Academic year 2015-2016

ANALYSING THE POTENTIAL OF KITCHEN GARDENS IN ENHANCING HOUSEHOLD FOOD SECURITY AND LIVELIHOODS IN RURAL TANZANIA.

CASE STUDY: SUBSISTENCE FARMERS IN THE MOROGORO AND DODOMA REGION.

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Thesis submitted in partial fulfilment of the requirements for the joint academic degree of International Master of Science in Rural Development from Ghent University (Belgium), Agrocampus Ouest (France), Humboldt University of Berlin (Germany), Slovak University of Agriculture in Nitra (Slovakia) and University of Pisa (Italy) in collaboration with Wageningen University (The Netherlands),

Certification

This thesis was elaborated and defended at the Humboldt University of Berlin within the framework of the European Erasmus Mundus programme "Erasmus Mundus International Master of Science in Rural Development " (Course N° 2010-0114 – R 04-018/001)

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Dedication

I dedicate this work to my parents, Mr. and Mrs. Bumah Joseph and my siblings: Melvis, Solange, Gisele, Gerald and Chelsea. Thank you for always believing in me, I am forever grateful for that.

Acknowledgements

I use this opportunity to express my sincere gratitude to some people who contributed to the success of my dissertation, without which it would have not been possible.

First and foremost, I would like to recognize the input of my promoter Prof. Wolfgang Bokelmann for accepting my research topic and his continuous guidance to me in carrying out my research work.

Secondly my sincere appreciation goes to Dr. Stefan Sieber, my co-promoter for accepting my request to join the Trans-SEC project. I appreciate his patience, moral support, guidance and continuous mentorship throughout my research period. I am grateful for his encouragement in carrying out my work and his comments on my draft

I also wish to express my profound gratitude to the entire Trans-SEC team in Germany (ZALF) for giving me a chance to work within their project and facilitating my research. I also sincerely thank the Trans-SEC team in Tanzania and corresponding colleagues at the Sokoine University of Agriculture for their valuable contributions and cooperation throughout my stay in Tanzania. Special thanks goes to my facilitator, Nyika for assisting me on the field, and to the farmers of Ilolo and Ilakala village for their time, patience, cooperation and candid responses during my field work in Tanzania.

Many thanks to the entire IMRD team especially to Ms. Judis for providing a conducive environment and making my stay throughout the IMRD program a memorable one.

I also want to acknowledge the support of my loving family for always believing in me and their enormous sacrifices, financially and morally without which, I would not have been at this level.

My heartfelt thanks to my second family in Germany for facilitating my entire stay and all their efforts rendered towards the successful completion of my study program. I recognise immensely the efforts made by all my classmates and friends whose guidance, love and prayers have become a priceless asset in my life especially: Comfort, Lisa, Willy, Julia, Ronald, Diminga, Edward, Edwin and Johannes, for their academic and moral support.

Finally, I thank God Almighty for his unconditional love and support throughout my study program.

ABSTRACT

Tanzania is one of the Sub-Saharan countries that have recorded one of the highest rates of malnutrition, with 42 percent of children being malnourished (UNICEF 2013). Although the number of food insecure and vulnerable people is widespread in rural Tanzania, a greater proportion exists in the Northern regions. The semi-arid Dodoma region is one of the vulnerable regions. Dealing with food insecurity remains a priority to the government that is committed to achieving acceptable levels of food security. About 40 percent of the Tanzanian population live in food-deficit areas mostly semi-arid. This requires sustainable strategies to ensure an all year round production of food. Hence, there is dire need to develop novel strategies to increase household food supply beyond food demand without compromising the use of resources. This study examines the potential of kitchen gardens in enhancing household food security and improving household livelihoods. The specific objectives were to determine the extent to which kitchen gardens influence the choice of the source of food for household; analyse the extent to which kitchen gardens influence vegetable consumption patterns of households; investigate whether kitchen gardens enhance food stability during the year and to determine the fostering and hindering factors encountered in the implementation of kitchen gardens. A household survey was conducted in the Kilosa and Chamwino districts; in which 60 households with kitchen gardens were purposively sampled and interviewed through face to face interviews. This study was carried out between the months of January and April which are usually characterised as lean periods; and employed both qualitative and quantitative techniques of data collection and analyses. The collection of primary data was facilitated through a semi-structured questionnaire. Furthermore, focus group discussions including 11 kitchen gardens farmers were organised in both case study areas. From our findings, it was revealed that vegetables sourced from kitchen gardens in Ilolo and Ilakala was 39% and 23%, respectively. This results in 86% and 50% of households' indirect savings from less vegetable purchases in Ilolo and Ilakala, respectively. As such, households saved an average of Tshs 945 (0.45 USD). Therefore, the livelihoods of the correspondents were enhanced through utilisation of vegetables of home gardens. However, it was deducted from the focus group discussions that the key constraints limiting the implementation of kitchen gardens are: poor access to improved seed varieties, prevalence of pests and diseases, poor access to water for irrigating gardens, inadequate nutrition knowledge, and poor yields, preventing households' ability to maximise the full potential of kitchen gardens. In spite of the above constraints, minimal agricultural input, indirect income generation, and maintaining a stable supply of food through lean seasons demonstrates the prospects of

kitchen gardens in curbing food insecurity. It is therefore imperative for multiple stakeholders to jointly encourage and promote policies fostering the practice of kitchen gardening, especially in semi-arid areas.

Keywords: Malnutrition, Kitchen gardens, Food security, Livelihoods, Food stability, Indirect Savings.

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Acronyms and Abbreviations

AITV- African Indigenous and Traditional Vegetables

AIVs- African Indigenous Vegetables

BMBF- Federal Ministry of Education and Research in Germany

CFSVA- Comprehensive Food Security and Vulnerability Analysis

DFID- Department for International Development

ECPDM-European Centre for Development Policy Management

ESRF- Economic and Social Research Foundation

FAO- Food and Agricultural Organisation

FBS- Food Based Strategies

FCD- Focus Group Discussion

FVC- Food Value Chain

GAM-Global Acute Malnutrition

GCAP-Global Climate Adaptation Partnership

HFS- Household Food Security

PHS-Population Housing Census

IFPRI-International Food Policy Research Institute

MAFC- Ministry of Agriculture, Food Security and Cooperatives

MAFAP- Monitoring African Food and Agricultural Policies

MDG- Millennium Development Goals

MKUKUTA- National Strategy for Growth and Poverty Reduction

MNM- Micronutrient Malnutrition

NCD-Non-Communicable Diseases

NCP, URT- United Republic of Tanzania

SLF-Sustainable Livelihoods Framework

SSA- Sub-Saharan Africa

SUA- Sokoine University of Agriculture

SWOT- Strengths Weaknesses Opportunities and Threats

TDHS- Tanzanian Demographic and Health Survey

Trans-SEC- Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer

Tshs- Tanzanian Shillings

UA- Urban Agriculture

UN- United Nations

UNDP- United Nations Development Program

UNICEF- United Nations Children's Emergency Fund

UPS- Upgrading Strategy

USAID- United States Agency for International Development

WFP- World Food Program

WHO- World Health Organisation

CHAPTER ONE
INTRODUCTION

Introduction and Rationale for Study

This section begins with an introductory chapter which gives a brief overview on the state of food security from a global perspective using some key food security indicators as threshold; with a specific focus on the food security and nutrition situation in Sub-Saharan Africa at large and Tanzania in particular. Also worth mentioning are the key challenges faced by this region in achieving an adequate level of food security.

1.1 The state of food and nutrition security in the world

The beginning of the millennium saw the emergence of global world leaders at the United Nations summit with a shared vision on the necessity to fight global poverty. The final results of this summit were summarised in eight goals termed the Millennium Development Goals (MDGs) which have remained a platform for the overarching development over the past 15 years, and recorded a significant number of successes. Since its inception, there has been a significant decline in the number of people living in extreme poverty, where 1.9 billion poor people in 1990 were reduced to 836 million people in 2015. Additionally since 1990, there has been a fall in the large numbers of undernourished people living in developing regions, from 23.3 percent between the years 1990-1992 to 12.9 per cent in recent years 2014-2016 (United Nations 2015). Subsequent to the MDGs, are seventeen Sustainable Development Goals (SDGs), a continuing mechanism set out by the United Nations in 2015 to ending global poverty, preserving the planet, while maintaining global prosperity.

