rejected with p values of between 0.608 – 1.000. The study then analysed the impact of treatment on the selected outcome variables using propensity score matching.

5.2.2 The effect of Urban Gardening Participation on the full and reduced Coping Strategy Index

This section presents the average treatment on the treated (ATT) PSM results on the impact of urban gardening on food security based on full (CSI) and reduced coping strategy indicators (rCSI) as explained in Chapter 3 (Table 5.5). The ATT results are also presented for the food security indicator based of the Household Dietary Diversity Scores as well as the Household Hunger Scale. Results from the matching algorithms on the impact of participation were found to be insignificant for the Household Hunger Scale and Dietary Diversity indicator. This section consists of interpretations and discussions of the significant results.

Table 5. 5: The effect (ATT) of Urban Gardening Participation on outcomes variables

Outcome Variables	Nearest Neighbour	Kernel Matching	Stratified Matching	Radius Matching
Dietary Diversity Scores distributed around mean	-0.167 (0.245)	-0.142 (0.200)	0.123 (0.119)	0.194* (0.109)
Coping Strategy Index	-8.550** (3.890)	-5.192* (3.109)	-2.717* (1.501)	-2.280* (1.266)
Reduced Coping Strategy Index	-7.183*** (2.962)	-5.192* (3.114)	-2.402* (1.314)	-1.867* (1.032)
Household Hunger Scale	0.683 (2.498)	0.029 (2.122)	-0.281 (1.824)	-0.420 (1.346)
ATT coefficients reported with standard errors in brackets. *, **, *** indicate significance of ATT at the 10%, 5% and 1% levels of significance.				

For the outcome indicators CSI and reduced CSI, significant ATT across all four matching algorithms can be observed (Table 5.5). The significant results are consistently negative which denotes that the impact of participation in urban gardening was to reduce the number of undesirable coping strategies that gardening households applied as a direct result of their participation in the activity.

The Nearest Neighbour matching method shows that participating in urban gardening has a negative and significant effect on the number of coping strategies a household employed in times of food insecurity. The impact of participating in urban gardening, in Makhanda East, was to reduce the Coping Strategy Index by 8.55. The Kernel Matching Algorithm also found the impact of engaging in urban gardening to be significant and negative. The impact of urban gardening was to reduce the Coping Strategy Index for participating households by 5.192. The Stratified and Radius matching methods too found the impact of urban gardening to be significantly negative on the number and frequency of coping strategies employed by the household. Going by the stratified matching algorithm, the impact of gardening was to reduce the CSI by 2.717 while the radius matching method similarly found the impact of participation was to reduce the CSI by 2.28. It can thus be concluded that, given the results and controlling for unobservable characteristics, the impact of participating in urban agriculture in Makhanda

East is to reduce the number of coping strategies employed by a household by the range 2.28 – 8.55.

Estimations of the impact of participation in urban gardening on the Reduced CSI was found to be significant and negative across all four matching algorithms. Using the Nearest Neighbour method, the impact of participation in urban gardening was found to be negative and highly significant at the 1% level of significance. Engaging in urban gardening impacted on the Reduced Coping Strategy Index value by reducing it by 7.183. As per Kernel Matching methods, the impact of participating in urban gardening was to reduce the rCSI by 5.192. Once again, the ATT based on Stratified and Radius Matching methods are similar in their estimate of the impact of participation on the rCSI. The impact on the rCSI of participation was to reduce it by 2.402 according to the stratified method, and 1.867 according to the radius matching method. As these results indicate, the impact of engaging in urban gardening activities, whether it be home or community gardening, is to reduce the number and frequency of coping strategies employed by households in times of food shortage by the ranges of 1.867 – 7.183.

These significant results are indicative of the positive effect that UGs garner from their participation in gardening activities. While the other indicators of food security are static, the Coping Strategy Index is dynamic and acts as a monitor of food security for the present as well as the vulnerability to future food insecurity (Christiaensen et al., 2000). As such, participation in urban gardening activities can be seen as improving the sustainability of the respondent's livelihoods into the future as well as at the time of survey. Given the dire lack of economic opportunities in Makhanda and the Eastern Cape and low likelihood of dramatic increases in economic growth and employment, urban home and community gardening does provide some level of stability in terms of food availability and security.

5.3.2 Rosenbaum bounds test for sensitivity

Rosenbaum bounds test was performed in order to check for the sensitivity of the result presented in Table 5.5 above to the effects of confounding unobservable variables. The test establishes how strongly the effects of the hidden bias (from an unmeasured confounding variable) needs to be in order to alter selection into treatment rendering statistical inference spurious. Table 5.6 presents the statistical significance of Rosenbaum upper bounds, Gamma denotes the odds of differential assignment due to unobserved factors confounding results. Note

that, for gamma = 1, where the odds of differential treatment due to confounding variables is unchanged, all results are highly insensitive to hidden bias across all three outcomes. As the gamma is drastically increased to assess at what level the treatment assignment would change due to the hidden bias, the significance of the upper bound marginally increases.

Table 5. 6: Rosenbaum bounds test for sensitivity

Gamma	Full Coping Strategy Index	Reduced Coping Strategy Index	Binary Dietary Diversity Indicator	Household Hunger Scale
r	Upper bound	Upper bound	Upper bound	Upper bound
1	0	0	7.7e-13	8.8e-14
6	.000083	.000083	.001946	.001319
11	.002706	.002705	.016503	.013179
16	.010548	.010545	.03855	.032776
21	.022053	.022048	.061411	.053986
26	.035211	.035204	.082759	.074289
31	.048772	.048764	.102042	.092925
36	.062084	.062075	.119296	.109789
41	.074832	.074822	.134728	.124997
46	.086889	.086878	.148573	.13873
51	.098218	.098207	.161051	.151168
56	.1088	.108823	.172352	.162481

It is only once the odds of alternative treatment assignment due to hidden bias breaches 56 for both the full CSI and rCSI, that the upper bound becomes significant. The focus of this research on Rosenbaum Upper bounds reflects the possibility of positive (unobserved) selection which, in the context of this evaluation denotes that the households who choose participation in urban gardening may also have a higher likelihood of being food secure and exhibit fewer recorded coping strategies as an indication thereof. Thus, as the significance of the upper bound indicated in the table for increasing gammas, the results presented in Table 5.5 are highly insensitive to hidden bias that would increase the odds of selecting treatment by 51 (where the upper bound is still insignificant for CSI = 0.098218 and for rCSI = 0.098297). However, the rbounds test when gamma = 55 is significant indicating that the study is sensitive to bias that would increase the odds of treatment assignment by 55.

