THE CONTRIBUTION OF COMMUNITY GARDENS TO LIVELIHOOD OF PARTICIPANTS: A CASE OF MUDAVULA VILLAGE, VHEMBE DISTRICT, LIMPOPO PROVINCE.

By

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DEDICATION

I dedicate this work to my heavenly Father, God Almighty, together with my Pastor, N. D. Mathukha for the words of faith and encouragement, for the Bible says, “Nothing is impossible with God” (Luke 1:37). I would also wish to dedicate this work to my employer, (Limpopo Department of Agriculture) for financial support and for giving me the time to carry on with my studies. I will be doing a very big mistake for not dedicating this work to my husband Chauke Rangani Donald, my sons (Bono and Khano) for their support, understanding, and words encouragement throughout the research process.

DECLARATION

I, Chauke Tshifhiwa Margaret, declare that the mini-dissertation hereby submitted to the University of Limpopo, for the degree of Master of Development Studies has not previously been submitted by me for a degree at this or any other University; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

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Chauke, T. M Date

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ABSTRACT

This study focuses on the contribution of community gardens to livelihoods of participants. It was carried out among 7 community gardens in Mudavula village in Thulamela Municipality in Limpopo Province, South Africa. The village is located in Vhembe District. The aim of this study was to assess the technical efficiency and the contribution of community gardens to the livelihoods of participants at Mudavula Village. The objectives of the study were to determine the contribution of community gardens to food security and the livelihood of Mudavula community gardens' participants using per capita production to determine the technical efficiency of the community gardens in the village and to identify sources of improvement of the contribution of the gardens towards food security and livelihoods. The findings from the descriptive and quantitative test revealed positive and negative relationship between variables and how the constraints affect their livelihood. The results shows that there is no relationship between gender and years of education, years of education and age, family size and age, employment and gender. The estimate of technical efficiency for the irrigated crops suffers more from omitted variable bias (OVB) than the rainfed equation. The study reveals that community gardens have positive impact to the livelihood of Mudavula villagers. It is therefore recommended that the Department of Agriculture capacitate farmers through their local extension officers to help empower them and equip them with the necessary skills and knowledge.

Key Words: community gardens, livelihood, technical efficiency, Mudavula.

Table of contents

Chapter 1: Introduction and Background

Chapter 2: Literature Review

Chapter 3: Research Design and Methodology

Chapter 4: Results and Discussion

Chapter 5: Summary, Conclusion and Recommendations

List of Tables

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1. Introduction

The present study focuses on the contribution of community garden to livelihoods of participants and was carried out among 7 community gardens of Mudavula village in Thulamela Municipality in Limpopo Province, South Africa. The municipality is located in Vhembe District. The chapter outlines the background as well as the problem statement relating to the study. The chapter further introduces the objectives of the study together with the significance of conducting a study of this nature. Concept and terms repeatedly used in the study are clearly defined. Delineations and limitations are explained in order to limit the scope of the study. The chapter concludes by outlining all the chapters contained in the mini-dissertation.

1.2. Background

It is well documented that agriculture can play an important role in improving livelihoods, reducing poverty and enhancing food security of rural small scale farmers or community garden participants (Machethe*,* 2004; Backeberg *et al*., 1996)

Mudavula village comprises six sub-villages namely: Dakari, Mbhalati, Salani, Mapimele, Machele and Xihosana. Members of Mudavula village responded to the call by the South African government and Vhembe District Municipality to initiate and establish community gardens for livelihood and job creation, with the assistance of government departments and non-governmental organisations (NGOs). In the area under study, there are seven community gardens that produce vegetables and maize.

The development of community gardens is a major focus of the Department of Agriculture. These assist people to achieve household food security, help to develop skills and expose people to the rudiments of business activities and resource management

1.3. **Rationale/ Motivation**

Individual farmers at Mudavula Village mobilized themselves and established community gardens. Little is known about the contribution of community gardens, so it is important therefore that studies such as the present one be conducted to find out the contribution that community gardens make to the livelihoods of the participants.

1.4 Significance of the Study

Food security is an important aspect of economic development in any country. A well-nourished nation is a healthy nation, and its people are able to actively contribute in the social and economic development of the country. Investigating the dynamics of food production is crucial. It is through such studies that new ways can be found to assist those who are engaged in agricultural activities that are likely to transform communities and the country at large. The present study provides a comprehensive analysis of Mudavula community gardens and seeks to recommend means to improve the contribution of community gardens to the livelihoods of the participants. The findings of the study will assist with the identification of positive contributions the villagers are making as well as identify challenges the participants face. The study will also suggest ways of addressing the various challenges.

1.5 Statement of the Problem

A study conducted by Tshitangoni *et al.* (2010) reveals that the contributions of community gardens are mostly on livelihood. Almost 62% of the people in Vhembe District depend largely on social grants and remittances (Mudau *et al.*, 2005). Social security is a critical economic survival element for a significant proportion of households. A considerable proportion of people live in poverty. The White Paper on Social Welfare (2006) reveals that the quality of lives of people in South Africa would be improved through poverty alleviation projects (PAPs), poverty relief, food security, poverty eradication, and community development or self-help projects such as community gardens. Community gardens in Vhembe District perform poorly in terms of self-reliance, level of production, generation of income and profit. (Tshitangoni *et al.,* 2010).

Given the situation highlighted above, it is important to assess the contribution of community gardens to the livelihood of community garden participants; to determine whether the participants are satisfied with the contribution of the garden and to know what can be done to sustain community development based on community gardens. This research undertook an assessment of the contribution of community gardens to the livelihood of community garden participants in Mudavula Village.

Sustainable production of the community gardens is a prerequisite to the contribution to food security and livelihoods. Per capita food production is used as an estimate of the gardens' ability to contribute towards food security and livelihoods. The technical efficiency of the gardens is also estimated, to evaluate whether there are potential gains associated with improving how the farmers combine inputs to produce output. This is one parameter used to the improvement of which can lead to sustainable production.

1.6. Aim of the study

The aim of this study is to assess the technical efficiency and the contribution of community gardens to the livelihoods of community garden participants at Mudavula village in Vhembe District, Limpopo Province.

1.7 Objectives

The objectives of the study are:

- To determine the contribution of community gardens to food security and the livelihood of Mudavula community gardens' participants using per capita production.
- To determine the technical efficiency of the community gardens in Mudavula village.
- To identify sources of improvement of the contribution of the gardens towards food security and livelihoods.

1.8 Research Questions

The inquiry was guided by the following questions:

- What is the contribution of community gardens to the livelihoods of participants at Mudavula?
- What are the constraints faced by community garden participants of Mudavula village?
- What is the technical efficiency of the community gardens at Mudavula village?

1.9 Definitions of Key Concepts

Community garden

A community garden is defined as an area of land to be used by a group of people to produce fruit and vegetables (Department of Agriculture, 2011). This land may be within the jurisdiction of a tribal authority, a local authority or it may be on state owned land or on private land which is communally managed.

Livelihood

A livelihood comprises the capabilities, assets (both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stress and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Ellis, 2000 and Mutangi, 2010).

1.10. Delimitations and Limitations

The study focused on the contribution of community garden to livelihoods of participants in Mudavula village in Vhembe District. All Community gardens established in the above area were included to the study. The study included the information collected from the participants and from the literature. The scope of the study was limited by lack of funds and the level of education of the respondents.

1.12. Chapter Overview

The structure of this study adhered to the following structure:

The researcher conducted the research at Mudavula village in order to assess the contribution of community gardens to the livelihood of community garden participants. The study consists of five chapters which are indicated as follows:

Chapter 1 contains an introduction of the study which covers rationale of the study, its significance, and statement of the problem, aim and objectives of the study, research questions and operational definitions.

Chapter 2 reviews the relevant literature pertaining to the contribution of community gardens to the livelihood of participants.

Chapter 3 encompasses the methodology and design on how the study conducted and expound on the techniques that are used to collect data.

Chapter 4 presents and interprets the results.

Chapter 5 gives the findings, conclusions and recommendations.

1.13. Conclusion

Apart from the outline of the background to the study and the objectives of the contribution of community gardens to livelihoods of participants, the chapter presented the plan and an overview of how the study was conducted. Detailed literature review and methodology are presented in the next chapters.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

A literature review is a critical and in depth evaluation of previous research. It is a summary and synopsis of a particular area of research, allowing anybody reading the paper (Shuttleworth, 2009) The purpose of this chapter is to present findings of a review of literature on projects focusing more on contribution of community gardens to the livelihood of participants and to present an account of existing knowledge in relation to the research topic. The chapter familiarized readers with the current stage of regarding the research problem. This was achieved through the desk study of a wide range of academic books, journals articles, and the internet. The objective of the chapter is to highlight the contribution of community gardens to the livelihood of participants, the constraints confronted by community gardens participants, and the economic viability of community gardens.

2.2. Sustainable livelihood and community gardens

The term sustainable livelihoods relates to a wide set of issues which encompass much of the broader debate about the relationships between poverty and environment (Scoones, 2010). Ellis, 2000 and Mutangi, 2010 supported that livelihoods comprise of the capabilities, assets (both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with, and recover from, stresses and shocks and maintain or enhance its capabilities and assets both now and in the future. In an attempt to make a living, people use a variety of resources such as social networks, capital knowledge and markets to produce food and marketable commodities and to raise their incomes, (Herbinck and Bourdillon, 2001; Mutangi, 2010). The sustainable livelihoods approach is a holistic approach that tries to capture, and provide a means of understanding, the fundamental causes and dimensions of poverty without collapsing the focus onto just a few factors (e.g. economic issues, food security, etc.). In addition, it tries to sketch out the relationships between the different aspects (causes,

manifestations) of poverty, allowing for more effective prioritization of action at an operational level.

However, when such resources are not available or when they are undermined people tend to go under stress and shock. This can be traced to Sen's theory of entitlements, which postulates that the purpose of development is to improve human lives through expanding the range of things a person could do and be, for example, being healthy and well nourished, being knowledgeable and being able to participate in the life of the community.

Development is thus about removing obstacles to what a person can do in life; for example illiteracy, ill health, lack of access to income and employment opportunities, lack of civil and political freedoms (Zimbabwe Human Development Report 2003). Before the inception of the garden, the people of Mberengwa were suffering from malnutrition and kwashiorkor due to a shortage of proteins in their diets. Gardening brought about rich protein crops such as beans, and peas.