However, reducing poverty remains a major global challenge and its manifestations are usually reflected in extreme hunger and malnutrition, poor access to education and other basic amenities, little or no participation in decision making and social discrimination. Developing countries still remain disadvantaged where a total of 836 million people are still living in extreme poverty, with overwhelming rates recorded in South Asia and Sub-Saharan Africa (United Nations 2016). Interim findings from the 2013 World Resources Report show that the population of ‘food insecure’ people in the world stands at 800 million people, indicating that they are periodically hungry. Most nutritionally insecure people in the world are found in Sub-Saharan Africa. High levels of malnutrition and food insecurity could be as result of insufficient resources in addition to conflict, and HIV (Fanzo 2012; Searchinger et al. 2013).

This situation has worsened by rapid growth pressures in these countries where the global population is expected to rise to approximately 9.6 billion by 2050 (Searchinger et al. 2013).

In addition to the above challenges, most of the diets of populations in highly food insecure countries are characterised by low volumes of basic micro nutrients (The Economist Intelligence Unit 2014) Gaining access to highly nutritious food remains a major challenge to most individuals residing in Africa; especially Sub Saharan Africa where most diets are predominantly starchy, comprising solely on cereal or staple crops with little diversification on animal based proteins, fruits and vegetables with high micro nutrient content and other quality foods in the food basket. Low consumption of these foods are either as a result of low accessibility due to high cost, no local availability, an unequal distribution of households and little consideration as household priorities in cases where incomes fall short of meeting high quality diet needs (Negin et al. 2009; Chastre et al. 2007).

Worse still, the situation of Micronutrient malnutrition (MNM) is pronounced in these countries with the most vulnerable groups being young children and women of reproductive age. The most common deficiencies associated to MNM are iron, vitamin A and iodine deficiency and jointly affect one third of the global population with iron deficiency being the most prevalent. Furthermore, MNM is more likely to occur in regions with low dietary diversity; which are mostly predominantly starchy: based on roots, tubers and cereals (Allen et al. 2006).

Fruits and vegetables remain an essential component in providing adequate nutrients, facilitating the achievement of healthy diets and increase the body's resistance to major diseases, especially cardiovascular diseases when consumed daily and in the right quantities. According to a joint report of the Food and Agricultural Organisation (FAO) and the World Health Organisation (WHO), the prevention of deficiencies associated with the low consumption of micronutrients as well as severe diseases including: cancer, heart diseases and obesity will require a minimum consumption of 400grams of fruit and vegetables daily, without including other starchy tubers. However, a huge proportion of African households fall short of this requirement. In response to this, there is need for various local innovative and sustainable strategies that could ensure adequate and all year round consumption of these foods at household level (Allen et al. 2006; Semba, Bloem 2009).

Food Based Strategies (FBS) and diet supplements are popularly known for their role in addressing malnutrition and reducing vulnerability in most food insecure communities'

especially rural areas. Strengthening interventions for the promotion of the production of fruits and vegetables on home gardens have been proven as an effective FBS in dealing with Vitamin A and iron deficiency (CHADHA, OLUOCH 2003). Through its direct provision of fresh fruits and vegetables, kitchen gardens have the potential of supplying significant amounts of nutrients and providing about half of non-staple food needs. In response, about 10,500 gardens have been established in Ngozi province, Burundi as part of the (FAO 2016) kitchen garden promotion project.

According to a World Food Program classification of food deficit areas, approximately 29 percent of Tanzanian people were classified as food deficit (WFP 2016). In addition, results from the Tanzanian national survey (2014) indicate high stunting rates in some regions above the national threshold of 40% and identified Dodoma as one of the regions to be prioritised in terms of nutrition intervention schemes. (Tanzania Food and Nutrition Centre 2014)

With a specific focus on the semi-arid Dodoma region and the semi-humid Morogoro region, both characterised by different climatic conditions and food systems, TRANSEC (Innovating Strategies to safeguard Food Security using Technology and Knowledge Transfer) aims at identifying successful strategies to secure food for the most vulnerable poor using the local and regional value chain approach. Through its promotion program on kitchen gardens, TRANSEC provides inputs and some assistance close to 60 vulnerable households in Dodoma, a region that is highly sensitive to food insecurity because of its high exposure to extreme weather conditions such as droughts and Morogoro which has both food secure and food insecure areas (Sieber, Graef 2015). Activities such as: distribution of pocket bags for the cultivation of indigenous vegetables, providing some technical assistance on the use of nursery practices, nutrition education and some inputs to concerned households were set out as part of the program. It was initiated to improve the consumption of indigenous fruits and vegetables. This study will examine the potential of kitchen gardens and their contribution towards reducing household food insecurity and improving the livelihoods of some of the selected beneficiaries.

1.2 Background and Research Context

The second part of this chapter presents a brief overview of the food security and nutrition situation in Tanzania, with some graph illustrations on the major indicators of food insecurity, some highlights on the major drivers of food insecurity and presentation of some

facts and figures regarding agricultural development in the country. The definition of kitchen gardens as used in this study will be emphasised in this section.

Overview of Food and Nutrition Security Situation in Tanzania

Eastern Africa in spite of its rapid growth remains an extreme poor area in Africa where the achievement of food security is hindered by extreme weather conditions, immature farming sectors and low income levels. According to the (Grebmer et al. 2013) of the International Food Policy Research Institute, countries such as: Burundi, Mozambique, Zambia, and Ethiopia including Tanzania is ranked amongst countries with the highest number of undernourished people in SSA.

Tanzania like every other country in SSA relies heavily on the agricultural sector as a key engine of growth. This sector accounts for about 26.5% of its GDP implying that the performance of the agricultural sector is responsible for comprehensive economic growth. Furthermore, a greater portion of poor people (87%) live in rural areas, where 75 % of their income is generated from agriculture; making growth in the agricultural sector a strong potential in reduction of poverty (Nutrition Country Paper – The United Republic of Tanzania 2013).

At the national level, Tanzania is termed food secure and its average food self-sufficiency has stood at 102.5 percent over the last years (Ministry of Agriculture Food Security and Cooperatives 2010). Since 2012, there has been a steady increase in the Average dietary supply adequacy rate which stands at 105 per cent (FAOSTAT 2016) this is clearly illustrated in Figure 1 below. However, the agricultural sector has recorded low growth below the target of 5 per cent set by the MKUKUTA. Export earnings generated from agriculture are regarded as meagre (Ministry of Agriculture Food Security and Cooperatives 2010). In terms of agricultural productivity, Tanzania has proven itself as self sufficient. Still, food insecurity at local and regional level is driven by the inefficiency of markets and underdeveloped infrastructure (CARE 2013)

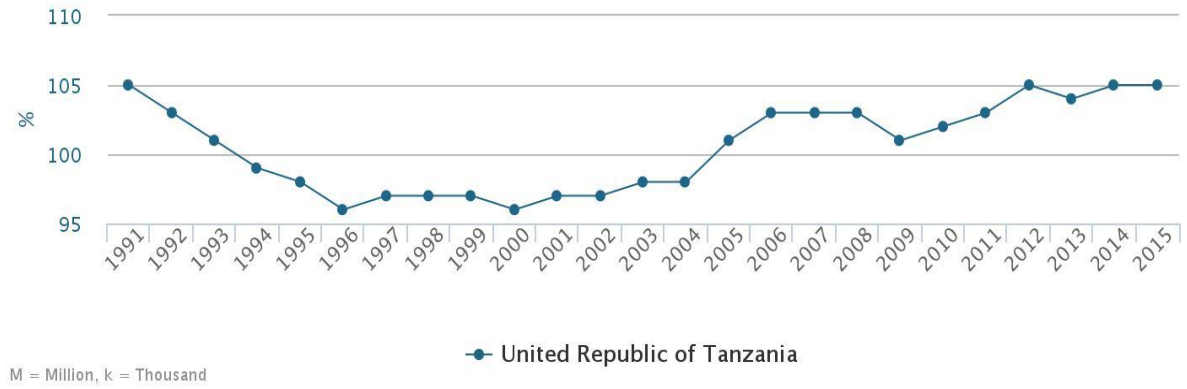


Figure 1 Average Dietary Supply Adequacy

Source: (FAOSTAT 2016)

In terms of malnutrition, Tanzania is considered to have recorded one of the highest rates of malnutrition, with 42 percent of its children being malnourished (CARE 2013). Between the years 2000 and 2016, there has been an increase in the number of undernourished people in Tanzania; that is from 13 million people between 2000 to 16.8 million people between 2016. The increases could be due to the increasing population growth and also the insufficient consumption of calories and energy-proteins (FAOSTAT 2016).