Given the relatively small sample size of this study (n=115), this implies that the model specification is sufficiently insensitive to hidden bias. Furthermore, the result indicates that the confidence interval for the ATT will include 0 if the effects of a confounding variable "caused the odds ratio of treatment assignment to differ between the treatment and comparison groups" by 51 (Bekker and Caliendo, 2007). What this implies is that the results are very insensitive to possible deviations from the unconfoundedness assumption which adds validity to results interpretations.

5.4 Discussion of Results

Participation in urban gardening was negatively and significantly influenced by the number of social grants a household received while the variable capturing whether a household member was employed (off-farm activity) exerted a strong positive and significant effect on the likelihood of participation. The results speak to the chronic lack of employment opportunities (54.78% unemployment) and income (46.09% of households' income was made up of social grant transfers alone) which both play a major part in household's choice to participate in urban gardening. Expanding economic and income generating opportunities will no doubt free up enough income for more households to consider gardening as a viable and sustainable means to supplement their nutrient intake and food security. When households are entirely reliant on social grant income, purchasing both food and non-food necessities for the household is a priority and no disposable income is available for the household to cultivate a home garden. This study rejects claims of a dependency on social grant income rather framing social grant income (87.83% of household were recipients) as providing critical income and social security for the huge number of low-income urban households vulnerable to food insecurity, a lack of dietary diversity and household hunger (Akinboade and Adeyefa, 2018).

The impact of age and the number of household members unable to work due to old-age or illness as well as number of unemployed household members is a positive and significant predictor for participation. These results reflect the dynamics of the low-income urban township existence characterised by mass unemployment in the Sarah Baartman Municipality (Eastern Cape Socio Economic Consultative Council, 2020). While the youth are seemingly averse to urban and rural agricultural activities as a livelihood strategy (Vibert, 2018; Modibedi et al., 2020), the older generations ascribe more value and enjoyment to tending a garden and

supplementing household diet with fresh produce. This was corroborated in the FGD. This intergenerational dynamic is undermining the future and sustainability of urban gardening increasing being undertaken by elderly community members only. According to Galhena (2013), one of the constraints to home gardening expanding has to do with its cultural acceptance, which in this case differs dramatically between older and younger generations. The empirical findings also reveal that the number of household members unable to work due to old-age or illness positively impacts on the propensity to take part in urban gardening. These relationships can thus be understood in the following light: as household members exit the labour force due to job loss, old-age and illness, there is a high likelihood that they will turn to cultivating a garden as means to secure more food for the household. This is due to loss of income and employment. However, gardeners were also motivated by the impetus to stay active and occupy their time in their old age.

Participation in urban gardening was found to have a causal link, exerting a negative and significant impact on two of the selected outcome variables which was computed using the propensity score method. Results from the estimation of the Average Treatment Effect on the Treated (ATT) using 4 matching algorithms (Nearest Neighbour, Kernel, Stratified and Radius Matching) were significant across all four algorithms. The empirical finding is that participation in urban gardening reduces the mean Coping Strategy Index score by the range of 2.28 – 8.55 compared to non-gardening households. The Reduced Coping Strategy Index was likewise significantly reduced by participation in urban gardening by the range of 1.867 – 7.183. Given that rCSI is constructed using part of the full index implies that the relatively close overlap of these results points to the strategies which appear in both as being significantly impacted on by participation in urban gardening activities. This is corroborated by significance testing of specific coping strategies between UGs and NGs find that of the 5 strategies contained within the rCSI, 2 were applied significantly more frequently in NG households. A descriptive analysis was presented in Section 4.11.3. Urban gardeners reduced the number of meals eaten in a day significantly less frequently compared to NGs (10% level of significance). Additionally, the frequency at which UGs had to borrow food from neighbours/relatives was significantly low compared to NGs.

Significance tests revealed a variety of significant changes to the livelihoods of the respondent households in the time period charactersied by the National Lockdown instituted on the 24th March 2020. Household income was significantly (10% level of significance) lower on average

after the lockdown (R3666) was instituted compared to household income in the months before the lockdown (R3958.65) reflecting the loss of employment and access to markets as well as continued economic decline in the region.

Various food security indicators were constructed for all surveyed households with the aim to analyse significant differences between gardening and non-gardening households. Household Dietary Diversity Scores were found to be significantly higher (5% level of significance) on average in participating households (mean = 7.55 Std Dev = 2.251) compared to NGs whose means HDD score was 6.67 (Std Dev = 2.816). This is noteworthy because, although participation in homestead and community gardening is theorised to improve dietary diversity by improving access to a variety of crops, research by Khumalo and Sibanda (2019) and Swanepoel et al. (2021) found participating households HDD scores to be higher but not significantly better than non-participants in urban agriculture.

The Household Hunger Scale data was collected for both pre and post lockdown time periods with results indicating no statistical difference between NG and UGs scores although mean score were lower in GHs. However, the Household Hunger Scale pooled sample mean did significantly increase between the two time periods from 1.1 to 1.45 at the 1% level of significance. This reflects the worsened food security situation of the survey recipients after the national lockdown period compared to prior to it. This is in line with data presented by the IPC (2021) which forecasted the number of severely food insecure households to drastically increase because of the Covid-19 Pandemic and National Lockdown period. The Self-Assessment of Food Security Indicator results reflected a positive effect associated with gardening on food security as more gardening households considered themselves food secure (31.67%) compared to NGs (21.82%). Additionally, 63.63% of NGs considered their household food security to have worsened which compares favorably to the 53.33% of gardeners who felt that way. Both results, however, clearly show how the food security of both UGs and NGs has generally deteriorated quite significantly since the onset of the National Lockdown instituted on March 24th 2020.

Propensity Score Matching results (ATT) do however indicate that there was a causal link between participation in gardening and significantly lower Coping Strategy Index scores compared to non-gardening households. This constitutes an important finding as participation in urban gardening improved the livelihoods of participants by lowering the number of

undesirable and unsustainable coping strategies which households apply when household food security deteriorates. This result illustrates that, as a result of the Covid-19 pandemic and worsening food insecurity experienced by the households in the sample area, households whom were not participating in urban gardening were forced into relying on a higher number of more severe coping strategies. Conversely, the coping strategies employed by UGs were indicative of less sever loss of food security during the Nation lockdown period in which mobility was restricted.

5.4 Summary of Results and Discussion.

Results from the Probit and average marginal effects models reveal that participation in urban gardening is largely motivated by demographical variables as well as the makeup of the household. The likelihood of participation significantly increased with the number of household members unable to work due to old-age or illness as well the number of household members who were unemployed. Additionally, households with diversified income sources through gainful employment or entrepreneurial activity were more likely to participate in urban gardening while each additional social grant that households received reduced the probability of participation.