According to FAO (2012), community garden constituted the affected and the vulnerable groups promoting vegetable garden to ensure food and nutrition security, providing medical role of treating HIV related symptoms and improving digestion and stimulating appetite. This was also witnessed from the Imbahuru garden as crops such as garlic are found in the garden. Respondents pointed out that they have better diet in their daily consumption. Many households indicated the changes in their quality of life since the inception of community gardens. They obtained basic food commodities like relish and spices for their meals. They have gained skills through workshops conducted for farming purposes which help them practise good methods of farming and cooperative efforts as these enhanced attitudes interdependency.

Respondents also indicated that they were gaining team spirit, financial transactions and reduced crime as the locals spend their time in gardening activities. Community gardening becomes a meeting point for formation of clubs and helps to reduce stress as gardeners

exchange ideas and knowledge. Moreover, gardeners enhanced community participation in their projects and improved social ties, networks and relations through interaction and by borrowing produce, equipment and sharing moral obligations that improve the sense of unity in their community. Other respondents indicated that they had gained knowledge about HIV and AIDS while working in the gardens. As a result gardening is seen as a centre for practising cultivation of different crops from different corners of the world and that this practice reduces laziness and dependency, and promotes diligence, leadership practice and identification of talents. Therefore, community gardens have proved to have different benefits.

2.3. Overview of Community gardens

According to the North American Urban Agriculture Committee, a conventional community garden is a large plot of land that has been divided into smaller plots for individual household use. Community gardens can have numerous owners in its lifetime: a municipality, an institution, a community group, a land trust, or a private proprietor (Kearney, 2009).

Community gardens have a deep history embedded in the oldest, most traditional patterns of human settlement: indigenes living in a self-sufficient village. With the exception of nomadic groups, many early pre-state societies survived because of their ability to establish subsistence horticulture and agriculture. In a mixed economy of hunting and gathering, villagers would sow, harvest, over winter and store their crops in order to provide for their families throughout the year. In other societies across the globe, including Asian, African, European and Pre-Columbian American, the basic pattern of indigenous agricultural practices was the same. As civilizations became more urbanized, and as states emerged the patterns of land use changed (Kearney, 2009).

Community gardens are either started by a group of interested individuals or by a community organization. Individuals can come together to form a group, and scout out possible locations for the garden, or approach the council and ask to lease council or

government land. Once a location has been secured, the group can apply to the council for grants for fencing, building materials and water tanks (Grayson and Campbell, 2002a and Gallizzo 2013). Sometimes the group has to apply for development approval for the garden, and go through the planning assessment process (Auckland City Council 2002). Alternatively, a community organization, community worker or local government employee can start a community garden by consulting with the community to gauge their interest, and forming a group of interested people.

Community gardens come in two types: communal or allotment systems, or a combination of both. Communal systems are gardened by one group, with the costs and harvests being shared between them (Harris, 2008). Allotment systems are divided into plots of land which are each gardened by an individual. It has been found that allotment systems create more of a sense of ownership and commitment (UKY, 2004).

Communities have been upgrading communal gardens by selling the surplus production to obtain household income. Gallizzo (2013) reveals that NGOs assist in establishing small irrigated vegetable gardens as they are a major component for the daily food consumption. Community gardens promote food security as children and elderly participate in this field agriculture, (World Bank, 2007).

According to Middleton (2009), community gardens are a place to grow food crops, flowers and herbs in the company of friends and neighbours. It may also be a place to reconnect with nature or to get physical exercise. Community gardens have attracted different uses, and purposes to different societies and communities. As a result, some use community gardens because they lack quiet space at their homes that would allow them to have a garden and to build a sense of community among neighbours (Middleton, 2009). In rural areas, community gardens take different shapes, forms, sizes and purposes that make them differ from each other and from place to place. Community gardens are innumerable, i.e. neighbourhood community gardens, youth communal gardens and school gardens, nutritional gardens, entrepreneurial and market gardens, home gardens, therapy gardens and demonstration gardens

2.4. Contribution of Community gardens to livelihood of participants

Community gardens have been shown to increase the food security and nutrition of residents, by providing them with healthy food at a minimal cost (UKY, 2004). They also give people the skills required to grow food for themselves, which they may use in the future. Open days of community gardens, and workshops, educate the broader public about growing food, which has the potential to increase their food security as well (Harris, 2008).

According to findings reported by (Tshitangoni *et al.,* 2010), less than half (41%) of the poverty alleviation projects (PAPs) in Vhembe District were community gardens, only 33% of the successful community gardens performed best in terms of level of commitment of project members (83%); availability of funding for projects (81%), and skills and knowledge gained (56%). However, the community gardens do not perform at the level of production; self-reliance (19%); relevance of projects to addressing project members` needs (20%), and the generation of income and profit (22%). The average performance rate for the projects is 40% (Tshitangoni *et al.,* 2010:1008)

Scoones (2010) postulates that gardens have benefited women through specialization as they obtained vegetables, groundnuts and Bambara nuts for household consumption. Communities have benefited from participation in gardening, obtaining their income in the process. Community-run schemes have performed better than government managed schemes because of their flexibility, lower cost of operation and participation of women (Rukuni *et al.,* 2006). Community gardens in rural areas utilized wetlands as sources of water to irrigate their crops and vegetables. These wetlands existed together with community gardens for many years and proved to be highly productive as they contributed to the social and economic welfare of many rural families (Rukuni *et al.,* 2006).The use of wetlands in vegetable gardening is increasing in small holder farmers. More so, community gardens do contribute to the affected and vulnerable households' food security. Implementing organizations are helping to promote vegetable gardens to help vulnerable groups and affected households get access to vegetables to ensure food and nutrition security (FAO, 2012).These nutritional gardens have benefited households

and chronically ill people with herbs and vegetables as they improve their nutrition throughout the year. These are also activities for women where income generation becomes easy for them. Medicinal plants found in these community gardens such as garlic and onions play a role in treating HIV related symptoms, improving digestion and stimulating appetite (FAO, 2012).Gardens are for income generation and food producing activities. These are necessary for the contribution to food security and safety. Over 2, 8 million dollars' worth of food was produced from the subsistence gardens during the end of the depression by the time of the Second World War, and the food administration set up a nutritional victory garden programme which saw huge benefits (FAO, 2012).

According to Jones (2012), community gardens contribute to community development, human capital, individual financial benefits and participant health. Gardeners may consume vegetables more frequently than non-gardeners (Ellis, 2000 and Mutangi, 2010). Community gardens located in low-income neighbourhoods may help residents' access fresh, healthy food they would not otherwise be able to procure and may help achieve food security for these individuals and communities (Armstrong, 2000: Jones 2012). Entrepreneurial gardens may provide opportunities for gains in human capital, specifically job training and education, for low-income individuals and at-risk youth (Armstrong, 2000: Jones (2012). Community gardens provide small but important financial gains for programme participants, specifically in an entrepreneurial garden programme (Armstrong, 2000). Proximity to community gardens results in increased residential property values in at least some locations (Been and Voicu, 2008).

Armstrong, 2000 and Jones 2012 indicated that Community gardens can be a catalyst for other neighbourhood improvements, especially in low-income communities and Community gardens can facilitate community cohesion and trust.

2.5. Motivations and benefits of community gardens

The motivations of the gardeners and benefits of the gardens are often very similar (Guitart, *et al.*, 2012). A motivation is the desire for achieving something while the benefit is actually achieving it. For this reason there are some overlaps in the terminology used for motivations and benefits. According to Guitart *et al.*, 2012, about 86% of the literature discussed the motivations of people involved in community gardens. The most common motivations reported were: to consume fresh foods, social development or cohesion such as community building and culture exchange, to improve health among members and to make or save money by eating from the garden or selling the produce. Other less common, but still important motivations included: to educate, to enhance cultural practices, to access land, to enjoy nature, environmental sustainability and to enhance spiritual practice. Most studies reported on the motivations of gardeners but some also discussed the motivations of project managers and institutions depending on who provided information. The most common benefits of community gardening included: social development or cohesion, enhanced health, access to fresh foods, saving or making money, and education. Other benefits discussed included: reduced crime and increased safety, environmental sustainability, enhancing cultural heritage, life satisfaction, environmental equity and increased biodiversity. All papers discussed between one and nine benefits (average 3.7), however only half (56.3%) of the papers were able to demonstrate between one and six benefits (average 2.1).

The most commonly demonstrated benefits based on the conclusion of literature reviewed were social benefits, such as community building/resilience and social interaction (keeping in mind that some benefits might be easier to demonstrate than others or requiring less complex methodologies). For example, improving nutrition by increasing fruit and vegetable intake was a benefit that was often mentioned in the literature but in some instances could not be demonstrated because of the complexity of evidence required in this field of study (Alaimo *et al*., 2008). There were often differences

between the benefits mentioned and those demonstrated. For example, environmental equity and increased biodiversity were two benefits that were mentioned.