Figure 2 below is an indication of the prevalence of undernourishment (PoU)[1] of children of 3 years average. This figure depicts that, although there has been a drop in this percentage over the years, there has been no significant drop between 2006 (35.40%) and 2015 (32.10%) (FAOSTAT 2016). Even though there has been an improvement in the prevalence of undernourishment since its heightening in 2002-2003, there has been a slight deterioration in the food security situation since the 1990s, as the undernourishment rate increased from 24.2 % in 1992 to 35.7% ten years later (2012) (FAOSTAT 2016).

According to the FAO, undernourishment is the measure for hunger and is defined as the proportion of the population whose energy consumption does not meet the determined threshold which is specified according to the country and is measured in terms needed to perform light or sedentary activities.[1]

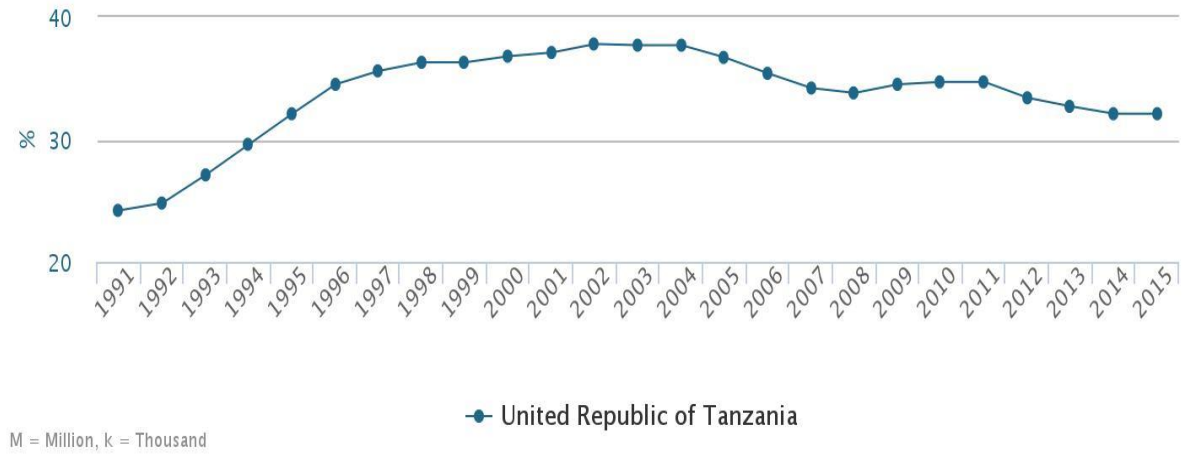


Figure 2 Prevalence of Undernourishment (%)-3 years average

Source: FAOSTAT 2016

With regards to diet diversity, most Tanzanian diets are less diverse and are based on cereals (maize and sorghum), starchy roots such as cassava and pulses (beans) with irregular consumption of micronutrient dense foods (animal products, fruits and vegetables); making the spread of micro nutrient deficiencies inevitable. Starchy foods account for almost three quarters of the total supply; leading to a very low dietary diversification index. (Nutrition Country Paper – The United Republic of Tanzania 2013) From a national stand point, the dietary energy supply falls below the population's average energy requirements prompting the government to import food and continually receive food aid to compensate for its production limitations (Nutrition Country Paper – The United Republic of Tanzania 2013).

Table 1 Selected key indicators on the food security situation in Tanzania

	1999	**2004**	**2009**	**2011**
Percentage of children under 5 years of age affected by wasting (%)	5.6	3.5	4.9	6.6
Percentage of children under 5 years of age who are stunted (%)	48.3	44.4	42.5	34.8
Percentage of children under 5 years of age who are underweight (%)	25.3	16.7	16.2	13.6
Prevalence of anaemia among children under 5 years of age (%)	73.7	71.2	62.9	60.8

Source: FAOSTAT, 2016

Table 1 above is an illustration on the major indicators of food insecurity in Tanzania. From the table it is depicted that there has been a drop in the percentages and prevalence of wasting, stunting, underweight and anaemia, although at a decreasing rate because of no significant differences in the percentages. According to findings from the Tanzanian National Nutrition Survey (2014), the prevalence of stunting at national level was higher among children between 0 to 59 months of age; with a rate of 34.7% which is considered high according to the WHO standards. However, based on the 40% threshold, Dodoma is one of the regions where chronic malnutrition rates are reportedly high and exceed the national threshold of 40% (Tanzania Food and Nutrition Centre 2014).

Additionally, Dodoma is identified as one of the regions requiring urgent nutrition interventions. It is estimated that 3.8% of children between the ages of 0-59 months suffered from Global Acute Malnutrition (GAM) and Severe Acute Malnutrition was found in 0.9% of this same group. Generally, although Mainland results revealed the level GAM as acceptable in all regions, Dodoma was the only exception thereby demonstrating a rate of 5.2%. This is compounded by the region's high exposure to droughts (Tanzania Food and Nutrition Centre 2014).

In order to get a clearer view of the food security situation of Tanzania, the spatial, temporal and socio-demographic dimensions of food insecurity of the country are worth understanding. Although there is widespread occurrence of food insecurity in all regions of rural Tanzania, some regions remain extremely vulnerable and contain the highest number of food insecure people (ECPDM, ESRF 2015). WFP estimates point out 45-55% of food insecure households are found in the regions of Dodoma, Singida and Tabora (WFP 2007).

Agriculture in Tanzania like most developing countries is predominantly rain fed and this accounts for majority of the climate related phenomenon such as famine and droughts. Seasonally and spatially, Tanzania has two rainfall regimes: a unimodal which encompasses the South, Central and West of Tanzania, with a single rainy season ranging from December to April. The bimodal zone experiences shorter rainy periods and span from October to December and the other from March to May. This zone covers the east, north and northern coast of Tanzania. Bimodal zones are more exposed to the extreme weather related conditions and are more vulnerable to erratic rains or extreme drought conditions ((Noel 2010; ECPDM, ESRF 2015). Even though 9% of Tanzanians experience food shortages, extreme food shortages resulting from shocks are more evident in unimodal zone.

Food shortages in Tanzania are witnessed during periods of drought and have an influence on the availability and access to food. In 2011, 56 out of 169 administrative districts in 16 regions (comprising mostly bimodal north east regions) faced acute food scarcity resulting from extreme droughts (Ministry of Agriculture, Food Security and Cooperatives (MAFC 2011)

Poverty remains one of the major drivers of food insecurity in the country as Tanzania still stands out as one of the poorest countries in the world. On the Human Development Index, Tanzania is ranked 159th out of 187. This is compounded by the fact that a huge proportion of households spend their income on food. About one third of all Tanzanian households' food expenditures account for more than 75% of their total expenses. 76% of poor households classified as living under the poverty line recorded very high food expenditures in 2008 (WFP 2007).

With a heavy reliance on rain fed agriculture, climate change in Tanzania is most likely to negatively deteriorate the food security situation in Tanzania. It is usually manifested in the form of periodic events such as floods and droughts; affecting many people and occasionally costing Tanzania more than 1 percent of its yearly GDP (Global Climate Adaptation Partnership (GCAP) 2011).

Land grabbing amongst other food insecurity drivers in Tanzania is a critical issue of concern which affects domestic food security. Majority of land deals in Tanzania are carried out by foreign investors with the aim of exporting produce to their home countries; consequently, plunging many investment host countries (including Tanzania) into critical food insecurity situations; making them more susceptible to regular food crises thus, increasing their reliance on food assistance on food assistance from the WFP ((Mann, Smaller 2010; GRAIN 2008). Tanzania is one of the countries worldwide whose small-scale farmers depend on land for their food security; losing land to land investors will mean a big loss to their direct source of food security (Daniel, Mittal 2009).