Results derived from the propensity score method and matching algorithms reveal that, of the four outcome variables under study, only two were significantly impacted as a result of household participation in urban gardening. Both the full and reduced Coping Strategy Indexes were significantly reduced for participating household indicative of a positive effect on the sustainability of households' livelihoods and food security going into the future.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1. Recapping the Research Objectives and Methods

The overarching research objective of this thesis was to evaluate the impact of participating in urban community and home gardening on the food security and livelihoods of respondents sampled from the populations of Extensions 6, 7, and 9 as well as Joza Location in Makhanda East. To that end, a dichotomous Probit regression model was specified modelling the factors which significantly determined participation in urban gardening from collected data. Data consisted of a group of UGs selected as the treatment group and a control group of NGs.

The study employed the propensity score matching method to estimate the impact of urban garden participation on household food security. Food security was measured using various food security indicators inclusive of Household Dietary Diversity Scores, the Household Hunger Scale, and Coping Strategy Indexes (both full and reduced indexes). The treatment and control groups were satisfactorily balanced and the problem of selection bias into the treatment group was controlled for allowing analysis to make inferences as to the impact of participation on selected outcome variables relating to food security. Data was collected and analysed with regards to changes in income/expenditure and food security outcomes for the period before the onset of the national lockdown as well as at the time of the survey. Significance testing revealed that household income had significantly decreased in the period and that the pooled sample Household Hunger Scale mean significantly increased. This is indicative of the worsening household food security and income levels which characterized the sample of gardening and non-gardening households from the study area in Makhanda's townships.

This research was framed within the Sustainable Livelihoods Approach and applied the principles of Random Utility Maximization Theory and Collective Action Theory to households' decision to participate in urban gardening activities. The SLA considers coping mechanisms and livelihood strategies as crucial to the construction of a sustainable livelihood within a particular vulnerability context (Mthethwa, 2012). The SLA denotes that it is imperative to empowering vulnerable individuals and households to become self-sustaining through sustainable use of different forms of capital available to them (Chikadzi and Munatwa, 2014). CAT was applied in conceptualizing the motivations for involvement in community garden collectives and home garden extension support provided by Umthathi Training Project Trust. In accordance with the pre-conditions for the success of Institutions for Collective

Action, the groups were found to be small (n=17 at Linomtha Community Garden; n=7 at Extension 7 Community Garden), interdependent on one another, and sharing strong social bonds and norms thus combatting the free-rider problem (Olson, 1967; Agrawal, 2001). Utility Maximization Theory denotes that, as self-interested and rational economic agents, the households' decision to participate or not is derived from the perceived level of utility acquired from participation ($U_i^{treatment}$) and non-participation ($U_i^{non\text{-}gard}$). The choice to engage in home and/or community urban gardening is only taken if: $U_i^{treatment} - U_i^{non\text{-}gard} > 0$ (Sinyolo and Mudhara, 2018).

This study provided evidence that participation in urban gardening in Makhanda East did not significantly improve the socio-economic status of participants enough to be considered viable as a primary livelihood strategy to be widely endorsed. Given the micro-scale nature of the community and home garden plots, this is not unexpected. This was found to be the case in research by Modipedi et al. (2020) and Olivier and Heinecken, (2017) into the potential for urban gardening to be a primary livelihood. However, evidence also points to gardening significantly impacting the livelihoods of participants by reducing the number and severity of coping strategies that households engage in when faced with deteriorating food security at the household level.

6.2. Conclusion

Participation in urban gardening was found to positively impact the Coping Strategies Index of treated households as the gardens provided supplementary intake of nutritious vegetables and shored up the food security of participants enough to reduce the proliferation of behaviours such as relying on less preferred foods, limiting the number and portion size of meals, and lowering adult food intake to allow children adequate food intake. This result is consistent with the findings of Majake (2005) which point to the frequency and severity of the coping strategies households applied to secure their livelihoods being reduced by involvement in a food security program. Majake (2005) found that participating households commonly applied the coping strategy of relying on less preferred foods more than non-participating households, while the reverse was true with regards to severe coping strategies such as sending household members to beg for food. This research produced similar results as the impact of participation in urban food gardening was to improve food security as measured by the Coping Strategy Index and sub-index the Reduced Coping Strategy Index.

The local NGO connected to the two community gardens and a small number of home gardeners, Umthathi Training Project Trust, contributes to building sustainable livelihood skills through affording access to start-up gardening kits, training, workshops and communal land. The involvement of the Umthathi Training Project Trust is a crucial part of the transforming process and structures which facilitate or hinder the success of the livelihood strategies applied by the local UGs of Makhanda East. Assessment of the 'asset pentagon' of capitals endowments at the disposal of the gardeners as composed by the DIFD (1999) reveals the many constraints, as well as facilitating factors, that are associated with urban gardening in Makhanda East. The human capital base was generally weak with low levels of average formal education at 7.1 years. However, among the treated (UGs), the average gardening experience was immense (10 years on average) which speaks to the vast knowledge base and integral skills associated with maintaining a productive garden over the long term in a sustainable manner. Physical capital constraints were evident as access to basic agricultural tools and transport was notably low and hampered the commercially minded farmers' access to markets. There was strong social cohesion among the community gardeners who regularly relied upon one another and their close-knit social networks to access physical and human capital to improve the productivity and viability of their gardens. The natural capital base of the gardeners constituted a major constraint to the achievement of sustainable production of produce. The gardeners were plagued by water insecurity (drought) and pollution which has inundated their water source and soil to a lesser extent. For home gardeners, the land availability constraint was the primary problem restricting the expansion of their gardens.

The main agricultural constraints revealed in this research predominantly relate to access to land, water, and agricultural equipment and tools. The assessment of households' access to agricultural assets points to a lack of tools and infrastructure owned and/or accessed otherwise by the respondents, particularly those engaging in gardening. Among the community gardeners, social cohesion and co-operation were very strong – and due to the lack of tools and inputs – they relied heavily on one another sharing both physical and intangible resources such as watering cans, wheelbarrows as well as gardening tips and techniques to deal with pests and increase garden productivity.

This study found that 64.04% of the control group of NGs had never heard of Umthathi Training Project Trust which reiterates the need for more awareness of home and community garden activities and the benefits thereof. Furthermore, 71.43% of home gardeners wished to

expand their home gardens with 64.86% citing the lack of land to expand into as a reason for not doing so. The existence and proximity of the community garden plots present an ideal space for these home gardeners to become community gardeners – however, as aforementioned, community awareness and visibility of Umthathi Training Project Trust and the Linomtha and Extension 7 community gardens are low.