Community gardens have been shown to have a range of benefits for the users of the garden and for the wider community as shown in figure 2:1

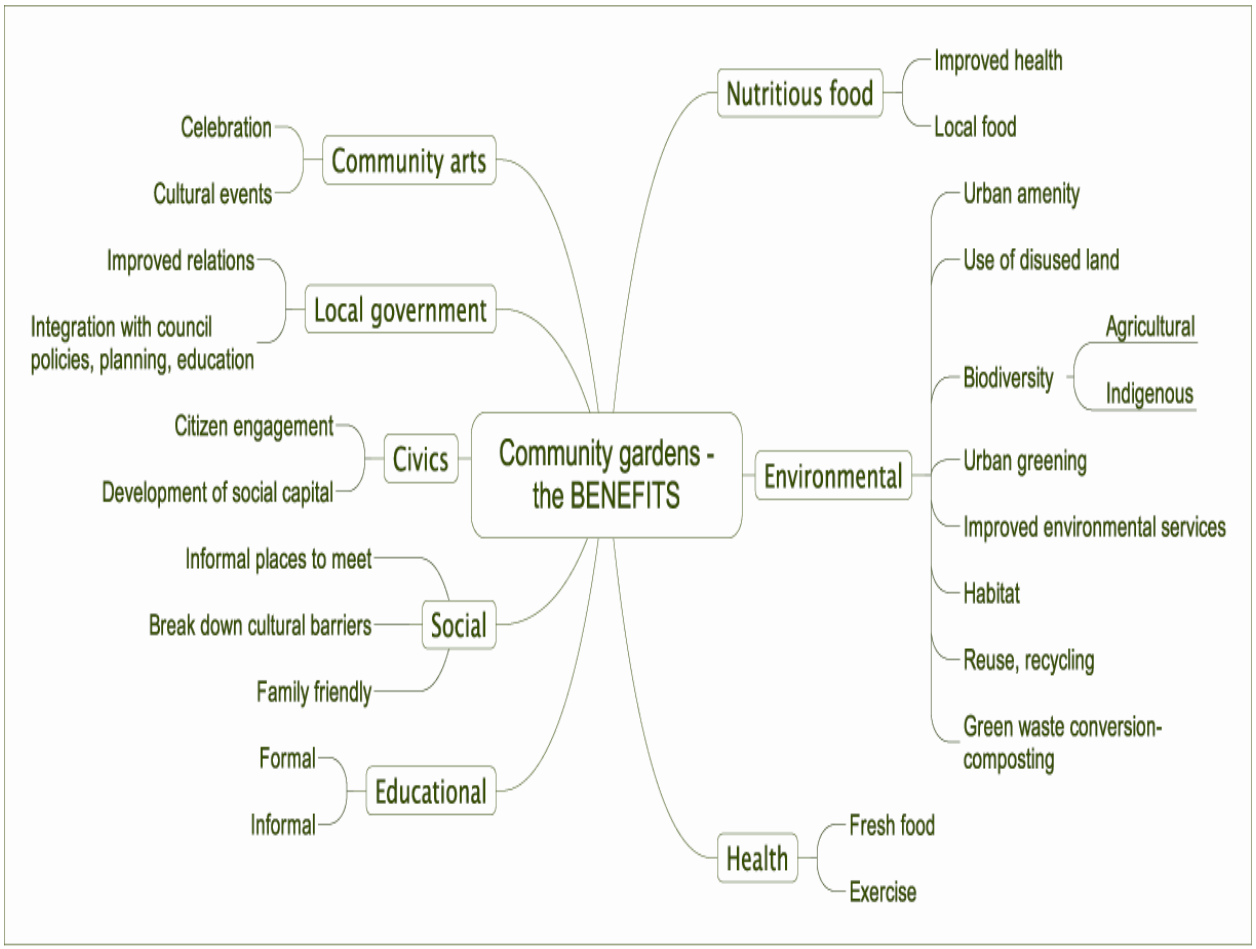

Figure 2:1The benefits of community gardens (Grayson, 2008: page 4)

2.6. Economic viability of community gardens

According to Mmbengeni and Makoka (2002) the largest contributor of the economic performance of community gardens in Limpopo Province to the Gross Domestic product (GDP) is the tertiary sector consisting of trade, transport, finance, community services, general government and other producers. That primary sector, consisting of the

agricultural and mining sector is the second largest contributor. The general government makes the largest contribution to the GDP, which is 27.3%. The role of Agriculture should also be viewed in the context that the economic activity Limpopo Province is relatively limited, such as Finance and Business Services and Community and Social Services became relatively more important in 2002 because they contributed 32.3% to the Gross Geographic Product per capita (Mmbengeni and Makoka, 2002). Agriculture contribution to the GDP in the Province was the highest in Messina (Vhembe District) 30%, Mopani, Capricorn and Waterberg districts 29.7% and Sekhukhune District 10%.

2.7. The constraints confronted by community gardens participants

Harris 2008 identified the following as the challenges faced by community gardens:

- Finding a suitable site;
- Convincing the landholder (private or government) that they will manage the land in a responsible manner;
- Raising start-up and ongoing funds (especially important for community gardens operated by non-government organizations);
- Organizing and paying for public liability insurance;
- Managing the site;
- Organizing training for the gardeners;
- Maintaining the interest of the gardeners (Grayson & Campbell, 2002);
- Lack of understanding in councils: one example was the rejection of a community composting scheme on the grounds that it was an ‘industrial activity’ and needed to be in an industrial area (Howe, 2002);
- Contamination of sites by past uses (Howe, 2002);
- Competition over land (Howe, 2002), and
- Conflicting policies concerning agriculture in urban areas (Foeken, 2006).

Sithole et al. (2012) indicated Community gardens can be a catalyst for other neighbourhood improvements, especially in low-income communities, Community gardens can facilitate community cohesion and trust, Community gardens face many challenges that limit their production and interaction between members. Lack of irrigation

equipment undermined the ability of poor households to raise their agricultural incomes and made them even more vulnerable to frequent droughts (Chazovachii et *al*., 2012).

According to Middleton (2009) community gardens in rural areas face management challenges. Most of the participants in community gardens lack gardening skills. Community gardens attracted members who are politically motivated and they tend to influence decision making. Middleton (2009) also noted that community gardens also face the challenge of water to irrigate fruits and vegetables during summer. Conflicts over control of land, competition between actors over use of scarce resources such as water because of population pressure are also common in community gardens.

Sithole et al. (2012) note that one of the major challenges of community gardens is associated with inadequate supplies of both surface and underground water as Bulawayo, being close to the Kalahari Desert, is vulnerable to droughts and receives low annual and erratic rainfall averaging 450mm – 600mm. Its water supply is mainly based on surface water accumulated in five reservoirs located in Upper Mzingwane catchment (the case of Bulawayo Metropolitan Province in Zimbabwe). There is therefore a chronic water shortage for domestic and industrial use resulting in frequent rationing of water. Use of hosepipes and any other form of watering/irrigation of gardens using municipal water is prohibited during critical water shortage periods (Sithole, *et al.,* 2012).

According to Mmbengeni and Makoka (2002), in Limpopo Province females are the majority in food security projects like poultry, piggery, vegetable gardens and grain crops, whereas men are in the commercial farming like cattle breeding and orchards. Mmbengeni and Makoka (2002) acknowledge that about 80% of community garden participants confronted with the following constraints in their production activities:

- High electricity costs;
- Shortage of storage facilities;
- Lack of markets;
- Lack of government support, and
- Lack of synergies.

Mmbengeni and Makoka (2002) further point out that the majority of farmers in Limpopo Province are above 45 years of age – only 17% of the respondents are below 45 years. The impression behind this is that farming is for the old people. According to SA Statistics, HIV/AIDS causes great losses in lives of young people, especially amongst the most disadvantaged group of South Africans. Due to high unemployment rate in the province, agriculture is taken as an important sector for income generation system and this places considerable strain on extensionists in terms of transfer of knowledge and skills in all farming areas or activities like feasibility studies.

The findings of Mmbengeni and Makoka (2002) showed that:

- Women are the majority in food security;
- Men are a majority in commercial farming;
- The majority of farmers are above 45 years of age, and
- There is a need for the Department of Agriculture to play a role in promoting and agriculture among the youth of the Province.

2.8. The impact of climate change on community gardens and sustainable livelihoods

2.8.1 Climate Change

The projected impact of climate change, increasing occurrence and magnitude of natural disasters such as drought, floods, poses serious constraints and challenges for Sustainable Agriculture and Rural Development (SARD). A recent study undertaken for maize indicates that some of the marginal western areas may become unsuitable for production under current management strategies while some of the eastern production areas may remain unchanged or increase production levels (AGIS, 2002) in South Africa. Specialty crops grown in specific environmentally favourable areas may also be at risk as both rainfall and temperature effects may cause changes in areas suitable for specialized production (AGIS, 2002). This can affect the production yield of community gardens.

2.9. Changes in agricultural management practices

These include change in planting dates, row spacing, planting density and cultivar choice, and other measures, which would counteract the effects of limited moisture. Irrigation is currently used to supplement low levels of precipitation, but this could become very expensive and less effective, giving conditions of increasing aridity. This would require a phasing out of irrigation farming and a relocation of the production areas eastwards, if practicable. To reduce the risk of famine, marginal production areas could be kept economically viable by, for example, decreasing input costs or planting drought resistant crops, such as sorghum or millet. Alternatively, land use could be changed to grazing (AGIS, 2002). Many current agricultural practices, such as conservation tilling, furrow disking, terracing, contouring, and planting vegetation as windbreaks, protect fields from water and wind erosion and assist in retaining moisture by reducing evaporation and increasing water infiltration. Management practices that reduce dependence on irrigation would reduce water consumption without reducing crop yields, and would allow for greater resiliency in adapting to future climate changes. Such methods include water harvesting. The reduced use of some pesticides could directly reduce greenhouse gas emissions and also reduce water pollution, thus contributing to both adaptation and mitigation.

Agricultural management practices that recognize drought as part of a highly variable climate, rather than a natural disaster, should be encouraged. Farmers should be provided with information on climatic conditions, and incentives should be given to those farmers who adopt sound practices for drought management, and therefore do not rely on drought relief funds.

2.10. The success of community gardens to sustainable livelihoods

The term sustainable livelihoods relates to a wide set of issues which encompass much of the broader debate about the relationships between poverty and the environment, (Scoones, 2010). A livelihood is sustainable when it can cope with, and recover from, stresses and shocks and maintain or enhance its capabilities and assets both now and in the future. In an attempt to make a living, people use a variety of resources such as social networks, capital knowledge and markets to produce food and marketable commodities and to raise their incomes (Herbinck and Bourdill on 2001, Mutangi, 2010). However, when such resources are not available or when they are undermined, people tend to go under stress and shock. This can be traced to Sen's theory of entitlements, which postulates that the purpose of development is to improve human lives through expanding the range of things a person could do and be, for example, being healthy and well nourished, being knowledgeable and being able to participate in the life of the community. Development is thus about removing obstacles to what a person can do in life for example illiteracy, ill health, lack of access to income and employment opportunities, lack of civil and political freedoms (Zimbabwe Human Development Report, 2003).

2.11. Theoretical and measures of technical efficiency

Measurement of technical efficiency is one of the very important topics of research in both developing and developed countries. Applications vary in content because most studies in developing counties are focused on agriculture, while in developed countries, the interest on technical efficiencies has tended to focus on the industrial sector, or the manufacturing sector in general (Obwona, 2006). In the literature it is well documented that technical efficiency is the effectiveness with which a given set of inputs is used to produce an output. A farm is said to be technically efficient if a farmer is producing the maximum output from the minimum quantity of inputs, such as labour, capital and technology. For example, a farm would be technically inefficient if a farmer employed too many workers than was necessary or used outdated equipment.