In response, there is a dire need to develop counter strategies to increase household food supply beyond food demand without compromising the use of resources. Amongst various strategies in preventing and mitigating severe food insecurity are kitchen gardens, with a proven track record of yielding significant nutritional, environmental and economic benefits (Home gardens: a promising approach to enhance household food security and wellbeing 2013; Saskia,De,Pee et al. 2005; Galhena et al. 2013) Growing literature on home gardens

and their relevance for food security have highlighted the multiple benefits derived from their use. These studies focus on the positive impacts of home gardens in addressing situations of malnutrition and food insecurity, their ability to provide livelihood opportunities for resource poor families, generating additional livelihood benefits through income provision, their usefulness in the conservation of biodiversity by using ecological friendly approaches ((Albuquerque, Andradeb 2005; Galhena 2012; Galhena et al. 2013; Blanckaert et al. 2004; Galhena et al. 2013).

1.3 Problem Statement and Significance of Study

Previously, most food insecurity concerns in Africa were associated with the insufficient intake of both micro and macro nutrients in the diets of most individuals. Recently, in spite of the persistence of under nutrition, there is also an increasing prevalence of diet related Non Communicable diseases (NCDs) centred on the poor and non-poor (Preedy et al. 2013). A shift in dietary patterns in SSA is exacerbated by rapid urbanizations rates which are rising faster as compared to other regions. Consequently there is a stronger preference for commercially prepared foods which are highly processed; contain huge amounts of sugar, sodium, saturated fats and less preference for diets containing nutritious fruits, vegetables, proteins and grains. This trend is visible among low income groups (Naik, Kaneda 2015).

An essential strategy for reorienting this dietary transition is the reestablishment of both traditional foods and practices (Preedy et al. 2013). Additionally, FAO suggests other ways of reorienting dietary transition through the production and consumption of fruits and vegetables and even subsidising ways of doing so (FAO 2004).

Although the numbers of food insecure and vulnerable people are widespread in rural Tanzania, a greater proportion exists in the Northern regions such as: Dodoma with about 45-55 percent being food insecure (ECPDM, ESRF 2015). A study carried out in the Chamwino and Kongwa districts of Dodoma region portrayed droughts as one of the major hazards significantly affecting the livelihoods of its inhabitants with significant effects reflected on the availability of water, agriculture and the human population. Different strategies employed by this region in dealing with climate change are hindered by poverty and weak institutions; resulting in high frequency of hunger and food insecurity. (F.Bernard Njau et al. 2014). Additionally, the uneven distribution of vegetable consumption, which is relatively abundant

in the wet season compared to the dry season increases household vulnerability. This problem is further compounded by weaknesses faced along the entire value chain, where post harvesting handling poses a serious challenge. (Global Alliance for Improved Nutrition, (GAIN 2016).

Under nutrition is a major impediment in the socio-economic development of a country and reduces its potential in reducing poverty. Chronic under nutrition undermines the physical and cognitive development of children at early stages and limits their productive capacity as adults. Children born with low weight are most likely to suffer from under nutrition as they grow older; resulting to a vicious cycle of under nutrition throughout the life cycle (UNICEF 2009).

Despite growing literature supporting home gardens as an invaluable tool for food security, significant gaps exist with regards to analysing the fostering and hindering factors of using kitchen gardens from a food system perspective. In spite of the depth of food security and its relevance for rural households in rural Tanzania, there has been little empirical evidence on assessing the potential of kitchen gardens and their role in improving the food security situation of rural poor households through the production and consumption of micro-nutrient rich indigenous vegetables; especially in the Kilosa and Chamwino districts (Case study areas).

The question of whether kitchen gardens regardless of their sizes could help in tackling the problem of household food insecurity with respect to food stability and providing direct food access and curbing under nutrition in poor households in semi-arid areas and to what extend it helps remains unclear. Plus, there is limited empirical evidence on their potential in maintaining a steady food supply for poor households in semi-arid areas. As such, by using two case study sites in the Morogoro and Dodoma rural areas of Tanzania, this thesis is dedicated to examining the potential of kitchen gardens in providing direct access to food and ensuring its stability all year round in both semi-arid and semi-humid areas.

Within the context of this study, the term ‘kitchen gardens’ which are sometimes synonymous to ‘home gardens’ refer to a traditional land use system where different species of vegetables are grown in vertical bags filled with soil; around the homestead and cultivation is done by members of the household with the primary motive of family consumption, diet

diversification, with surpluses sold on the market (Shrestha et al. 2012 (Mitchell, Hanstad 2004a) (Helen Keller International 2010)

Alleviating food insecurity is increasingly a priority both to the government of Tanzania and falls within efforts made by international development agencies. Its increasing prominence on most of these agendas includes the reduction of extreme hunger and poverty. Similarly, the Tanzanian government has committed to achieving acceptable levels of food security through its inclusion in some of its key points in its strategic polihy7cies and programs; which include: Tanzanian Development Vision 2025, National Strategy for Growth and Reduction of Poverty II, otherwise known as MKUKUTA II, amongst others.

Dealing with the 40 percent of the Tanzanian population living in food-deficit areas comprising most of semi-arid areas (WFP 2009), will require strategies which ensure an all year round production of food. Apart from the direct values obtained from home gardens, (Sthapit et al. 2004) pointed out some other reasons for famer's utilization of home gardens including: the ease of accessing fresh food in areas where refrigerators where not a common preservation option, increasing households' available options of fresh leafy vegetables, fruits and a way of maintaining a healthy level of nutrition through an increase in vegetable and fruit variety (Sthapit et al. 2004).

According to (Bradford 2010), Wild Vegetables otherwise known as indigenous vegetables increases the resilience of the food systems of most subsistence farmers through their stable supply and survival in harsh environmental conditions. They are therefore used as 'safety nets' which are particularly useful in periods of food shortages during droughts or instances of insufficient money to purchase other vegetables, mostly exotic vegetables (Shackleton et al. 2009)

Through this research, policy makers will be informed about the local innovative strategies to secure food especially among areas with differing climatic conditions and at all seasons irrespective of the climatic conditions specific to an area. Furthermore, findings realised from this study will be relevant to governmental, non-governmental organisations, international aid agencies and organisations involved in designing successful food security strategies for rural households and will therefore contribute to an ongoing literature on kitchen gardens and their relevance for food and nutrition security.

1.5 Research Objectives

The main objective of this study is to examine the potential of kitchen gardens in enhancing household food security (with respect to ensuring direct and continuous access to food) and improving the households' livelihoods through creating direct and indirect sources of income in the Morogoro and Dodoma regions. In order to fulfil the above objective this research focuses on answering to the following research questions:

1. To what extent does the implementation of kitchen gardens influences the choice of the source of food of households in the Morogoro and Dodoma regions.
2. To what extent does the implementation of kitchen gardens influences the vegetable consumption patterns of households in the Morogoro and Dodoma regions.
3. Do the kitchen gardens enhance food access stability during the year?
4. What are the fostering and hindering factors encountered by households implementing kitchen gardens?

In order to achieve the above objectives, a household survey was carried out by the researcher with a total number of 60 households in both the Morogoro and Dodoma regions, to whom a semi-structured questionnaire was administered, including both open ended and close ended questions relating to relevant concepts of our study. Focus group discussions were also organised with a total number of 11 farmers in each region to get an in depth analysis on the problems faced by farmers as well as their opportunities encountered in using kitchen gardens. Then we analysed literature and derived conclusions based on our data.

1.6 Outline of Thesis

This work is structured into 5 main chapters; each chapter serving as a preliminary to consequent ones. The first chapter analyses the current food security situation in Tanzania by using major indicators and pointing out main food insecurity drivers. Facts, figures, tables and graph illustrations are used to facilitate this analysis. Some specific focus is placed on the Northern region of Tanzania which is particularly vulnerable to climate change and its manifestations.