The quality of extension supports from the state, municipality and UTPT must be noted to be poor. Although the community gardeners had contact with extension through the NGO in establishing their community plot, home garden extension support was extremely low at 12.95% with Government Extension even lower at 4.35%. Critically, from the FGD held with the community gardeners of Linomtha Community Garden, members expressed enmity towards Umthathi Training Project Trust. To them, the involvement of the NGO appeared to be a hindrance and not a source of support with one member lamenting that, *"there's no other aid we receive"* other than facilitating access to the communal land. This also refers to the fact that the relationship the gardeners and NGO had with the local municipality had fallen through entirely.

6.3. Policy Recommendations

Having undertaken the analysis of food security and its relationship with participation in urban gardening, it has become clear that, although urban community and home gardening do have a role to play in diversifying the sources of households' sustainable livelihoods, the promotion of urban gardening alone will not solve urban food insecurity. Rather, it is recommended that attention be paid to bringing stakeholders together (gardeners, NGOs, local municipalities, and state policymakers) to formulate a cooperative effort to expand both non-agricultural and entrepreneurial income-earning opportunities connected to the smallholder and community gardening sectors as well as other sectors. Revitalizing the relationship between the community gardens and local authorities as well as repairing the relationship between the co-operatives and UTPT would go far in expanding income-generating activities (by affording members inputs to produce and sell compost) and improving soil quality/productivity.

It is recommended that a collective effort be made to reduce the health risk posed to the gardeners by the contaminated water source as well as incentivising cooperation between all the stakeholders being the gardeners, the local authorities, and Umthathi Training Project Trust.

At present, the gardeners face the inherent risks and constraints of urban agriculture alone, while the NGO is noncommunicative and the municipality has stepped back altogether.

The productivity of both agricultural and non-agricultural entrepreneurial activities is closely related to underlying (agricultural) knowledge and skills development as well as the ease of access to more profitable market channels. As such, local municipalities should incentivise local businesses to shorten their supply chains by purchasing produce grown by nearby UGs and employ local businesses connected to the industry for transport, packaging, marketing, and advertising.

It is recommended that the local municipality work in tandem with UTPT to raise awareness in the surrounding communities. This would require both these stakeholders to train and employ more committed extension support officers thereby expanding the access of willing households to agricultural and marketing information. The relative average sizes of the home (13.19m^2) and community garden plots (26.58m^2) indicate the micro-scale nature of the gardens which formed the treatment group for this research. Tending a backyard garden is no full-time occupation and does not significantly improve the food security or incomes of households. However, involvement in the community garden co-ops is an opportunity for township inhabitants to expand their plot size substantially as well as leverage the skills and vast experience of the other community gardeners to cultivate a commercially viable garden.

This endorsement of a transition from home to community gardens is not a blanket statement by any means but rather reflects the chronic need of township communities for employment and income-earning opportunities as well as a means with which to generate cost savings on foodstuffs usually purchased from shops at ever-increasing prices. Awareness of the vegetable production taking place in Extension 7 and Linomtha Community Gardens remains low and heightened awareness of their produce for sale may increase the commercial viability of the community gardeners who usually have to travel, at their own cost, into town to make sales.

As previously referenced, the youth unemployment in the Eastern Cape is catastrophically high and increasing having risen from 40% in 2015 to over 50% in Quarter 2 of 2020. Turning this trend around must be prioritised by provincial and state entities as well as private institutions involved in social and economic development as a failure to do so will be economically and socially untenable. The structural nature of youth unemployment in South Africa and the

Eastern Cape needs to be central to any intervention. There is a skills mismatch between the needs of the labour market and the skills and capabilities afforded to young individuals by the public basic education system. Interventions at the national level to combat the education (literacy and numeracy) deficit have been unsatisfactory and limited. The potential impact of pointed policy which addresses these shortcomings, in particular, should be of particular interest to national and regional institutions.

The South African economy is moving away from being driven by the primary sectors (labour intensive) of the economy with trends showing a move towards tertiary sectors – which are more skills intensive. Initiatives and projects which aim to address this skills gap among the poor youth of South Africa ought to be ascribed high value to society. This includes a focus on boosting the entrepreneurial education of young people which may enable productive self-employment and the creation of jobs in the agricultural and other sectors of the economy. In South Africa's burgeoning townships, formal marketplaces play second fiddle to the largely unrecognised informal sector. Research and collaboration with business owners and entrepreneurs in this sector have the potential to unlock great potential for economic growth, skills development, and secure job creation. Recognising, researching, valuing, and leveraging these enterprises from a policy development standpoint must be seen as an avenue towards combatting the poverty, food insecurity, and unemployment rampant in South Africa. These social and economic ills clear in Makhanda East, as well as the archipelago of informal settlements which house the most vulnerable members across urban South African society, must be central to policy formation.

To sum up, participation in urban gardening does positively impact the food security and livelihoods of participants by reducing the number and severity of coping strategies that households employ when faced with worsening food insecurity. The limited size of garden plots and the existing capital endowments of township inhabitants in Makhanda East, however, limits these gardens' ability to substantially improve the socio-economic status of participants. By raising awareness among households in Makhanda East about urban gardening and offering up improved and more widespread state, municipal, and NGO extension support, urban gardening may have a most significant effect on food availability, access, and utilisation. In light of the findings of this research, Section 6.4 presents the research limitations and suggested areas for further research.

6.4. Limitations and suggested further research areas

Identifying the study area and, to some degree, the study participants (particularly the community gardeners) was done using purposive sampling methods. Thus, although the sample of home gardeners and control units were randomly selected, the results of this research should be cautiously generalised to the rest of Makhanda and the Eastern Cape. The use of regression analysis and particularly the Propensity Score Matching method thrives on the quantity and quality of data collected. Although the quality of the data captured is good, and the data collection process was efficient, the quality of the quantitative analysis will only be improved by using a larger data set. Due to the financial and time constraints, however, 115 respondents were surveyed.

Recommended areas for further research include the need for an impact assessment of the Covid-19 pandemic and concomitant national lockdown period on the food security of vulnerable township households. Although this research assessed differences in food security indicators and income and expenditure levels from prior to, and after the lockdown period, more pointed research needs to be undertaken.