According to Osawe *et al.* (2008), the concept of technical efficiency model can be illustrated graphically using a simple example of a two input (*x*1, *x*2)-two output (*y*1, *y*2) production process (Figure 2.2)

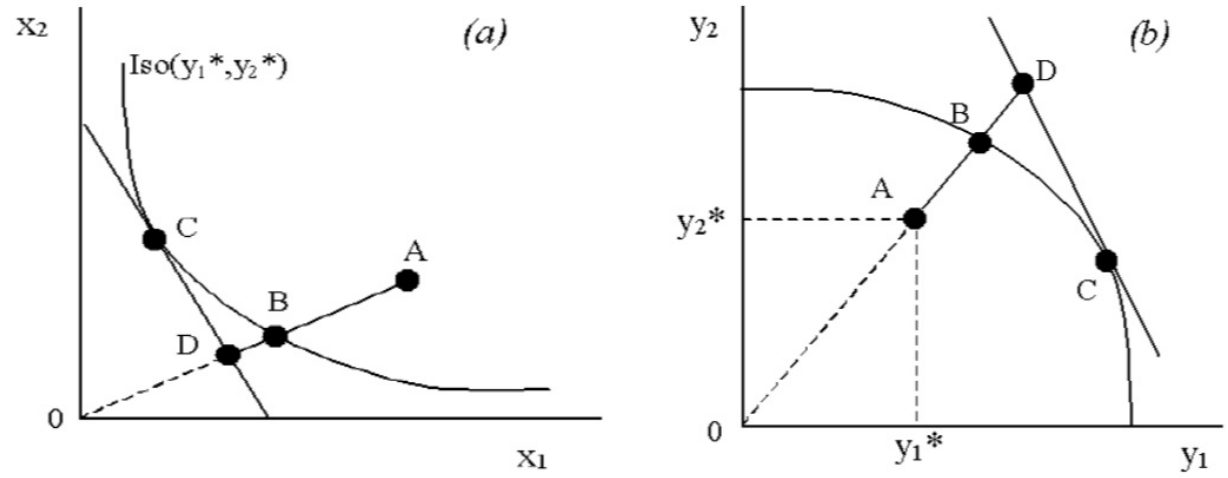

Figure 2.2: Input (a) and output (b) oriented efficiency measures (Osawe *et al.,* 2008: 71-82).

Efficiency can be considered in terms of the optimal combination of inputs to achieve a given level of output (an input-orientation), or the optimal output that could be produced given a set of inputs (an output-orientation).

In Figure 2.2. (a), the firm is producing a given level of output (*y*1*, *y*2*) using an input combination defined by point A. The same level of output could have been produced by radially contracting the use of both inputs back to point B, which lies on the isoquant associated with the minimum level of inputs required to produce (*y*1*, *y*2*) (i.e. Iso (*y*1*, *y*2*)). The input oriented level of technical efficiency (TEI(*y*, *x*)) is defined by 0B/0A.
However, the least-cost combination of inputs that produces (*y*1*, *y*2*) is given by point C (i.e. the point where the marginal rate of technical substitution is equal to the input price ratio *w*2/*w*1) (Kumbhaker and Lovell, 2000 and Osawe *et al.* 2008).

The production possibility frontier for a given set of inputs is illustrated in Figure 2.2. (b) (i.e. an output-orientation). If the inputs employed by the firm were used efficiently, the

output of the firm, producing at point A, can be expanded radially to point B. Hence, the output oriented measure of technical efficiency (TEO(y, x)) can be given by 0A/0B. This is only equivalent to the input-oriented measure of technical efficiency under conditions of constant returns to scale. While point B is technically efficient, in the sense that it lies on the production possibility frontier, higher revenue could be achieved by producing at point C (the point where the marginal rate of transformation is equal to the price ratio *p*2/*p*1). In this case, more of *y*1 should be produced and less of *y*2 in order to maximize revenue. To achieve the same level of revenue as at point C while maintaining the same input and output combination, output of the firm would need to be expanded to point D. (Kumbhaker and Lovell, 2000 and Osawe *et al.* (2008).

The literature emphasizes two broad approaches to production frontier estimation and technical efficiency measurement:

- The non-parametric programming approach, and
- The statistical approach.

2.12. The Stochastic Frontier

Aigner et al. (1977) and Meeusen and Van den Broeck (1977) introduced **stochastic frontier analysis** (SFA) as a method of economic modelling, and Chiona et al. (2014) reviewed the stochastic frontier analysis. It has its starting point in the stochastic production frontier models simultaneously.

According to Mastromarco (2008), stochastic frontier models allow to analyse technical inefficiency in the framework of production functions. Production units (firms, regions, countries, etc.) are assumed to produce according to a common technology, and reach the frontier when they produce the maximum possible output for a given set of inputs. Inefficiencies can be due to structural problems or market imperfections and other factors which cause countries to produce below their maximum attainable output.

In addition Mastromarco (2008) indicated that production units can move along the frontier by changing input quantities and Mastromarco (2008) again introduced that there can be some combination of three effects. The stochastic frontier method allows to

decompose growth into changes in input use, changes in technology and changes in efficiency, thus extending the widely used growth accounting method.
To distinguish the sources of productivity change, it is desirable to incorporate the possibility of changes in efficiency.

The stochastic frontier methodology, pioneered by Aigner et al. (1977) and Meeusen and van den Broeck (1977) and supported by Chiona et al. (2014), allows the important distinction between efficiency gains or losses and technical progress. In addition, it allows to include explanatory variables in both the production function and the efficiency term.

2.12.1. Origins of Stochastic Frontier Analysis

Stochastic Frontier Analysis originated with two papers published nearly simultaneously by two teams on two continents. Meeusen and Vanden Broeck 1977 appeared in June, and Aigner et al. (1977), appeared a month later. Aigner et al. (1977) and Meeusen and Vanden Broeck 1977 papers are themselves very similar. Both papers were three years in the making, and both appeared shortly before a third Stochastic Frontier Analysis paper by Battese and Corra (1977), the senior author who had been a referee of the Aigner et al. paper. Stochastic production frontiers were initially developed for estimating technical efficiency rather than capacity and capacity utilization. However, the technique also can be applied by Chiona et al. (2014).to capacity estimation through modification of the inputs incorporated in the production (or distance) function.

2.12.2. The Production Frontier

The standard definition of a production function is that it gives the maximum possible output for a given set of inputs. The production function therefore defines a boundary or a frontier. All the production units on the frontier will be fully efficient. Efficiency can be of two kinds: technical and allocative (Kumbhakar and Lovell, 2000: Osawe et al. 2008). Technical efficiency is defined either as producing the maximum level of output given inputs or as using the minimum level of inputs given output. Allocative efficiency occurs

when the marginal rate of substitution between any of the inputs equals the corresponding input price ratio. Technical efficiency can be modelled using either the deterministic or the stochastic production frontier Kumbhakar and Lovell, 2000: Osawe et al. 2008). In the case of the deterministic frontier model the entire shortfall of observed output from maximum feasible output is attributed to technical inefficiency, whereas the stochastic frontier model includes the effect of random shocks to the production frontier. There are two alternative approaches to estimate frontier models: one is a non-parametric approach which uses linear programming techniques, the other is a parametric approach and utilizes econometric estimation. The characterizing feature and main advantage of the non-parametric approach, the Data Envelopment Analysis, or DEA, is that no explicit functional form needs to be imposed on the data.

2.12.3. Stochastic Frontier Production Functions and Panel Data

The seminal work on frontier production functions was by Farrell (1957). His analysis considers the estimation of a deterministic frontier production function using nonparametric (e.g., mathematical programming) techniques. A one-sided error term (the inefficiency term) accounts for all deviations from optimality. The idea of a stochastic frontier production function came to prominence in the late 1970s as a result of the work of Aigner et al. (1977); Battese and Corra (1977); and Meeusen and van den Broeck (1977), it is applied by several researches including Chiona et al. (2014). In contrast to the deterministic frontier, the stochastic model includes a two-sided error term (measuring the effects of statistical noise) as well as a one-sided error term.

This approach is intuitively appealing because deviations from the frontier can be explained by events under the control of the manager (team selection or the timing of substitutions) as well as events not under control of the manager (good/bad luck or the state of the weather). The increasing availability of panel data has increased the scope of frontier estimation procedures. Maximum likelihood (ML) estimation can be used if we introduce distributional assumptions for the error term.

2.13. Conclusion

The studies reviewed above show that community gardens contribute to the livelihood of community garden participants and the chapter also revealed the economic viability and constrains confronted by community garden participants. The chapter helped the researcher by providing more information about the topic and stimulated the interest of researcher. The chapter continued to bring the researcher's confidence about the relevance of the topic.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The aim of this chapter is to illustrate an overall methodology together with the methods used to achieve the objectives of this research as stated in chapter one. It also describes the overall methodology adopted, population identification, sampling procedures and unit of analysis, the means to study site methods for data collection and analysis.

3.2 Research methodology

The collection of primary data for this study involved field surveys which comprised semi-structured interviews through the use of a questionnaire. The use of survey design is the main element for data collection procedure in scientific research (Bless and Higson-Smith, 2000: Neuman, 2006). In conducting the survey, participatory approaches were used to collect information for this study. Research methodologies refer to the rationale and the philosophical assumptions that underlie a particular study (Leedy, 2004). This is therefore, informed by quantitative approach. Philosophically, its arguments are underlined by contribution of community to livelihood of participants.

According to Leedy (2004), quantitative approach is based on positivism, in which scientific explanation is adopted. Quantitative data collection methods are based on measurements using verification instruments in order to objectify phenomena under study. Measuring instruments involve the assignment of numbers, in terms of fixed rules, to reflect differences between them in some of their characteristics. Quantitative research focuses on measuring objectives facts and variable and uses statistical analyses to express numbers (Neuman, 2006). Because of the power the statistical evidence provides to research methods, it was used in this study to statistically support how the community thinks about the gardens to livelihood of the participants.

The research was carried out at Mudavula village located in Vhembe District, Limpopo Province. The study used quantitative research methods. Seven community gardens

were visited and all the objectives were assessed in order to determine their contribution to livelihood. The sample consists of all beneficiaries of the seven community gardeners.