Chapter two provides a general review of literature, theoretical and conceptual grounds relevant for the study. This is closely followed by a general understanding of global food security and home gardens, their historical perspectives and current evolution; underpinning its dimensions. Furthermore, there is an expansion of the contribution of home gardens to food security and its relevance for household livelihoods. Also, African Indigenous Vegetables (AIVs) are highlighted in this section as well as the nutrient composition of the

AIVs cultivated on home gardens. An adapted analytical framework used for this study is presented based on the combination of some relevant concepts from the 'Two Key Pathways for Urban Agriculture to Food Security' framework and the Sustainable Livelihood Framework. Relevant components of the Global Value Chain approach will be used to examine fostering and hindering factors of using kitchen gardens at household level.

Chapter three describes the research design and methodological aspects of the empirical research with details on the data set used for the study, a brief explanation of the data collection process, the sample size, a description of the case study areas and a brief explanation of the measurable concepts. Some major findings will be presented in this section.

In chapter 4, discussions relating to our findings will be elaborated. Focus is placed on home gardens and their contributions to household food security and livelihoods. This will be closely followed by a brief discussion on the fostering and hindering factors, while placing focus on the case study areas.

Finally, chapter five presents the summary of the major findings and results which will be briefly discussed in the direction of the research questions, conclusions presented, lessons drawn and areas for future research identified.

CHAPTER 2
LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

The second chapter of this study presents a more detailed overview of home gardens with greater emphasis placed on their role for livelihoods and food security. Some key concepts relevant for this study are defined with some brief examples. Also, AIVs which make up most of the vegetables cultivated on the kitchen gardens are highlighted and a brief analysis on their nutrient composition explained.

In the last section, a conceptual framework is developed which is an adapted framework for this study and is a combination of concepts derived from the Sustainable Livelihood Framework (DFID 1999) and ideas from a 'Two key pathways of urban agriculture food security' framework and serves as a base in the assessment of the potential of kitchen gardens in reducing household food security and improving livelihoods in semi arid (Dodoma) and semi humid (Morogoro) regions on Tanzania.

2.1 Evolution of Home Gardens and Global Food Security

The concept of Food Security can be regarded as a shifting paradigm which has witnessed an evolution over time accompanied by a change in its priorities. Food security in the 1970s was attributed to concerns about national and global food supplies. Meanwhile the 1980s witnessed a shift in this paradigm and questions concerning access of food both at household and individual levels started surfacing. Focusing on the 1980s, the definition of food security lays emphasis on three aspects namely: access, vulnerability and entitlement. Since the 1990s, there is a continuous growth in the interest of food security and a huge generation of academic related literature from most developing countries' national, regional and local programmes (FAO, 2006).

The Sustainable Livelihoods (SL) framework is seen as the most comprehensive food security analysis approach is used in a more general sense towards poverty and development. With the 'pentagon of assets' being the centre of this approach, its application is spread among several issues including food security, (Devereux 2001; DFID 1999). Distinctive features of this approach over other food security approaches include its long-term viewpoint and its incorporation of various contexts' (political, economic, social, physical, and cultural).

Over the last decades, food security discussions have focused largely on agriculture in association with its major challenges and implications on the agricultural system with direct linkages on aspects of hunger, poverty and humanitarian efforts. Recent discussions shed more light on the issue of sustainability. This is driven by: a rapidly growing population that will require food demand to increase to 50% by 2030 in comparison to present needs; a greater proportion of hungry people residing in rural areas; limitation in the expansion of agricultural land; adverse effects of climate change; a rising demand for energy input food such as: animal based products (Kearney 2010; Freibauer et al. 2011).

Through the mid-1980s, there was a revival of interest among world development agencies on small-scale food production systems both at farm and household levels. These growing interests stemmed from the growing need to accelerate food production in order reduce malnutrition suffered by developing countries.

Producing food on small plots close to human settlements consists of one of the oldest, yet enduring way of cultivation. The idea and importance of 'garden plots' have gained universal recognition on the part of theorists concerned with the origins of agriculture. Gardens are a representation of a 'genetic backstop' with the role of preserving variety of species with small scale cultivation as a result of taste, preferences, tradition; depending on the available planting materials Most literature on indigenous tropical garden indicates a reflection of their human and ecological conditions. Studies focused on Asia have pointed out the evolvement of gardens as an important food production strategy.

The origin of modern agriculture can be traced back to subsistence production systems, characterised by small garden plots surrounding the household; which have continuously played a key role in the provision of family food and income (Marsh 1998). Home gardens have globally been recognised for their supplemental role in securing food, nutrition as well as livelihoods and have been termed 'the oldest and most enduring form of cultivation' (Terra. G, J, A 1958).

Literature reveals that the practice of home gardening is widespread globally and is classified as: mixed, kitchen, backyard, farmyard, homestead gardens (Terra. G, J, A 1958; Ruthenberg 1980; Puri, Nair 2004; Rowe ,William, Campbell 2009).

2.2 Definition of Key Concepts

2.2.1 Household Food Security (HFS)

Food security is a multi dimensional concept having several definitions compiled by different authors and institutions with great variations based on different continents and regions; each sharing some peculiar characteristics. According to (Maxwell, Frankenberger 1992b) ,in spite of the numerous definitions of household food security, they all share the view that 'the key defining characteristic of household food security is secure access at all times to sufficient food'. Another definition of HFS put forward by CARE , describes household food security as households' ability to secure enough food on a sustainable basis (CARE 2013).

The ability of household to acquire foods by transforming their endowments such as: land, labour and capital into food entitlements describes the accessibility component. As such, seeing HFS beyond household food production to include the ability of transforming household endowments ((Frankenberger 1992; Sen 1983).

Consequently, the term 'food security' has been expanded to include aspects beyond food supply; such as: components of access driven by entitlements (Sen 1983) vulnerability and sustainability.

2.2.2 Dimensions of Food Security

The World Food Summit organised by the (FAO 1996) gave rise to the definition of food security which is most widely accepted and states that "food security exists when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life". Four dimensions are reinforced in this definition and include: Food availability which refers to sufficient availability in the quantity and quality of food for a proper diet. According to the (WFP 2009), access is ensured when the household livelihoods ensure the provision of enough food supplies to all household members either through transfers, home production or market purchases.

Utilization involves the utilization of food through the adequacy of diet, clean water and adequate water, sanitation and health care facilities to meet psychological needs. Food stability involves the access to adequate food at all times even in the midst of sudden shocks and cyclical events (FAO 2006).

The temporal dimension of nutrition security refers to the Stability or Sustainability dimension which refers to time frame set for the consideration of food security. In food security discussions, there is a clear distinction made between chronic food insecurity which

is the situation where food needs are not met on a continuous basis; and transitory food insecurity which describes the temporal inability to meet food needs (Maxwell, Frankenberger 1992b).

Understanding the conceptual framework of food security requires an analysis on its categorical elements and the relationship existing between them. The FS framework is influenced by two factors: the physical factor (Availability, Accessibility, Use and Utilization) and the temporal factor (Stability) (Weingartner 2005a).

2.2.3 Home Gardens

There have been varying definitions of home gardens put forward by different authors. Most of them centre on the same concept but may vary based on their classification which could either be: kitchen, mixed, backyard of homestead. Generally, home gardening refers to the practice of cultivating small portions of land within the household or on areas within walking reach from the family home (Odebode SO 2006). A similar definition was put forward by (Gautam et al. 2006), who described home gardens as a traditional land use system located close to a homestead, in which different species of crops and vegetables are cultivated, and maintenance done by household members with the primary motive of family consumption and utilization of garden products. Some studies also recognise the well defined, multi-storied and multi-usage characteristics of home gardens with its location close to the family and its possibility of serving as a supplementary small scale food production system, and could be regarded as a natural eco-system which embraces a wide range of plants and animal species (Eyzaguirre, Linares 2010; Krishna, G, C 2006; Hoogerbrugge, Fresco 1993).

Furthermore, home gardens have the capacity of encompassing vegetables, fruits, plantation crops, spices, herbs, medicinal plants and livestock crops; thus they could be described as a mixed cropping system serving as supplementary food and income source. The role played by home gardens in the provision of food, fodder, fuel, medicines, herbs and flowers; makes them an invaluable tool for food and nutrition security to farming communities relying on them. They are therefore crucial in contributing to farming community's livelihoods as well as food security in many countries (Galhena et al. 2013)

In a survey carried out in three low income households in South West Sydney, Australia, food insecurity was revealed as a major problem. A sum of 21.9% of all households, 30% of households with children and 45% of households with single parents were faced with food insecurity. Local food production through the use of their own home gardens were identified

as an alternative and potential successful pathway in achieving household self-sufficiency, and consequently, food security (Paolon et al. 2010).