Future research should additionally address the potential for food systems to integrate a more substantial contribution from urban producers. Urbanization poses a threat to the sustainability of food systems and the food security of the burgeoning township populations. Research should investigate the low levels of youth involvement in urban agriculture and how best to generate income-generating opportunities both in the urban agricultural and other sectors. Research needs to investigate accessible entry points for youths to participate in urban cultivation with the entrepreneurial and agricultural skills required to succeed in creating a sustainable livelihood.

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Appendices

Appendix A: Questionnaire used for Data Collection

Rhodes University
Department of Economics and Economic History

Note: The information captured in this questionnaire is strictly confidential and can be used for further research and academic publication. Participation in the survey is voluntary and no financial or non-financial benefits are paid during or after participation. The respondent should be the (actual) household head or anyone well informed about the household. Participants can withdraw from the survey anytime they feel like doing. However, your cooperation is highly appreciated.

Signature of interviewee:…….

Questionnaire for Gardening Households

Identification

Name of survey participant	
1= Co-op member/ 2= home gardener 3= Non gardener 4=Ext 7 community gardener 5=home gardener and community coop member	
Cell number of participant	
Location	
Name of Enumerator	
Date of interview	

Section 1: Demographics

1.A Household Head and other household members	1.B Age	1.C Gender	1.D Education level	1.E Marital Status	1.F Primary employment

1=Yes 0=No	Years	1=Male 0=Female	Number of educational years (grades) completed	1=Single 2=Married 3=Divorced 4=Widowed 5= Cohabiting	1=Full Time gardener 2=Stable Waged employment 3=Retired 4=Part-time work 5=Unemployed 6=Self-employed 7=Other (specify)

*1. A If participant not Household head fill in household head's information as well.

1.G How many adult HH members are unable to work due to illness or old-age?		
1.H How many HH members are formally employed?		
1.I How many HH members are temporarily employed?		
1.J Does the household have running water? 1=Yes 0=No		
1.K What is the main source of household drinking water?	1=Spring 2=Household tap 3=Public tap 4=Purchased water 5=Rainwater 6=other (specify…….)	
1.L What is the main source of water for domestic use?		

Section 2: Home garden

2.A How many years of farming experience do you have? (**input =0 years if no farming experience**)		
2.B Do you have a home garden? 1=Yes 0=No (**skip to Section 3**)		
2.C How long has the household been gardening at home?		
2.D Identify the level of anxiety concerning security of land tenure in the home garden 1=Secure land tenure 2=Some anxiety over tenure 3=High anxiety over tenure		
2.E Total area of land cultivated (meters^2) in the home garden before and after lockdown started (24th March 2020)	2.E Before	2.F After
2.G Does your household wish to expand the size of the home garden? 1=Yes (**skip to 2.I**) 0=No		
2.H What is the main reason for not expanding the home garden? 1=Land availability 2=Time constraints 3=Lack of resources to expand 4=Water availability 5=other (specify……..)		
2.I Have you had contact with an extension officer in the past 12 months =? 1=Yes 0=No (**skip to 2.K**)		
2.J What form did the support come in? 1=Market information 2=Inputs 3=Agricultural training 4=Funding/Credit		
2.K How often do you share or receive information and farming knowledge with other home or community farmers? 1=Never 2=Sometimes 3=Often		
2.L Is water security a problem for the home garden? 1=No, never 2=Only during the dry months 3=Yes, it is a constant problem		
2.M In the last 30 days, how many days did you have access to water your garden?		
2.N What is the main source of water for use in the home garden? 1=Rainwater harvesting 2=Public tap 2=Household tap 3=Spring 4=other (specify…….)		
Rank the following reasons for engaging in home gardening on a scale of 1-5 where***: 1=Strongly Agree 2=Agree 3=Neutral 4=Agree 5=Strongly Agree***		
2.O The home garden is for growing food for household consumption		
2.P The home garden is for improving household nutrition		
2.Q The home garden produce is sold for income		
2.R The home garden improves the appearance of the household and its surroundings		
2.S It is enjoyable to work in the home garden		

Complete the table below regarding home garden cultivation:
Use the following ***CODES GIVEN BELOW TABLE 2.1 FOR REFERENCE:***
Code 1 specifies the crop planted in column 2.1.A.
Code 2 specifies market buyer in column 2.1.E
Code 3 specifies the water source for that crop in column 2.1.H
For columns 2.1.C, 2.1.D, 2.1.F and 2.1.G *measurement of quantity used is kg OR let respondent identify Unit (i.e. Bunch)*

2.1.A Crop *[CODE 1]*	2.1.B Area Planted (m^2)	2.1.C Quantity Harvested	2.1.D Quantity Sold	2.1.E Market buyer *[CODE 2]*	2.1.F Price per KG/unit sold	2.1.G Quantity consumed at home	2.1.H Water source [CODE 3]

Code 1: 1=Maize 2=Potato 3=Tomato 4=Spinach/Chard 5=Beans 6=Groundnuts 7=Sweet Potato 8=Butternut 9=Pumpkin 10=Pepper 11=Cabbage 12=Chilli 13=Herbs 14=Onion/Spring Onion 15=Beetroot 16=Carrots other
Code 2: 1=Co-op contract Contribution 2=Local shop 3=Shop in town 4=Friend/Neighbour 5=Individually sales 6=Stall sales 7=Hawkers 8=other (specify…….)
Code 3*:* 1=Rainwater harvesting 2=Public tap 2=Household tap 3=Spring 4=other (specify…….)

Section 3: Household income/expenditure

Source of income	3.A Amount per installment	3.B Frequency of income	3.C Total Amount
3.1 Permanent employment			
3.2 Temporary employment			
3.3 Crop production			
3.4 Livestock			
3.5 Remittances			
3.6 Non-agricultural self-employment - entrepreneurial efforts			
3.7 Other (Specify)			
3.8 Does a member/member of your household receive a government social grant? 1=Yes 0=No (**skip to 3.11**)			
3.9 Specify which grant(s) are received and how many?		A. Grant type	B. Number of grants
3.10 Do you ever spend your grant money on agricultural inputs? 1=Never 2=Sometimes 3=Always			
3.11 Did any member of your household receive a Covid-19 state grant? 1=Yes 0=No **(skip to 3.16)**			
3.12 How many Covid-19 grants did members of the household receive?			
3.13 Did the household receive food aid during the lockdown period?			
3.14 How many times did this happen?			
3.15 What was the quality of the food received? Very poor=1 Poor=2 Average=3 Good=4 Very good=5			
3.16 Are you a member of any other associations/groups? 1=No 2=Savings Group 3=Religious/Church Group 4=Burial Scheme/Society 5=Other (specify……..)			
3.17 Have you, in the last year, taken out a loan? Or used a credit facility? 1=Yes 0=No **(skip to Section 4)**			
3.18 Where did you source the funds? 1=Umthathi/other member at Umthathi 2=Relative/friend 3=Local moneylender 4=Bank/Financial institution 5=Stokvel/Savings Club 6=Other (specify …….)			