3.3. Research design

According to Babbie and Mouton (2006:72), research design addresses the planning of scientific inquiry and strategy for investigation. It has already been indicated above that quantitative research methods were used; therefore, the researcher conducted a survey design and drew a questionnaire to collect primary data about the contribution of community gardens to livelihood. The study used the sustainable livelihoods model to establish causality between community gardens and livelihoods of community garden participants.

3.3.1 Population of the study

Donald and Pamela (2003:78) define population as the group upon which the researcher is interested in making inferences. In statistics, a population is defined as an entire group about which some information is required to be ascertained (Banerjee and Chaudhary, 2010). A statistical population need not consist only of people. The population of this study is community garden participants at Mudavula village in Limpopo Province. It embraces two types of community gardens: dry-land and irrigated. In literature rain-fed community garden has been defined as a type of farming practised in arid areas without irrigation by planting drought-resistant crops and maintaining a fine surface tilth or mulch that protects the natural moisture of the soil from evaporation. Dry land community gardens are gardens that depend on rain; they produce during summer seasons and irrigated community gardens have water supply, and they produce all year round.

3.3.2 Sampling technique and sample

Mudavula village in the Thulamela municipality area was purposely selected for this study. Mudavula was selected because it has been subjected to a variety of contribution of community to livelihood of participants. There are seven community gardens in the village. All the gardens are included in the study. The seven community gardens are composed of 54 beneficiaries. The researcher purposely conducted a research to seven community gardens in the village.

3.3.3 Methods of data collection

Both primary and secondary data were used for this study. Secondary data were obtained from government publications, research publications and reports. Secondary data were collected through literature review aimed at identifying attributes and contribution of community to livelihood of participants. Primary data were obtained through field observation of infrastructure and questionnaires.

3.3.4 Data collection

Mudavula database for community gardens were used to access farmers who are producing different crops in their community gardens. This was obtained from extension officers. The community gardens were visited and the local extension officer was used as the initial contact person when visiting community gardens. Scheduled un-structured interviews and structured questionnaires were used to collect quantitative data respectively. Data about the production on community gardens, the constraints faced by community garden participants were collected from a total of 54 farmers with a total of 270 household members.

3.3.5 Questionnaire Survey

A list of structured questionnaires was administered to 54 farmers that were purposively selected. The researcher embarked on a door to door activity and only 54 farmers who were selected were given questionnaires to answer on their own. In cases where the respondent could not read and write the researcher assisted the respondent by reading out and then explaining to them in the language that they understand. The first set of questionnaires were asking questions related to the social demography of the target population. This information helped the researcher to know the social response of people concerning the contribution of community gardens to the livelihood of participants.

3.3.6 Field survey

An observation was also undertaken to assess the contribution of community gardens to the livelihood of participants. An observation on whether the community can afford to participate on the livelihood was also done. Several site visits were undertaken to observe and collect relevant data. During the visit data related to deforestation and many other environmental problems such as lack of water and soil structure were also observed. Images that were taken also include an overview of the natural environment in its current state. They include photographs of the most harvested products which are used for livelihood purpose.

3.4 Data processing and analysis

Questionnaires were distributed purposively to all community gardeners in the village. The data were collected and then captured into Microsoft Excel after which it was analysed statistically using SPSS, and it was presented in the form of tables in a percentage format. During data analysis quantitative approach was used to get the logic of the primary data. The questionnaires were coded and analyzed according to the procedures as described by Robson (2002) and De Vaus (2002). The questionnaires

were processed and analyzed in order to obtain the findings for the research objectives and research questions of the present study.

The researcher recorded all the information given by the respondents in a note book. The quantitative data were analysed using the SPSS (Statistical Package for Social Sciences) computer package. Tables were used for data presentation. Regression analysis was used to assess the performance of community gardens.

The stochastic frontier model, as proposed by Aigner et al. (1977); and applied by several researches including: Kumbhakar, (2000). , Battese and Corra (1977); Meeusen and van den Broeck (1977) and Chiona et al. (2014) was used. The model was stated as:

$Y = f(A, L)$

Where:

Y = output measured in kg

A = Area measured in ha

L = labour measured in mandays.

3.4.1. Statistical Procedures

This study used the Statistical Package for Social Sciences (SPSS) as the statistical software for data analysis. According to Coakes (2009), SPSS is a software for performing statistical procedures in the social sciences field. SPSS is among the most widely used programmes for statistical analysis in social sciences. It is a complete statistical package that is based on a point and click interface. SPSS has almost all statistical features available and widely used by researchers to perform quantitative analysis. Chi-square, cross tabulation, Pearson Product-Moment Correlation and descriptive statistics were used to analyse the data.

3.4.2 A Stochastic Frontier approach of measuring agricultural productivity and efficiency

According to Chiona et al. 2014, there are several econometric (Parametric) and linear programming (Non-parametric) techniques used to measure efficiency. The parametric approach has the advantage of allowing noise in the measurement of inefficiency, however the approach needs to specify the functional form for production cost or profit. The non-parametric approach is simple and easy to calculate since it does not require the specification of the functional form (Coelli, 2004).
Makombe *et al.* (2011) discussed that the common parametric methods are the Stochastic Frontier Approach, the thick frontier approach and the distribution-free approach, while the common non-parametric techniques are the free disposal hull analysis and data envelopment analysis.

Measuring productivity growth in agriculture sector is imperative, but a challenging task. There exist many methodologies for measuring productivity growth and efficiency, and each method has its own advantages and disadvantages depending on the research question at hand (Makombe, *et al.,* 2011). For example, Index Numbers is quite simple to implement, but it is susceptible to the noise in the data as well as measurement errors. In addition, it does not allow for the measurements of technical change, scale effects or technical inefficiency. Linear programming approach such as Data Envelopment Analysis (DEA) is more flexible in the sense that it is robust to the functional form of the production frontier and it can accommodate various production constraints and efficiency measurement. In most agriculture applications of production frontier models, frontier parameters are often assumed to be the same for all cross-section units and time. Such assumption might be questionable, especially in the application where the number of time observations is large.

Makombe *et al.* (2011) describe various ways to model heterogeneity in production frontier and they start with the most general model and then provide discussion of various special cases by imposing certain parameters restrictions on the frontier. They use the

stochastic frontier production function as proposed by Aigner *et al*. (1977) to estimate technical inefficiency across a cross section of firms or farms. From the Stochastic frontier production function analysis Makombe *et al.* (2011) show that the production frontier of the modern irrigation scheme is higher than that of the traditional irrigation farmers. They further show that the benefit of raising the production function of the traditional scheme to that of the modern systems is very high, from a purely technical perception. An approach similar to that used by Makombe *et al*. (2011) is adopted in this study using Frontier version 4.1 as the analytical software.

3.5 Ethical considerations

For Neuman (2006:131) “ethical research requires balancing the value of advancing knowledge against the value of non-interference in the lives of others”. Lives will always be interrupted when people are included in research, even if it is stopping a person on the street to ask a few questions. Henning, 2004 identifies three stages in a research project where ethical consideration comes into play. Firstly when participants are recruited at the outset of the investigation, their written permission must be obtained. Secondly, the measurement procedures should not be harmful in anyway, i.e. physically or mentally and thirdly, when the results are released, the researcher must be sensitive not to release results that might link any individual to the research.

The researcher remains accountable for the quality of the research and should take care when conducting the research in all three stages (Henning, 2004:73-74). Ethical considerations commenced long before the participants were recruited. Firstly, the researcher has to first obtain permission from the relevant institution to conduct the research. Rubin (2005:104) explain how institutions, such as universities, are required to have a review board that evaluates the research proposals of students and staff members. This is done to ensure that the research is ethically sound before the researchers are permitted to commence research. After permission is obtained a researcher starts recruiting participants.

Permission was obtained from the headman to work in his village. Thereafter, participants who agreed to be included in the research signed a letter of informed consent, which was drawn up on the basis of the guidelines provided by authors such as Henning (2004:73) and Rubin (2005:104). The informed consent letter explained the nature of the study and the rights of the participants, such as opportunity to think about the research before agreeing to participate and the freedom to ask questions about the investigation. Potential participants were also assured that they were under no obligation to participate in the study and issues of confidentiality, privacy and freedom from harm for the participants were explained. It was made clear that the participants could withdraw from the study whenever they wished to. Finally, the participants were informed about how the research results would be used.

The informed consent letter as well as the satisfaction survey and the activity of the focus groups were translated into Tsonga (the local language in the study area) to enable people to read the letter and the questionnaires in their home language. During interviews, the letter was read out aloud to all the participants and they were given an opportunity to confirm whether they understood the contents by signing or drawing a cross at the end of the letter.

3.6 Conclusion

This chapter has covered most of the important issues concerning overall research methodology adopted, population identification, sampling procedures and units of analysis, the means of access to study sites and methods for data collection and analysis. The issue of how data were collected and analysed was dealt with in this chapter. Mudavula village is actively involved in the consumption and poor management of natural resources. Most of the respondents are women in both study areas which proves that women are always in the forefront when it comes to livelihood matters. The next chapter deals with the interpretation and analysis of the collected data.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

The previous chapter discussed how the research was conducted. The purpose of this chapter is to present and interpret the empirical findings. Data obtained from the questionnaires were analysed and interpreted. Tables were used for data presentation. Statistics like the Chi-square-test, and other descriptive statistics were used to analyse the data.

4.2. Descriptive statistical analysis

Data were summarised and presented by making use of descriptive statistics. The mean, standard deviation, minimum and maximum values for all scaled questions were computed and used in the explanation of the findings.

4.2.1. Age

Table 4.1 presents the age of the household head. The average age of the sample was 34.34 years with a standard deviation of 23.4

Table 4.1. Age distribution of household head (%). (n=54)

	Age distribution of family members
Age Categories	**(%)**
>15 to ≤30	2
>30 to ≤45	7
>45 to ≤60	24
>60	67
Total	**100**

Sixty-seven percent of the household heads were older than 60. This indicates a lack of interest in such agricultural projects by younger people, who may actually be dependent

on the elderly for food security. Why it is mostly the elderly who are involved in the food security projects is an area requiring further research.