2.2.4 Food Based Strategies

In order to counter the negative effects of malnutrition usually occurring in the form of micro nutrient deficiencies, food based approaches were designed. Food based approaches are long-term action comprehensive programs aimed at controlling and preventing micro-nutrient deficiencies (Georg Bokeloh 2005). Home gardens make up an important element in pursuing this approach. Through their ability in growing fruits and vegetables, their significant role is enhanced by broadening the production of micro-nutrient-foods for households in both rural and urban areas. A sound understanding of local conditions is required for the success of these gardens (Georg Bokeloh 2005)

2.2.5 African Indigenous Vegetables and Food and Nutrition Security

Within the context of African vegetables, there is an appropriateness in the use of both terms 'indigenous' and 'traditional' which could jointly be referred to as African Indigenous Vegetables; and could be defined as : plants originating from the African continent or plants with a long cultivation history and whose domestication is based on African conditions (Lotter et al. 2014).

Some properties contained in AIVs have the potential in alleviating diseases associated with the deficiency of micro nutrients. Indigenous vegetables contain significant portions of provitamin A, vitamin C, mineral micro nutrients in addition to other micro nutrients and nutraceuticals and are a less expensive source in combating micro nutrient deficiencies compared to bio fortification and diet supplementation techniques (Keding, Yang 2009).

In the same view, (Keding et al. 2007) describe indigenous vegetables as a sustainable way in providing the body with a variety of nutrients through diversification of diets, making them a vital tool in dealing with malnutrition especially for poor households who relatively suffer the high costs of diet supplementation supplied by drug treatments or food additives. Through their substantial contribution to the intake (Keding, Yang 2009) of minerals, protein and vitamins, Tanzania like most other countries in SSA witnessed a shift in dietary preferences; from indigenous foods usually perceived as 'poor people's food' otherwise known in Swahili as 'wanakijiji' to bush dwellers towards non-indigenous foods especially among urban dwellers and gradually among rural dwellers; for reasons of abandoning the consumption of AIVs which comes along with 'modernisation' (Keding, Yang 2009).

Tanzania like most countries in Sub-Saharan Africa experiences high levels of malnutrition usually demonstrated in the form of: stunting which affects 42% of children under the ages of 5. 53% of pregnant women, 60% of children below the ages of five and 81% of infants within the age range of 9-11 months, are being affected by anaemia. However, there is a strong potential in AIVs in improving the nutrition situation and having a positive influence on dietary diversity (World Bank, 2010).

Table 2 illustrates the most commonly known African indigenous and traditional vegetables which are sold in the public markets of Tanzania. Their listing is done in order of popularity; some popular species identified on this table will be examined in this study.

Table 1: African Indigenous and Traditional Vegetables (AITVS) commonly sold in the public markets of Tanzania in the approximate order of popularity

Common name	Scientific name	Swahili name	Family
Amaranth leaf	*Amaranthus* spp.	*mchicha*	Amaranthaceae
Nightshade leaf	*Solanum scabrum* (Mill.) *S. villosum* (Mill.) *S. americanum* (Mill.)	*mnavu*	Solanaceae
Cowpea leaf	*Vigna unguiculata* (L.) Walp)	*kunde*	Papillionaceae
Squash leaf	*Cucurbita pepo* (L.)	*maboga*	Cucurbitaceae
Ipomea leaf	*Ipomea batata* (L.)	*maternbele*	Convolvulaceae
Cassava leaf	*Manihot esculenta* (Crantz);*M. glaziovii* (Mull. Arg.)	*kisamvu*	Euphorbiaceae
African eggplant	*Solanum aethiopicum* (L.);*S. macrocarpon* (L.)	*nyanya chungu, ngogwe*	Solanaceae
Spiderflower leaf	*Cleome gynandra*,(L.)	*mgagani*	Cleomaceae
Okra	*Abelmoschus esculentus* (L.) Moench.	*bamia*	Malvaceae
Ethiopian mustard leaf	*Brassica carinata* (A. Braun)	*sukuma wiki*	Brassicaceae
Less common AITVs			
Mlenda A** - Jute mallow	*Corchorus olitorius* (L.)	*mlenda*	Tiliaceae
Mlenda B – False sesame	*Ceratotheca sesamoides* (Endl.)	*mlenda wa sege*	Pedaliaceae
Mlenda C – Wild simsim	*Sesamum angustifolium* (Oliv.) Engl.	*mlenda mwitu*	Pedaliaceae
Bur gherkin leaf	*Cucumis anguria* (L.)	*mlenda matango*	Cucurbitaceae
Bitter lettuce	*Sonchus exauriculatus* (Oliv. & Hiern) O. Hoffm. *Launaea cornuta* (Oliv. & Hiern) O. Jeffrey	*mchunga*	Asteraceae

Source: (Lotter et al. 2014)

2.2.6 Vicious Cycle of Malnutrition

The importance of nutrition is highlighted at every stage of the lifecycle. Figure 3 depicts the consequences of malnutrition occurring in different ways throughout the life cycle. Its starting point is reflected in the uterus with the outcome being a baby born with low weight, with a tendency of continuation through childhood and adolescence. There is an increased risk of these children to suffer from cardio vascular diseases. Pregnant and lactating women are particularly vulnerable leading to an inter-generational cycle of malnutrition which is passed on to the baby at birth and continues through generations (Weingartner 2005b). The above effects are illustrated in Figure 3 below.

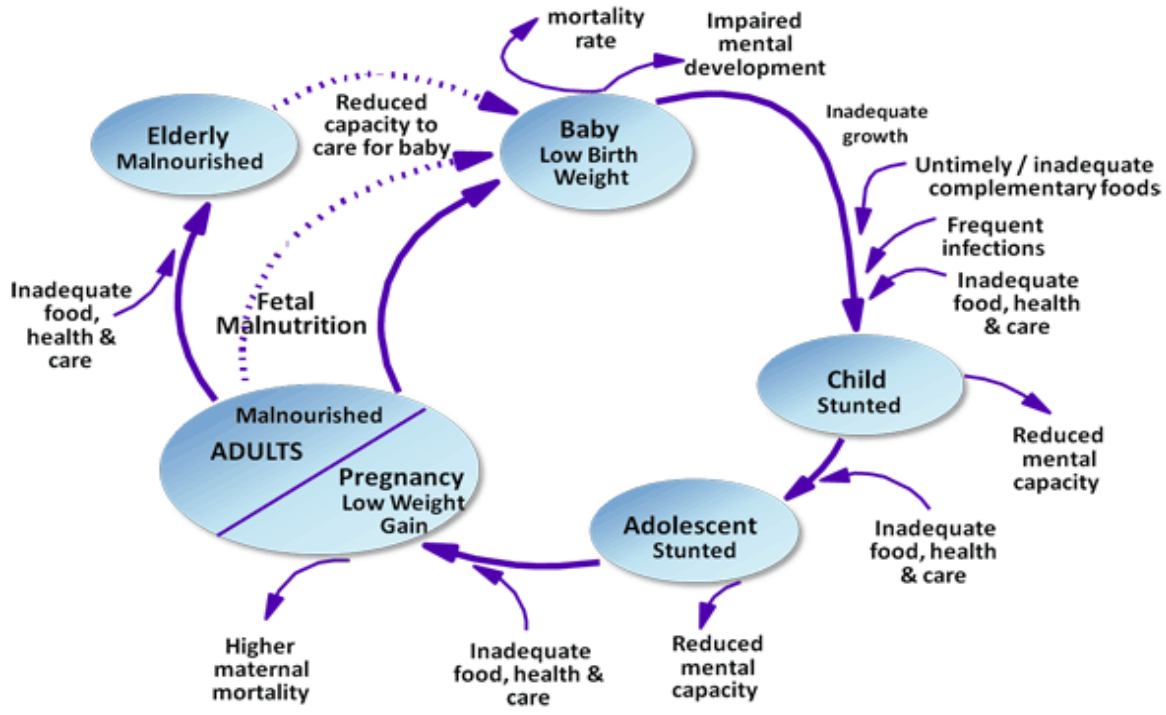


Figure 3 Nutrition throughout the Life Cycle

Source: Adapted from (ACC/SCN 2000) Fourth Report on the World Nutrition Situation, Geneva: ACC/SCN in collaboration with the International Food Policy Research Institute.