Section 4: Livestock

4.A Does your Household own livestock? 1=Yes 0=No **(skip to section 5)**			
4.B Specify which livestock and how many are owned by the household. 1=Cows 2= Goat 3= Chicken 4= Pigs 5= Donkey 6= Sheep	Livestock type	Number owned	Livestock value
4.C What is the main reason for keeping livestock? 1=Sales 2=Consumption 3=Wealth 4=Cultural Reasons 5=Other **(Unless answer=1 or 2 skip to Section 5)**			

4.D If livestock consumed or for sale, indicate which livestock type and how many were consumed/sold?	Livestock consumed	Number consumed	Livestock type	Number sold

Section 5: Physical Capital Endowment

Which of the following production assets does your household have access to?	A. Indicate the type of access your household has? 1=Own 2=Via Umthathi 3=Borrow elsewhere 4=Hire 5=No access	B. Number of assets held if owned?	C. Total current value
5.1 Spades			
5.2 Hand hoe/garden fork			
5.3 Wheelbarrow			
5.4 Private small car			
5.5 Bakkie			
5.6 Total land holdings (Property owned)			
5.7 Truck			
5.8 Cell phone			

5.9 TV			
5.10 Bicycle			
5.11 Radio			
5.12 Watering can			
5.13 Water storage tank			
5.14 Others (specify……)			

Section 6: Credit and Extension Support

6.A Have you received government (extension/funding/training) support in the last 12 months? 1=Yes 0=No **(skip 6.C)**	
6.B What form did the support come in? 1=Information from Extension Officer/Municipality 2=Inputs from Extension officer 3=Government Funding 4=Other (specify ……..)	
6.C Did you receive support/inputs/training from Umthathi in the last 12 months? 1=Yes 0=No	
6.D **If 6.C=NO input 5=Never**. How often do you receive inputs/training? 1=Weekly 2=Monthly 3=Seasonally (biannual) 4=Only when joining Umthathi 5=Never	

Section 7: Communal Land holdings and Security of Tenure

If respondent **NOT** a Community gardener **skip to Section 13**

7.A What is the quality of the land/soil for crop production? 0=Poor 1=Average 2=Good	
7.B Identify the level of anxiety concerning security of land tenure in the garden co-op 1=Secure land tenure 2=Some anxiety over tenure 3=High anxiety over tenure	
7.C Rate how important Umthathi is for the sustaining the garden co-op into the future 1=Not important at all 2=Not vital 3=Neutral 4=Important 5=Vitally important	

Section 8: Community Garden Crop Production and Market Activity

8.1 How long have you been a member of the garden co-op?							
8.2 Total area of land cultivated (meters^2) in garden co-op before and after lockdown started (24th March 2020)						8.2 Before A	8.3 After B
Complete the table below regarding community garden cultivation: *Use the following* ***CODES GIVEN BELOW TABLE 8.3 FOR REFERENCE:*** *Code 1 specifies the crop planted in column 8.3.A.* *Code 2 specifies market buyer in column 8.3.E* *Code 3 specifies the water source for that crop in column 8.3.H* ***For columns 2.1.C, 2.1.D, 2.1.F and 2.1.G*** *measurement of quantity used is kg OR let respondent identify Unit (i.e. Bunch)*							
8.3.A Crop *[CODE 1]*	8.3.B Area Planted (m^2)	8.3.C Quantity Harvested	8.3.D Quantity Sold	8.3.E Market buyer *[CODE 2]*	8.3.F Price per KG/unit sold	8.3.G Quantity consumed at home	8.3.H Water source

Code 1: 1=Maize 2=Potato 3=Tomato 4=Spinach/Chard 5=Beans 6=Groundnuts 7=Sweet Potato 8=Butternut 9=Pumpkin 10=Pepper 11=Cabbage 12=Chilli 13=Herbs 14=Onion/Spring Onion 15=Beetroot 16=other

Code 2: 1=Co-op contract Contribution 2=Local shop 3=Shop in town 4=Friend/Neighbour 5=Individually sales 6=Stall sales 7=Hawkers 8=other (specify…….)

Code 3: 1=Rainwater harvesting 2=Public tap 2=Household tap 3=Spring 4=On-site community garden water source 5=other (specify…….)

Section 9: Market access

9.A Rate your normal level of market access 1=very poor 2=poor 3=average 4=good 5=very good	
To what extent do you agree with the following statements about market access: 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree	
9.B I receive low prices	
9.C I struggle to access vital market information	
9.D I market my produce with trusted/established market connections which I have made	
9.E I struggle to make individual sales of my crops	
Complete the following statement relating to market conditions since the onset of the lockdown period (24th March 2020)1=Significantly decreased 2=Decreased 3=Unchanged 4=Increased 5=Significantly Increased	
9.F Since the onset of the lockdown period (24th March), demand for produce has...	
9.G Since the onset of the lockdown period (24th March), prices received for produce have...	
9.H Since the onset of the lockdown period (24th March), the price of inputs (e.g. compost) has...	

Section 10: Agricultural constraints

10. **Are the following significant challenges to agricultural productivity in the community Garden? 1=Often true 2=Sometimes true 3=Never true**	
10.A There is insufficient rainfall	
10.B Water availability (including water on site & Umthathi (free) provision of water) is a major concern	
10.C Soil erosion is a problem	
10.D There is theft and destruction of cultivated crops	
10.E I am unable access the tools/equipment I need	
10.F Financial constraints stop me from buying inputs and increasing productivity	

Section 11: Social Network/Collective action

11.A What is your position in the Co-op? 1=General Member 2=Committee Member 3=Secretary 4=Other (specify…….)	
11.B How did you hear about UTP? 1=You approached UTP as a local 2=Relative/Friend 3=A member told you 4=Other (specify……..)	
11.C Do you participate in Co-op decision making? 1=Never 2=Sometimes 3=For most decisions 4=Always	
11.D If Yes, how satisfied with the level of your participation? 1= Strongly dissatisfied 2= dissatisfied 3= neutral 4= satisfied 5= strongly satisfied.	
11.E Have you attended co-op meetings/training sessions in the last 30 days? 1=Yes 0=No (**skip to 11.G**)	
11.F How often do you attend/contribute to co-op activities/meetings? 1=Not since initial contact/training/ Not since joining co-op 2=Only when required 3=Monthly 4=Weekly	
11.G Do you have trust in the group leaders/committee to achieve group goals and/or help with co-op challenges? 1=No 2=Neutral 3=Yes	