4.2. 2 Years of education

The average years of education for the household head was 7 years (sdev= 5.5) with an average of 6 years (sdev=5.7) for females and an average of 8 (sdev=5.3) for males.

Table 4.2 summarises the results of the analysis of years of education of the household head by gender.

Table 4.2.Years of education of household head by gender (%) (n=54)

Years of education Category	Male	Female	Total
≤5	15	28	**43**
>5 to ≤10	13	13	**26**
>10	18	13	**31**
Total	**46**	**54**	**100**

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About 43 percent of the household heads had less than five years of education. Of those, 28 percent of were female and 15 percent were male. Those who had more than 5 years to 10 years of education, were 26 percent, (13 percent males and 13 percent females). Those who had more than 10 years of education were 31 percent (18 percent males and 13 percent females). These results raise the question whether education is related to gender. To test this hypothesis the Chi-square test was performed (p= 0.305), showing that there was no relationship between gender and years of education of household head. This question still lingers on because the distribution seems to suggest a bias towards men and the test is significant at 20 percent. The relationship needs to be tested using a bigger sample.

Table 4.3 shows the relationship between years of education of household members from the sample demographics and gender.

Table 4.3. Years of education of household member by gender (%) (n=270)

Years of education Category	Male	Female	Total
≤5	17	18	**35**
>5 to ≤10	7	9	**16**
>10	24	25	**49**
Total	**48**	**52**	**100**

About 35 percent of the household members had less than five years of education. Of those, 18 percent were female and 17 percent were male. Those who had more than 5 years to 10 years of education were 16 percent (7 percent males and 9 percent females). Of those who had more than 10 years of education (49 percent), 24 percent were males and 25 percent females. To test the whether there was a relationship between gender and education, the Chi-square test was performed (p= 0.899), showing that there was no relationship between gender and years of education of household member.

Table 4.4 indicates that household heads are quite diverse in terms of their level of schooling by age category.

Table 4.4. Years of education of household head by age category (n=54)

Years of education of HH member		Age category			
	>15 to ≤30	**>30 to ≤45**	**>45to≤ 60**	**>60**	**Total**
≤5	**0**	**0**	**4**	**39**	**43**
>5 to ≤10	**0**	**2**	**6**	**18**	**26**
>10 to ≤14	**2**	**5**	**15**	**9**	**31**
TOTAL	**2**	**7**	**24**	**67**	**100**

The largest group of household heads who had less than or equal to 5 years of education (39 percent) had less than or equal to 5 years of education. This was the age group of greater than 60 years. For the same age group, 18 percent had greater than 5 to less than or equal to 10 years of education. To whether there was a relationship between age and level of education, the Chi-square test was performed (p= 0.006) and it showed that there was a relationship between age and years of education of household head.

Table 4.5 shows that household members (from the sample demographics) are quite diverse in terms of their level of education.

Table 4.5. Years of education of household member by age category (%) (n=270)

Years of education of HH member	Age of HH member in years						
	0	**≤15**	**>15 to ≤30**	**>30 to ≤45**	**>45to≤ 60**	**>60**	**Total**
≤5	**1**	**17**	**0**	**0**	**4**	**13**	**35**
>5 to ≤10	**0**	**5**	**2**	**1**	**3**	**5**	**16**
>10 to ≤14	**0**	**3**	**27**	**13**	**4**	**2**	**49**
TOTAL	**1**	**25**	**29**	**14**	**11**	**20**	**100**

The largest group of household members (49 percent) had less than 10 to 14 years of education, and of those 27 percent were for the age group of less than15 years to 30 years old and 13 percent were those who had greater than 30 to 45 years old. To test whether there was a relationship between age and years of education, the Chi-square test was performed (p= 0.000), showing that there was a relationship between age and years of education of household member. In a nation where the older people did not get an education, there would be no relationship. However, in a nation where there are improvements in education, there would be a significant relationship, with the younger being more educated than the old. This may be the case in South Africa as 29 percent of

those with greater than 10 and less than or equal to 14 years of education are found in the age group less than 15 to less than or equal to 30 age group.

4.2.3 Family size

The average family size is 5 people with a standard deviation of 1.6. The highest family size is 9 and the lowest is 2. Table 4.6 indicates the relationship between the family size and the ages of the household heads.

Table 4.6.Family size by age of household head (%) (n=54)

Family size category	Household head age group (%)				
	>15 to ≤30	>30 to ≤45	>45 to≤ 60	>60	Total (%)
≤3	0	4	0	13	17
>3 to ≤6	2	3	18	37	61
>6 to ≤ 9	0	0	6	17	22
Total	2	7	24	67	100

The results show that 18 percent had family size greater than 3 to less than or equal to 6 members and were of the age group of greater than 45 to less than or equals to 60 years. Thirty seven percent had the same family size of 3 to less than or equals to 6 members and were for the age group of greater than 60 years. About 17 percent of family size who are greater than 6 to less than or equal to 9 members were of the age group of greater than 60 years. As expected, it is the older household heads who have larger families. This means that the families headed by older members will have more food security challenges than those headed by younger ones. This may partly explain why the older household heads participate more in food security projects than younger ones, as observed earlier. Given our sample size, these relationships warrant further investigation.

Table 4.7 shows the relationship between years of education of household head and family size. Twenty-six percent had years of education less than or equal to 5 and had family size of greater than 3 and less than or equal to 6. For the same family size, 15 percent and 20 percent respectively had less than 5 to less than or equal to 10 years of education, and greater than 10 years of education.

Table 4.7. Years of education of HH member by family size (%) (n=270)

Years of education of HH member	**Family size (%)**			
	≤3	**>3 to ≤6**	**>6 to≤ 9**	**Total (%)**
≤5	**9**	**26**	**7**	**42**
>5 to ≤10	**2**	**15**	**9**	**26**
>10	**6**	**20**	**6**	**32**
Total	**17**	**61**	**22**	**100**

To test whether there is a relationship between years of education of household head and family size, the Chi-Square test was performed. The p- value is 0.601, so it can be concluded that there is no association between family size and years of education of household head. The Chi-Square test was performed to test for this relationship on the assumption that more educated household heads would have smaller families.

4.2.4. Occupation

Table 4.8.summarises the results of occupation analysis for the household members from the sample demographics.

Table 4.8. Occupation of household members (%) (n=270)

Occupation	Employment status of household member
Farming	27
Student	28
Formal employment	15
Unemployed	30
Total	100

Twenty-seven percent are involved in farming, 28 percent are students, 15 percent are in formal employment and 30 percent were not employed. Employment analysis of the whole family is essential because it shows how much support for a family's living comes from. In this case only 15 percent are involved in formal employment. Ideally this analysis should be done by including an estimate of the income from each occupation. However, the resources did no permit collection of these data so this is an area of further study.

Table 4.9 shows the occupation of the family members (from the demographics) by gender.

Table 4.9. Occupation of household members by gender (%)(n=270)

Occupation	Gender		Total
	Male	Female	
Farming	9	18	27
Student	16	12	28
Formal employment	7	8	15
Unemployed	16	14	30
Total	48	52	100

Of the 15 percent involved in formal employment, 7 percent are male and of the 30 percent unemployed, 16 percent are males.

4.2.5 Perceived Economic status

Household heads were asked about their perceptions of their economic status. Table 4.10 summarises the results.

Table 4.10. Household Perceived Economic status by Gender of household head (%) (n=54)

Gender of HH Member	Perceived economic status			Total
	Poor	Medium	Rich	
Female	48	6	0	43
Male	37	9	0	57
Total	85	15	0	100

Eighty-five percent of household heads perceived their households as poor and 15 percent medium, and none as rich. The Chi-square test was performed to test for association between gender of household head and perceived economic status. The result, p=.270, shows that there is no relationship.

4.2.5.1. Perceived economic status by education

The hypotheses that the way household heads perceived the economic status is a function of the education of the household head was tested. Table 4.11 summarises the results.

Table 4.11. Economic status by education of household head

Years of education Category	Perceived Economic status			Total
	Poor	Medium	Rich	(%)
≤5	41	2	0	43
>5 to ≤10	24	2	0	26
>10 to ≤14	20	11	0	31
Total	85	15	0	100

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About eighty-five percent of household heads perceived their households as poor, and 41 percent of them had less than or equal to five years of education, and 24 percent attended school for greater than or equal to ten years. The Chi-Square was used to test for the relationship between the education of the household head and perceived

economic status. The result, p = 0.016, indicates that there is a relationship between the economic status and years of education of household head with the less educated household heads perceiving themselves as poor.

4.3 Source of water

Farmers were asked about the availability of water sources for irrigation. Table 4.12 shows the results.

Table 4.12. Sources of water by gender of household head (%) (n=54)

Gender of HH Member	Source of water			Total
	River	Borehole	None	(%)
Female	7	15	32	54
Male	13	11	22	46
Total	20	26	54	100

Twenty percent of the farmers used water from the Levubu River and 26 percent use borehole as the water source. Fifty-four percent used rainfed production using the Chi-square the relationship between water sources and gender was tested. The result (p=0.053) indicates a weak relationship between gender and water source. Proportionately more females have no access to irrigation water. The way in which access to water is determined requires further research. Over 70% of crop is rain fed and less than 30% is produced with irrigation. In total agriculture accounts for over 60% of the total water were utilized (AGIS, 2014). The majority of Africa's poor live in rural areas where agriculture and livestock production, both water dependent, as the mainstay of livelihood. For community gardens in particular, basic well-being depends on water availability and reliability of supply (AGIS, 2014).

4.10. How does community garden help farmers?

Farmers were asked how the community gardens affected their lives. Table 4.13 summarises the results.

Table 4.13. How does community garden help by gender of HH member (%) (n=270)

		Gender of HH member %		
		Male	Female	
How does community garden help	Job creation	7	6	
	Poverty alleviation	13	13	
	Livelihood	26	35	
Total		46	54	

Table 4.13. Indicates that community gardens are perceived to have positive impact on livelihoods. About 61 percent reported that the gardens contributed to their livelihoods. Of these, 35 percent were female and 26 percent male. The p= 0.738 from the Chi-Square test implies that there is no relationship between how the community garden assists and gender of household head.

4.4. **Technical efficiency analysis**

Technical efficiency is the effectiveness with which a given set of inputs is used to produce an output.

4.4.1 Technical efficiency of rainfed community garden maize crop

Table 4.14 summarises the variables for the stochastic frontier estimation for rainfed community garden maize.