2.3 The Relevance of Home Gardens for Food and Nutrition Security

In present day, the numbers of food insecure people go beyond 800 million people. With rising population projections, there is in global drop in the calorie based on 2006 figures. Projections from the World Resources Institute (2015) indicate that there is an increasingly likelihood of the existence of a gap of 69 percent between 2006 produced crop calories and calories needed in 2050 (Freibauer et al. 2011).

Increasing the availability, accessibility and utilisation of food products; hence the direct contribution to household food security has been identified as the most outstanding social benefit of home gardens to households. Through them, the ease in assessing fresh plant and animal food in rural and urban areas is safeguarded; consequently increasing substantial amounts to nutritive and energy requirements of a family on a regular basis (Galhena et al. 2013).

World evidence suggests the versatility of home gardens in addressing challenging situations of food insecurity, thus gaining recognition and advocacy on the part of several government, non-governmental and international organisations. As a result, the significant multiplication

of home garden production remains an instrumental tool in reducing 'hidden hunger' and deficiencies related to the insufficiency of micro nutrient consumption (Galhena et al. 2013).

The key benefits yielded from home gardening are determined. The main benefits include: enhanced food security, improved food diversity resulting from better nutrition and increased food availability, income generating opportunities and better rural employment through the production in off-season, Lower occurrence of risk due to diversification, Attainment of environment benefits from the recycling of water and waste nutrients, dust and erosion control and the promotion of local biodiversity. In addition to the multiple potential benefits of home gardens, (Marsh 1998) highlighted their importance to food insecure households by serving as a direct source in increasing their access to nutritious food. He also noted their crucial role played in the attainment of food security through their daily contribution in food provision.

Additionally, home gardens are a reliable asset to resource-poor families with limited amount of assets and resources such as land and capital. Resource poor families rely heavily on home gardens for the provision of their food and secondary stables when compared to families with a reasonable share of assets and resources (Nair 2006). As such, home gardens offer a cheaper alternative to poor households who are unable to satisfy their dietary and nutritional needs obtained from animal products (Ali, M, Y et al. 2008).

Successes have been recorded from recent national home gardening programs in countries like Bangladesh. These programs have proven to be successful in increasing the accessibility and frequency of consuming food items rich in Vitamin A (Talukder et al. 2000).

Nutrition deficiencies account for majority of nutrition related illnesses worldwide. Vitamin A deficiency amongst others is responsible for main health problems in many countries especially for lactating women, their babies as well as children growing up. In countries of acute Vitamin A deficiency, programs on homestead food production have been advanced to address the situation in addition to augmenting diet quality through the maintenance of the production of fruits and vegetables all year round (Iannotti et al. 2009).

A study carried out in the Eastern Cape Province of South Africa aimed at examining the role of home gardening in enhancing the household food security among rural households in the Municipality of Nkonkobe. This study employed the simple random technique in obtaining a total population of 60 households comprising of 20 respondents from each of the 3 villages to which questionnaires were administered. Data obtained from this study was analysed

quantitatively and the results revealed the significant contribution of home gardening and their role in safeguarding food security of households. A great proportion of households in this study (60%) revealed their reliance on their own food production as they witnessed an all year round consumption of crops and vegetables obtained from their own farms (Adekunle 2013) .

A similar standpoint was shared by (King, Burgess 2015). In the third edition of their fact book 'Nutrition for developing countries' some practical solutions were outlined to improve the nutritional situation of the vulnerable population, including babies, pregnant and lactating women using their available resources; the solutions are aimed at counteracting deficiencies associated with malnutrition and poor vitamin intake. In one of their chapters, some possible ways are presented on improving household food security. Kitchen gardens in both rural and urban areas are highlighted a reliable strategy in maintaining a steady all year round supply of food through the cultivation of vegetables, fruits, and herbs, legumes and tubers. However, the authors argued that homestead crop production is necessary but relying solely on it is not sufficient enough to safeguard household food security and calls on addressing poverty and the market integration of small holder farmers; which are key challenges requiring major attention in order to maintain acceptable levels of food security (King, Burgess 2015).

2.4 Home Gardens and their Contribution to Livelihoods

According the (Galhena et al. 2013), apart from maintaining food and nutrition security as well as subsistence, the economic benefits for home gardens are wider to encompass income generating benefits, livelihood improvement as well as the promotion of entrepreneurship and rural development (Calvet-Mir et al. 2012).

Another study was carried out by (Manyatsi, Makhanya 2002) in Swaziland with the main objective of determining the contribution of home gardens to homesteads livelihoods, while analysing the major constraints encountered by households involved in the cultivation of home gardens. Out of a total of 150 homesteads, questionnaires were administered to 13 households who possessed home gardens. Additionally, a control group of 7 homesteads who did not implement home gardens were selected for analysis. The results obtained revealed home gardens as a major source of food and income. However a small proportion of households (15 percent) obtained an annual income of approximately 780 US Dollars while the remaining 85 percent of the households obtained less than this amount. The major

constraints recorded by these households included: insufficient funds for the development of irrigation systems and the acquisition of inputs, limited labour to facilitate farming activities and insufficiency in extension services for the facilitation of garden activities.

Another attempt at determining the contribution of home gardens to livelihoods was done by (Mitchell, Hanstad 2004b) using a review from several case studies. Their results indicated a positive contribution of home gardens to the economic wellbeing of households through the sale of garden products and generating additional income (Eyzaguirre 2010). By consuming products grown at home, household disposable income is increased and could be useful in purchasing other household items. In a similar manner, results from studies conducted in Nepal, Cambodia and Papua New Guinea report that income was derived from households who sold home garden vegetables, fruits and other livestock products. The income obtained from the sales of these products permitted households to buy extra food items and pay for some services including education and savings (Vasey 1985; Niñez 1985) Additional household disposable income gotten from the sale of home garden produce helps in improving the financial situation of the family whilst leading to social and cultural improvement, hence making home gardens a reliable poverty reduction strategy for poor households (Kehlenbeck, Maass 2004). A case study carried out by (Okigbo 1990) in the Southern Eastern part of Nigeria reported that more than 60 % of household income was gotten through the production of tree crops and livestock, found on home gardens.

According to (Marsh 1998), resource poor families benefit from home production as a cheaper and more affordable option from its agro economic advantage. Although small in nature, an assessment carried out by the same author demonstrated that medium livestock and crop production in home gardens was able to realise as much revenue as the outcome per unit area of field crop production.

An attempt to examine the benefits and constraints of home gardening was done by (Olajide-Taiwo et al. 2010) in the National Horticultural Research Institute's (NIHORT) neighbourhood in Ibadan. The study covered three Local Government Areas (LGAs) within shared boundaries of the institute. 63 respondents were purposively sampled to include households containing home gardens. Through a thorough data analysis using frequency, counts, percentages and Chi square, some 85.5% of households identified the ease of getting fresh food as the main benefit of using home gardens. Subsequent benefits including saving family food budget were identified by 69.8% of households, using home gardens for

relaxation and easing emotional stress were identified by 54% and 30.2% respectively. The key constraints identified in this study in order of graveness included: attacks by insects, crop destruction by animals, incidence of pests and diseases, with a poor quality in planting materials. Also, a significant relationship was established between home gardens contribution to household supply and the educational level and marital status of respondents. In addition, the marital status and training were significant variables in reducing the household budget on food resulting from home gardening involvement.

One of the most extensive reviews on home gardens and their socio economic and environmental benefits was carried out by (Galhena et al. 2013). In an attempt to find out the role of home gardens and their enhancement of food security, the research utilized a three pronged approach; firstly, a rigorous review of literature was used to analyze the previous experiences of home gardens in developing countries; secondly, research data was obtained from a garden survey of 167 home gardens and lastly innovative strategies to boost gardens were obtained from the findings.