Perception of Co-op Dynamics

Rank your responses on a scale on 1-5 where: 1=Strongly Agree 2=Agree 3=Neutral 4=Agree 5=Strongly Agree	Rank
11.H There is a feeling of togetherness/cohesion among members of the co-op	
11.I There is often conflict in the co-op	
11.J I share information/knowledge/farming techniques freely with other co-op members	
11.K I am treated with respect and fairness within the co-op and am free to speak openly during meetings	
11.L I trust the co-op leadership and other members	
11.M All co-op members contribute equally to decision making	
11.N Umthathi actively promotes collective action, cohesion and integration between co-op members	

Section 12: Still interested

12.A Are you still interested in remaining in the co-op? 1=Yes 0=No	
12.B What do you think about the general policies and rules of the co-op? 1=Poor 2=Could be improved 3=Good	

Skip to Section 14 for community gardeners

Section 13: Reason NOT in Co-op **(only ask Home Gardeners)**

13 *Rank the reasons for non-participation in co-op on a scale between 1-5 where: 1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree*	Rank
13.A I do not have the time to tend a garden/attend meetings due to work	
13.B Membership costs are too high	
13.C I like working alone to avoid freeriding problems	
13.D I am not interested in sharing knowledge and earned income with the co-op members	
13.E Rate your knowledge of Umthathi Training Project. 1=No knowledge 2=Some knowledge, not interested 4=Good knowledge, have considered joining 5=Good knowledge, former member	

Section 14: Impact of the Lockdown period

In the two time periods given specify the following:	Before lockdown (24th March 2020)	After lockdown (currently)
14.1 Household income	A	B
14.2 Amount spent on food	A	B
14.3 Amount spent on non-food	A	B

Section 15: Household food security Self-assessment

15.A What is the current level of food security experienced in the household? 1=Food secure 2=Mildly food insecure 3=Moderately food insecure 4=Severely food secure	
15.B How does the level of food security in the household *since March 24th 2020* compare to the household food security level from previous years? Significantly improved=1 Mildly improved=2 Unchanged=3 Mildly worsened=4 Significantly worsened=5	

Section 16: Household food insecurity access scale and Household Hunger Scale

1 = Rarely (once or twice in the past month) 2 = Sometimes (three to ten times in the past month) 3 = Often (more than ten times in the past month)

For all primary questions (A): In the past 30 days, how often did this happen… **For all secondary questions (B): In the month before the lockdown was implemented (Feb 24th – March 24th) how often did this happen…**	***Code*** 0=Never 1= Rarely 2=Sometimes 3=Often
16.1 Did you worry that your household would not have enough food?	A
	B
16.B Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	A
	B
16.C Did you or any household member have to eat a limited variety of foods due to a lack of resources?	A
	B
16.D Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	A
	B
16.E Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	A
	B
16.F Did you or any household member have to eat fewer meals in a day because there was not enough food?	A
	B
16.G Was there ever no food to eat of any kind in your household because of lack of resources to get food?	A
	B
16.H Did you or any household member go to sleep at night hungry because there was not enough food?	A
	B
16.I Did you or any household member go a whole day and night without eating anything because there was not enough food?	A
	B

Section 17: Household Dietary Diversity

Questions for Respondents: Has you or another member of your Household eaten the following foods in the household since yesterday morning and throughout the day?

Coded responses: Yes=1 No=0

FOOD GROUP	**CODED RESPONSES**
17.A Cereals [e.g. mielie pap, bread, rice, biscuits, millet, sorghum, pasta]	
17.B Roots and Tubers [potatoes, sweet potatoes, mdumbi]	
17.C Vegetables	
17.D Fruits	
17.E Meat, poultry, offal [beef, chicken meat, liver, kidney or giblets, pork, lamb, goat, venison]	
17.F Eggs	
17.G Fish and seafood [fresh and dried fish or shellfish]	
17.H Pulses, legumes, nuts [beans, peas, lentils]	
17.I Milk and milk products [amasi, yogurt, cheese]	
17.J Oils, fats [any oils, natural or animal fat, butter]	
17.K Sugar, honey	
17.L Miscellaneous [other foods not mentioned - condiments like tea, coffee, spices, herbs]	

Section 18: Coping Strategies Index

Codes: Never=0 Hardly at all (<1 time/week)=1 Once in a while (1-2 times/week)=2 Often (3-6 times/week)=3 Every day=4

In the past 7 days, if there have been times when you did not have enough food or money to buy food, how often has your household:	Codes:
18.A Relied on less preferred and less expensive foods?	
18.B Limited portion size at mealtimes?	

18.C Reduced number meals eaten in a day?	
18.D Borrowed food, or rely on help from a friend or relative?	
18.E Purchased food on credit?	
18.F Sent household members to eat elsewhere?	
18.G Consumed seed held for next season?	
18.H Restricted consumption of adults in order for small children to eat?	
18.I Sent households members to beg?	
18.J Went entire days without eating?	
18.K Gathered wild food, hunt or harvest immature crops?	

For Reduced Coping Strategy Index (rCSI) use: 16.A, 16.B, 16.C, 16.D & 16.H

Appendix B: Focus Group Discussion Questionnaire

Rhodes University
Department of Economics and Economic History

Note: The information captured in this questionnaire is strictly confidential and can be used for further research and academic publication. Participation in the survey is voluntary and no financial or non-financial benefits are paid during or after participation. The respondent should be the (actual) household head or anyone well informed about the household. Participants can withdraw from the survey anytime they feel like doing. However, your cooperation is highly appreciated.

Focus Group Discussion Questionnaire

A focus group discussion will take place at each of the community gardens under study as well as with a group of home gardeners. A total number of 8 people per group.

1. How important is your garden in contributing to household food security?
2. Has your garden impacted on the variety of foods your household eat? If YES, please explain how.
3. How secure is the land tenure at your co-op/home?
4. What are the main challenges/constraints that co-op/home gardeners face?
5. What are the key decisions/choices that co-op/home gardeners face?
6. What is the most valuable thing you associate with co-op membership/your home garden?
7. When gardening challenges arise, do you share information with other community/home gardeners?

The impact of the lockdown on household food security:

8. How has the lockdown (March 24th 2020) affected household food security?
9. How important was gardening in sustaining household food security during the lockdown/times of food shortage?
10. What do you do to cope in times of drought and food shortage (Coping strategies)?