Table 4.14: Summaries the variables for the stochastic frontier estimation for rainfed community garden maize.

Variable	Mean	Sdev	Min	Max
Production (t/ha)	9.8	29.1	0	20
Area (ha)	0.87	0.6	0.25	3.0
Labour (mandays)	187	251	0	200

Table 4.14 summarises the variables for the stochastic frontier estimation for rainfed community garden maize with the mean, standard deviations, minimum and maximum values of the variables. The production (t/ha) has mean of 9.8, standard deviations of 29.1, the minimum of 0 and maximum of 20. The area (ha) has mean of 0.87, standard deviations of 0.6, minimum of 0, 25 and maximum of 3.0. The labour (mandays) has mean of 187, standard deviations of 251, minimum of 0 and maximum of 200.

Table 4.15 summarises the technical efficiency of the rainfed community garden crop.

Table 4.15: Maximum likelihood estimates of best practice stochastic frontier production function for rainfed community garden maize crop (n=45 plots)

	Estimate	SE	t-ratio
Constant**	1.990	0.881	2.256
LnA***	2.036	0.481	4.233
LnL	2.926	0.201	0.146
Z's			
Constant	-36.177	61.874	-0.585
Gender	-1.862	4.328	0.629
Age	0.457	0.726	0.629
Education	-2.092	5.862	-0.357
Sigma squared	9.182	12.018	0.764
Gamma***	0.770	0.257	2.999

*** = Significant atα= 0.01; ** = Significant at α= 0.05; * = Significant at α= 0.1

The technical efficiency of the rainfed community garden maize is 55 percent. This means that production can be improved by altering how the two inputs of labour and land are combined. The selected inefficiency effects of gender, age and education are not statistically significant. This warrants further study into potential inefficiency effects which were not collected in this study. One possibility is extension contact. Through a combination of education and extension it is possible that farmers may increase their technical efficiency. Besides the possibility offered by increasing technical efficiency, the system could increase production by input intensification accompanied by supplementary irrigation.

4.4.2 Technical efficiency of irrigated community garden crops

Table 4.16 summarises the variables for the stochastic frontier estimation for irrigated garden crops.

Table 4:16 Summaries the variables for the stochastic frontier estimation for irrigated garden crops.

Variable	Mean	Sdev	Min	Max
Production (t/ha)	65.0	95.1	0.05	267
Area (ha)	1.87	1.53	0.25	4.50
Labour (mandays)	7.9	6.3	2.3	29.7

Table 4.16 summarises the variables for the stochastic frontier estimation for irrigated garden crops with the mean, standard deviations, minimum and maximum values of the variables. The production (t/ha) has mean of 65.0, standard deviations of 95.1, the minimum of 0.05 and maximum of 267. The area (ha) has mean of 1.87, standard deviations of 1.53, minimum of 0, 25 and maximum of 4.50. The labour (mandays) has mean of 7.9, standard deviations of 6.3, minimum of 2.3 and maximum of 29.7.

Table 4.17 summarises the results of the technical efficiency estimates for the irrigated community garden crops.

Table 4.17. Maximum likelihood estimates of best practice Stochastic Frontier production function for winter irrigated community garden crops (n=20 plots)

	Estimate	SE	t-ratio
Constant***	-3.214	1.790	-1.796
LnA***	2.676	0.516	5.187
LnL***	1.070	0.359	2.982
Z's			
Constant	-2.408	2.577	-0.934
Gender	-0.183	0.576	-0.317
Age*	5.469	3.139	1.742
Education	0.165	0.396	0.418
Sigma squared***	0.626	0.164	3.814
Gamma***	17.998	4.086	4.405

*** = Significant atα= 0.01; ** = Significant at α= 0.05; * = Significant at α= 0.1

The technical efficiency of the irrigated community garden crops is 41 percent. This also means that production can be improved by altering how the two inputs of labour and land are combined. Of the selected inefficiency effects of gender, age and education, only age is statistically significant. Since the sign is positive, this means that the higher the age the higher the efficiency. This implies that there is some value to experience. This estimate of technical efficiency warrants further investigation because irrigation was not quantified as water applied. This is a very difficult prospect to accomplish under the circumstances of the community garden irrigation practices, but it means that the estimate of technical efficiency for the irrigated crops suffers more from omitted variable bias (OVB) than the rainfed equation. Keeping this in mind the combination of education and

extension suggested above may also increase technical efficiency. Input intensification under irrigation is also a possibility.

4.12. Constraints

Farmers were asked about the constraints they faced at Mudavula Village.

Table 4.18 summarises the results.

Table 4.18. The type of constraints

Constraint	Percent reporting constraint
Lack of water	44
Lack of agricultural implements	6
Climate change	2
Lack of business management skill	2
Pest and diseases	9
High costing of inputs	9
Competitors	6
Transport to market is too costing	7
Financial problem	4
Lack of support from traditional Leader	2
Lack of land	4
Theft	5
Total	**100**

The constraints reported by Mudavula farmers were: lack of water, reported by 44 percent of the farmers, high cost of input (9 percent), pest and diseases (9 percent), lack of agricultural implements (6 percent), climate change (2 percent), lack of business management skill (2 percent), competitors (6 percent), high cost of transport to market (7 percent), lack of support from traditional leaders (2 percent), financial problems (4 percent), lack of land (4 percent) and theft (6 percent). We tested for the relationship between all constraints and gender of household head (p=685) and all constraints and

education of household head (p=0.464) and concluded that there is no relationship in both cases. Maybe the test should be done for individual constraints. However, our sample size did not permit this. We concluded that addressing some of these constraints, especially lack of water, might increase the technical efficiency of both rainfed and irrigated crops.

4.13. Chapter summary

From the above results, it shows that community gardens have a positive impact of livelihoods in the rural areas, although age is one of the limitations to the sustainability of community gardens. A number of constraints have been identified that contribute to limited production in Mudavula. Some of these are: lack of water, poor skills, theft, lack of agricultural implements and inputs. Many participants in the community gardens are from disadvantaged families with poor educational background. This state of affairs calls for the Department of Agriculture to intervene to help equip these farmers with the necessary skills and knowledge. The results of the technical efficiency analysis show that the efficiency of production can be improved without a change in technology. This means that the efficiency is still low for the applied technology. For irrigated production it is possible to encourage input intensification.

CHAPTER 5: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Introduction

The chapter presents conclusions based on a summary of the findings of the study, the extent to which research objectives and research questions were addressed.

5.2. Summary of research findings

The objective of the study was to determine the contribution of community gardens to food security and the livelihood of Mudavula community gardens' participants, technical efficiency of the community gardens in the Village and the socioeconomic attributes of the garden participants.

Both primary and secondary data were used. Primary data were used and 54 respondents' community gardeners were interviewed using a questionnaire. The data collected from the gardeners were used to determine the relationship between variables such as the relationship between gender and education; economic status and gender; economic status and years of education, and family size and age. Secondary data were obtained from government publications, research publications and reports.

The descriptive statistics revealed that the majority of Mudavula community gardeners are confronted by lack of water, which leads to low yield and low quality of produce. Community gardens at Mudavula village had a positive impact to the livelihood of the participants.

The result shows that community gardens at Mudavula village have a positive impact on the livelihood of the people. However, the results of the estimate of technical efficiency show that it is possible to improve the contribution of the food security gardens to livelihoods by improving the aspect of technical efficiency.

5.3. Conclusion

The findings of this study show that community gardens have the potential to contribute in the livelihood of the gardeners at Mudavula village. The challenges being faced by community gardeners are: lack of water; high cost of input; pest and diseases; lack of agricultural implements; climate change; lack of business management skill; competitors; high cost of transport to the market; lack of support from the traditional leaders; financial problems, and lack of land and theft. Challenges such as lack of water and pests and diseases are inherent and measures are needed to solve such problems as they contribute to community breakdown. Addressing these challenges can lead to better performance of future projects. There should be attempts to increasing the technical efficiency of the gardeners so their activities can contribute more to their livelihoods.

5.4. Recommendations

Based on the findings from the study, it is recommended that attention to the major constraints is needed as the constraints tend to hinder garden production, which in turn leads to high rates poverty, low income and high rates of food insecurity. It has been noted that lack of water was one of the major constraints. This is a constraint which can be addressed directly by the government. The Department of Agriculture can also empower community gardeners by providing training in the areas of water harvesting and soil conservation. Institutions such as Tompiseleka and Madzivhandila agriculture colleges can play a critical role in this effort.

Gardeners need to work hand in hand with local extension officers to augment their production skills. It is through such skills improvement encounters that the technical efficiency of production can be improved.

Food production programmes for food security such as Letsima and Fetsatlala could be introduced to the gardeners in rural areas to assist them with mechanization and other useful inputs required for production. Production at Mudavula community garden needs to be improved by altering how the two inputs of labour and land are combined. Gardening

projects at Mudavula village should be done to reduce poverty and the capacitate farmers to help reduce dependency on government employment and improve self-employment. Improvement of community gardens will also lead to community development.

The Department of Agriculture and Rural Development should implement relevant strategies and policies that may be used to improve gardeners' livelihood, which will also contribute to food security. Youth, female farmers and small scale farmers from disadvantaged families should be empowered to participate effectively in community gardens to reduce poverty, unemployment and fight against food insecurity.

The Department of Agriculture should implement some strategies and policies on how gardeners can improve their livelihood: land tenure policies, empowerment programmes of female farmers to influence them to participate in community garden activities. This approach may have a positive impact on the technical efficiency of production, bringing social and economic development to many communities in the country, without these communities having to depend on the government.

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APPENDIX A: Ethical statement to be read to the potential participants when requesting their permission to participate in the interviews.

I would like to thank you for welcoming me. My name is Tshifhiwa Margaret Chauke and I work at the Department of Agriculture, Malamulele Service Centre, Vhembe District. I am studying towards a Master's Degree in Development at the University of Limpopo in the Department of Management and Law.

I am currently doing a research on the contribution of community gardens to the livelihood of participants at Mudavula village. I am investigating the technical efficiency and the contribution of community gardens to the livelihoods of community garden participants at Mudavula, investigating the constraints confronted by Mudavula farmers in agricultural development.