Supplementary questions for Community gardeners:

11. Do co-op gardeners rely on Umthathi for extension services?
12. Do gardeners have adequate resources to maintain the garden? If NO - what resources would allow the co-op/home garden to sustainably operate?
13. What is the group dynamic between community garden members?

Appendix C: Correlation Coefficients of Explanatory Variables of Probit Regression

	Gender	Age	Household Unemployment	Income per capita	Number Social Grants	Number of Dependents	Marital Status	Credit Access	Earned Income	Stokvel Membership	Access to Transport	Land Value (logged)
Gender	1.0000											
Age	-0.0643	1.0000										
Household Unemployment	-0.0620	0.1644	1.0000									
Income per capita	0.1940	-0.1140	-0.3262	1.0000								
Number Social Grants	-0.0783	0.4110	0.2725	-0.2108	1.0000							
Number of Dependents	-0.0237	0.5542	0.1211	-0.0919	0.3259	1.0000						
Marital Status	0.2915	0.0780	0.1591	0.0393	-0.0435	0.1756	1.0000					
Credit Access	0.0222	0.1417	0.0391	0.2322	0.0591	0.0632	0.0878	1.0000				
Earned Income	0.2322	-0.0715	-0.1033	0.3130	-0.0649	-0.2316	0.2348	-0.0360	1.0000			
Stokvel Membership	-0.0614	0.0600	-0.1134	0.0970	0.0115	0.1758	0.0842	-0.0482	0.0062	1.0000		
Access to Vehicle	0.0644	-0.0584	-0.1645	0.3541	-0.1486	0.0425	0.0441	-0.0082	-0.0338	0.0947	1.00	
Land Value (logged)	-0.0595	0.2174	0.0677	-0.0419	0.0206	0.2486	0.0848	-0.0740	0.1193	0.1216	0.001	1.0

Appendix D: Probit Regression and Average Marginal Effects Models: Stata Output

```
. probit GardParticipationYN GenderHH AgeHH NoUnemployedperHH INCOMEpercapita SocialGrantnumberreceived HHMemUnabletoWork  MaritalStatusBinary HHCredit_p
> astYear IncGenerated StokfelDummy PCEaccessTransport logLandValue

Iteration 0:   log likelihood = -79.603196
Iteration 1:   log likelihood = -59.702258
Iteration 2:   log likelihood = -59.410378
Iteration 3:   log likelihood = -59.409444
Iteration 4:   log likelihood = -59.409444

Probit regression                                 Number of obs =    115
                                                  LR chi2(12)   =  40.39
                                                  Prob > chi2   = 0.0001
Log likelihood = -59.409444                       Pseudo R2     = 0.2537
```

GardParticipationYN	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
GenderHH	.5271112	.2980954	1.77	0.077	-.0571451	1.111367
AgeHH	.0343874	.0134628	2.55	0.011	.0080009	.0607739
NoUnemployedperHH	.348506	.1220568	2.86	0.004	.109279	.587733
INCOMEpercapita	.0001956	.0001358	1.44	0.150	-.0000705	.0004616
SocialGrantnumberreceived	-.2689901	.1214949	-2.21	0.027	-.5071157	-.0308645
HHMemUnabletoWork	.5868016	.2710449	2.16	0.030	.0555634	1.11804
MaritalStatusBinary	.2778625	.2899171	0.96	0.338	-.2903645	.8460895
HHCredit_pastYear	-.2694492	.395439	-0.68	0.496	-1.044495	.5055971
IncGenerated	.5478973	.3247243	1.69	0.092	-.0885507	1.184345
StokfelDummy	.3633898	.347884	1.04	0.296	-.3184503	1.04523
PCEaccessTransport	-.4431297	.4183394	-1.06	0.289	-1.26306	.3768004
logLandValue	-.0057472	.0258717	-0.22	0.824	-.0564548	.0449604
_cons	-3.193375	.8202487	-3.89	0.000	-4.801033	-1.585717

```
. margins, dydx (*)

Average marginal effects                          Number of obs = 115
Model VCE: OIM

Expression: Pr(GardParticipationYN), predict()
dy/dx wrt:  GenderHH AgeHH NoUnemployedperHH INCOMEpercapita SocialGrantnumberreceived HHMemUnabletoWork MaritalStatusBinary HHCredit_pastYear
            IncGenerated StokfelDummy PCEaccessTransport logLandValue
```

	dy/dx	Delta-method std. err.	z	P>|z|	[95% conf.	interval]
GenderHH	.1529969	.0829401	1.84	0.065	-.0095628	.3155565
AgeHH	.0099811	.0035719	2.79	0.005	.0029804	.0169818
NoUnemployedperHH	.1011558	.0315032	3.21	0.001	.0394107	.1629008
INCOMEpercapita	.0000568	.0000383	1.48	0.138	-.0000182	.0001317
SocialGrantnumberreceived	-.0780758	.0329997	-2.37	0.018	-.1427541	-.0133976
HHMemUnabletoWork	.1703224	.0739617	2.30	0.021	.0253602	.3152845
MaritalStatusBinary	.0806511	.0828219	0.97	0.330	-.0816768	.242979
HHCredit_pastYear	-.0782091	.11421	-0.68	0.493	-.3020565	.1456384
IncGenerated	.1590302	.091002	1.75	0.081	-.0193305	.3373908
StokfelDummy	.1054759	.099512	1.06	0.289	-.089564	.3005157
PCEaccessTransport	-.1286208	.1195404	-1.08	0.282	-.3629157	.105674
logLandValue	-.0016681	.0075023	-0.22	0.824	-.0163724	.0130361

Appendix D: The Impact of Participation in Urban Gardening on the Full Coping Strategy Index

Propensity Score Matching Results: Estimation of Average Treatment Effect on he Treated with four different matching estimators

ATT estimation with Nearest Neighbor Matching method
(random draw version)
Bootstrapped standard errors

n. treat.	n. contr.	ATT	Std. Err.	t
60	22	-8.550	3.498	-2.444

Note: the numbers of treated and controls refer to actual

ATT estimation with the Kernel Matching method
Bootstrapped standard errors

n. treat.	n. contr.	ATT	Std. Err.	t
60	49	-5.192	3.096	-1.677

ATT estimation with the Radius Matching method
Bootstrapped standard errors

n. treat.	n. contr.	ATT	Std. Err.	t
44	49	-2.280	1.374	-1.659

Note: the numbers of treated and controls refer to actual
matches within radius

ATT estimation with the Stratification method
Bootstrapped standard errors

n. treat.	n. contr.	ATT	Std. Err.	t
33	76	-2.717	1.565	-1.736