The findings of my research might help you to solve certain problems and to broaden knowledge and understanding of a particular phenomenon. I would like you to participate in my research. Your participation is voluntary and you have the right to refuse to answer any question I ask, or to discontinue the interview at any time without providing a reason for doing so. You have the right not to disclose your personal details. The names of all the respondents will not be assigned when reporting on the findings. I also want to promise you that all the information you supply will be kept confidential. Only my Supervisor, Prof. G. Makombe, of the University of Limpopo and I will have access to your information.

I would like to inform you that by answering the questions it will be assumed that you understand what my research is all about and that you agreed to participate in my study. Please feel free to ask me any question related to my research project before you make any decision on your participation.

Your co-operation will be highly valued. Thank you for taking your time to listen to me.

Chauke TM

APPENDIX B: QUESTIONNAIRE FOR COMMUNITY GARDENERS

Identifiers:

Name of household head: ----------

Name of village: ----------

Interview date : /__/__/__/__/__/__/__/__/ (ddmmyyyy)

Production type: 1. Rainfed 2. Irrigated

Please answer the following questions by putting a cross (x) in the relevant block or writing down your answer in the space provided. All responses will strictly be kept in confidence.

SECTION A- DEMOGRAPHIC INFORMATION

This section collects demographic information. Although we are aware of the sensitivity of the questions in this section, the information will allow for the comparison of groups of respondents. Your cooperation is appreciated.

1. Household structure

1.1. How many are you in your household? _____

1.2. What is the composition of your household?

Name of household member	Gender of household member	Age of household member	Years of Education of household member	Occupation of household member	Designation of household member

1.3. What is the economic status of your household?

Very poor	Poor	Medium	Rich	Very Rich
1	2	3	4	5

SECTION B- PRODUCTION INFORMATION

This section of the questionnaire collects information on your production and marketing practices (to be completed by individual participant)

2. Production data for the Summer crop: Output and Inputs used on individual plots and crops

Plot number	Crop	Area	Seeds planted (kg)	Type of fertilizer	Quantity of fertilizers applied (kg)	Type of insecticide	Quantity of insecticides applied per ml or kg	Type of herbicide used	Quantity of herbicides applied per ml or kg	Total Output Output(Ton)

Crop code: 1=Vegetables 2=Maize Fertilizer code: 1=Organic fertilizer 2=Inorganic fertilizer

2.1 External labour for individual summer crops

Plot	Crop	Activity		Number of persons from outside the household who have really worked on the field							
				Adults at least 15 years old				Children below 15 years old			
				Number	Time (days/hours)	**1=Hired2=Help**	Pay (R)	Number	Time (days/hr)	**1=Hired 2=Help**	Pay (R)
		Ploughing									
		Planting									
		Weeding	First								
			Second								
			Third								
		Fertilizer application									
		Pesticide application									
		Herbicide application									
		Harvesting									
		Ploughing									
		Planting									
		Weeding		First							
				Second							
				Third							
		Fertilizer application									
		Pesticide application									
		Herbicide application									
		Harvesting									

2.2. Internal labour individual summer crops (family labour)

Plot	Crop	Activity		Number of persons from outside the household who have really worked on the field			
				Adults at least 15 years old		Children below 15 years old	
				Number	Time (days/hours)	Number	Time (days/hours)
		Ploughing					
		Planting					
		Weeding	First				
			Second				
			Third				
		Fertilizer application					
		Pesticide application					
		Herbicide application					
		Harvesting					
		Ploughing					
		Planting					
		Weeding		First			
				Second			
				Third			
		Fertilizer application					
		Pesticide application					
		Herbicide application					
		Harvesting					

2.3. Marketing of individual summer crops

Please provide information about marketing

Type of Crop	Quantity sold		Price		Market			
	Amount	Unit	Amount	Unit	Name	Type of Market	Distance (Km)	Access 1=Easy 0=Difficult

3. Production data for the Winter crop: Output and Inputs used on individual plots and crops

Plot number	Crop	Area	Seeds planted (kg)	Type of fertilizer	Quantity of fertilizers applied (kg)	Type of insecticide	Quantity of insecticides applied per ml (kg)	Type of herbicide used	Quantity of herbicides applied per ml (kg)	Total Output Output(Ton)

Crop code: 1=Vegetables 2=Maize Fertilizer code: 1=Organic fertilizer 2=Inorganic fertilizer

3.1. External labour for individual winter crops

Plot	Crop	Activity		Number of persons from outside the household who have really worked on the field							
				Adults at least 15 years old				Children below 15 years old			
				Number	Time (days/hours)	**1=Hired2= Help**	Pay (R)	Number	Time (days/hours)	**1=Hired 2=Help**	Pay (R)
		Ploughing									
		Planting									
		Weeding	First								
			Second								
			Third								
		Fertilizer application									
		Pesticide application									
		Herbicide application									
		Harvesting									
		Ploughing									
		Planting									
		Weeding		First							
				Second							
				Third							
		Fertilizer application									
		Pesticide application									
		Herbicide application									
		Harvesting									

3.2. Internal labour individual winter crops (family labour)

Plot	Crop	Activity		Number of persons from outside the household who have really worked on the field			
				Adults at least 15 years old		Children below 15 years old	
				Number	Time (days/hours)	Number	Time (days/hours)
		Ploughing					
		Planting					
		Weeding	First				
			Second				
			Third				
		Fertilizer application					
		Pesticide application					
		Herbicide application					
		Harvesting					
		Ploughing					
		Planting					
		Weeding		First			
				Second			
				Third			
		Fertilizer application					
		Pesticide application					
		Herbicide application					
		Harvesting					

3.3. Marketing of individual winter crops

Please provide information about marketing

Type of Crop	Quantity sold		Price		Market				
	Amount	Unit	Amount	Unit	Name	Type of Market	Distance (Km)	Access 1=Easy 0=Difficult	

.

4. Summer crop: Output and Inputs used for group crops

Plot number	Crop	Area	Seeds planted (kg)	Type of fertilizer	Quantity of fertilizers applied (kg)	Type of insecticide	Quantity of insecticides applied per ml or kg	Type of herbicide used	Quantity of herbicides applied per ml or kg	Total Output Output(Ton)

Crop code: 1=Vegetables 2=Maize Fertilizer code: 1=Organic fertilizer 2=Inorganic fertilizer

4.1. External labour for group summer crops

Plot	Crop	Activity		Number of persons from outside the household who have really worked on the field							
				Adults at least 15 years old				Children below 15 years old			
				Number	Time (days/hours)	**1=Hired2=Help**	Pay (R)	Number	Time (days/hours)	**1=Hired 2=Help**	Pay (R)
		Ploughing									
		Planting									
		Weeding	First								
			Second								
			Third								
		Fertilizer application									
		Pesticide application									
		Herbicide application									
		Harvesting									
		Ploughing									
		Planting									
		Weeding	First								
			Second								
			Third								
		Fertilizer application									
		Pesticide application									
		Herbicide application									
		Harvesting									

4.2. Internal labour group summer crops (family labour)

Plot	Crop	Activity		Number of persons from outside the household who have really worked on the field			
				Adults at least 15 years old		Children below 15 years old	
				Number	Time (days/hours)	Number	Time (days/hours)
		Ploughing					
		Planting					
		Weeding	First				
			Second				
			Third				
		Fertilizer application					
		Pesticide application					
		Herbicide application					
		Harvesting					
		Ploughing					
		Planting					
		Weeding		First			
				Second			
				Third			
		Fertilizer application					
		Pesticide application					
		Herbicide application					
		Harvesting					

4.3. Marketing

Please provide information about marketing

Type of Crop	Quantity sold		Price		Market				
	Amount	Unit	Amount	Unit	Name	Type of Market	Distance (Km)	Access **1=Easy** **0=Difficult**	

5. Winter crop: Output and Inputs used for group

Plot number	Crop	Area	Seeds planted (kg)	Type of fertilizer	Quantity of fertilizers applied (kg)	Type of insecticide	Quantity of insecticides applied per ml or kg	Type of herbicide used	Quantity of herbicides applied per ml or kg	Total Output Output(Ton)

Crop code: 1=Vegetables 2=Maize Fertilizer code: 1=Organic fertilizer 2=Inorganic fertilizer

5.1. External labour for group winter crops

Plot	Crop	Activity		Number of persons from outside the household who have really worked on the field							
				Adults at least 15 years old				Children below 15 years old			
				Number	Time (days/hours)	**1=Hired2 =Help**	Pay (R)	Number	Time (days/hours)	**1=Hired 2=Help**	Pay (R)
		Ploughing									
		Planting									
		Weeding	First								
			Second								
			Third								
		Fertilizer application									
		Pesticide application									
		Herbicide application									
		Harvesting									
		Ploughing									
		Planting									
		Weeding		First							
				Second							
				Third							
		Fertilizer application									
		Pesticide application									
		Herbicide application									
		Harvesting									

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5.2. Internal labour for group winter crops

Plot	Crop	Activity		Number of persons from outside the household who have really worked on the field			
				Adults at least 15 years old		Children below 15 years old	
				Number	Time (days/hours)	Number	Time (days/hours)
		Ploughing					
		Planting					
		Weeding	First				
			Second				
			Third				
		Fertilizer application					
		Pesticide application					
		Herbicide application					
		Harvesting					
		Ploughing					
		Planting					
		Weeding	First				
			Second				
			Third				
		Fertilizer application					
		Pesticide application					
		Herbicide application					
		Harvesting					

5.3. Marketing

Please provide information about marketing

Type of Crop	Quantity sold		Price		Market				
	Amount	Unit	Amount	Unit	Name	Type of Market	Distance (Km)	Access 1=Easy 0=Difficult	

If irrigated:

6. What is your source of water?

River	1
Borehole	2
Dam	3
Rain harvesting	4

7. How does community garden help you?

Job creation	1
Poverty alleviation	2
Income generation	3
Livelihoods	4
Other	5

8. How much do you pay for water per month? (Rand)

_____

9. Besides the garden, what are your other sources of income, and how much do you make from each source per year.

Source	Amount per year

Income code: 1=R250-R500.00 2=R750.00-R1000.00 3=R1250.00-R1500.00

4=R1750.00-R2000

SECTION C: CONSTRAINTS INFORMATION

10. Please list four of the most important constraints which you face in the community garden. Please list them from the most important to the least important constraint.

Constraint description	Importance
	1
	2
	3
	4