Experiences shared in her work encompass research and experiences on the composition of home gardens in developing countries such as Africa, Asia and Latin America. The overall studies demonstrate positive effects of home gardens in dealing with situations of food insecurity as well as malnutrition and also in the provision of additional income and livelihood benefits for poor households with limited resource endowments in addition to providing a variety of ecosystem services. In providing a general overview of these studies, the main aim of their research was to investigate the experiences of home gardens in Sri Lanka in post conflict situations, a country with the on-going practise of home gardens for centuries. In addition to the multiple benefits provided by the home gardens, this study also threw some highlight on some main constraints. However, the study called for more research and empirical data to be carried out in the light of appraising the role of home gardens in situations of crisis and post-crisis, an assessment of their economic value and an evaluation of their impact on food security, nutrition, economic growth and gender related issues.

Furthermore, the additional benefits of homestead gardening program designated to control the deficiency of Vitamin A in Bangladesh was assessed in a paper by (Saskia,De,Pee et al. 2005) To realise this objective, food security data was collected as well as women's status data was collected 2160 households, comprising of active and former participants of the gardening program as well as control groups; with the secondary aim of evaluating the impact

and sustainability of the gardening program. Results revealed a higher median recorded among production and consumption of the active group participants (135kg and 85kg respectively) as opposed to that of the control group with a median of 46kg produced and 38kg consumed.

Median garden income was gotten from 64% of the active household's equivalent to 17,697 USD and the proceeds were mostly used on food purchases. 10,200USD was generated by 25% of the control households in the same period. After a withdrawal of support program three years later, the sustainability of the program with its high ability to maintain household food security was demonstrated in the high garden production and income levels of households who formerly participated in the gardening scheme as opposed to those of the control group. In addition, a perception study aimed at assessing the contribution of homestead gardening on household economic contribution indicated a significantly higher contribution (more than 85%) of women participants in active and former participant households than that of the control group (52%).

The overall results demonstrate the multiple benefits incurred from the use of homestead gardening programs and their eligibility in the designation of nutritional and development programs with a target on poor households. The above study however failed to assess the possibility of all year round food production and distribution resulting from homestead food production programs. An assessment of this kind will be relevant in strengthening household food security

However the term 'home gardens' as used in most of the studies identified above occupy land sizes of 0.4acres on average of total land holdings (Galhena 2012) and are characterised with mixed farming patterns encompassing multiple species of root crops, perennial crops, livestock crops and different fruit, vegetable and plant species. To the best of my knowledge, limited empirical exists on how the cultivation of only few vegetable species using kitchen gardens could be used in enhancing the food security status of rural households. This study will therefore illustrate the potential of kitchen gardens in maintaining direct access of food through the cultivation of indigenous vegetables and their ability in ensuring a stable food supply to practising households even during off seasons usually characterised as lean periods. Furthermore, by using the components of the food value chain, constraints and opportunities of using kitchen gardens will be identified and will therefore serve as an entry point for improvement and the setting up of more efficient upgrading strategies.

2.5 Additional Benefits of using home gardens

Environmental and Ecological benefits of Home Gardens

In order to get an in depth analysis on the multiple benefits of home gardens from a worldwide perspective, it is important to categorise the benefits into different components in order to simplify the analysis. Apart from the socio-economic benefits provided through the use of home gardens, their utilization yields multiple environmental and ecological benefits. Their utilization of environmentally and ecologically friendly approaches for the production of food emphasise their role in the conservation of biodiversity and the judicious use of natural resources (Blanckaert et al 2004). An assessment was done by (Buchmann 2009) on 25 home gardens in Central Cuba; the outcome of this assessment recorded 182 plant species found in their home gardens.

An ethnography conducted by (Porter, McIlvaine-Newsad 2014) examined the roots and stags of a rural garden; in the light of food security, leisure and social capital using an environmental justice framework. Healthy produce was done in accordance with production costs and some commercial practices and was carried out by residents of the community, populations with low incomes, disabled people and older citizens. Results revealed that the main motivation of participant's entry into gardening activities was due to food security but in the course of gardening, leisure benefits such as socializing and meeting new people were discovered. The creation of internal social capital and increase in the knowledge of gardening were spill over effects of the external social networks eased by the gardens.

From most of the studies identified above, the key contribution of home gardens pertaining to majority them is their usefulness to food security and livelihoods with some of them highlighting their environmental and ecological benefits. It should however be noted that, most of the gardens examined in these studies were mixed gardens with a wider range of benefits in which risks could be easily diversified from the cultivation of a combination of staple crops, fruits and vegetables, and livestock (including chickens, pigs and goat rearing). There is however no doubt that these forms of gardening yield greater supplies of produce as well as incomes when commercialized. However, there has been limited analysis on the potential of kitchen gardens which are relatively smaller in size in providing direct and stable supply of food to rural households depending on them. Also, there is limited examination on kitchen gardens as a direct intervention strategy in contributing to household food and nutrition security.

Although most proponents for nutrition oriented gardens illustrate their relevance for home consumption, most of them fail to encourage their possibility in generating income, insisting on their exclusivity of their production to home consumption. In spite of what the primary objective of utilising gardens is, it is opposing to include only the nutrition objective to exclude the income objective. It is therefore imperative to include income generation as a complementary objective to home consumption. Looking into the dual benefits of home gardens for the provision of food and the generation of income should be considered in the designation of garden projects (Marsh 1998).

For this reason, this study will employ some concepts adapted from the Sustainable Livelihoods, the Fruits and Vegetable Global Value Chain approach, the Food System approach supported by some theories such as: the Entitlement Theory of (Sen 1983) (Sen 1981) and other backings from some authors to facilitate our analysis on the potential of kitchen gardens on household food security and livelihoods as well as some constraints encountered.

2.6 Summary of Analytical Framework

In order to facilitate the realisation of our objectives identified in chapter one above, this study employs a framework which embodies combined concepts relevant to the contribution of kitchen gardens to food security and livelihoods of households. This framework served as a base in the construction of the questionnaires used during the household survey.

Qualitative techniques were also applied in which focus group discussions were used to bring out an in depth analysis on the fostering and hindering factors of using kitchen gardens. Figure 4 brings out components of the fruit and vegetable segments which will be used as guidelines in bringing out obstacles faced and realised opportunities in the utilisation of kitchen gardens.

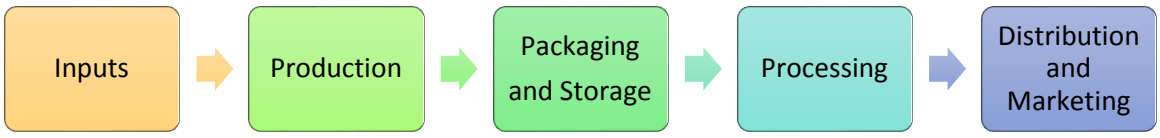


Figure 4 Fruit and Vegetable Global Value Chain System

Source: (Gereffi, Fernandez-Stark 2011)

Food Systems Approach

This study also throws some light on the benefits of local food systems and urges for more attention on its promotion. According to the FAO (2014), the diversity in traditional food systems of most communities in developing countries is embedded in their traditional or indigenous food resources which are proven to contain more nutrients than recognisable worldwide species as they cause less damage to the environment while addressing cultural needs and preserving local communities' cultural heritage. Furthermore traditional food systems have the potential of mitigating issues related to hidden hunger issues through the provision of nutrients, flavour and texture which is usually absent in the most transition diets. (FAO 2014).

Community or home gardens are good examples of traditional food systems. Most home gardening programs have demonstrated an improvement in the access to micronutrient rich foods. A successful example of a home gardening program was that implemented by Helen Keller International in four countries: Bangladesh, Cambodia, Nepal and the Phillipines with rising hidden hunger levels. This could be seen through integrated community based home gardening with successful outcomes of a greater diversity in diets, an increase in the consumption of animal rich food and a reduction in the incidence of childhood anaemia (Talukder 2010).

According to (Hawkes, Ruel 2011) a better understanding on the ongoing processes between production and consumption are needed to understand the role played by agriculture in leading to better nutrition. This could be done through the food system which is (Anderson, Molly, DelCarmen 2015) described as a process involving the transformation of natural as well as human-made resources into food. Food systems are dynamic in nature that could be easily adaptable to changes.

For the purpose of this study, an attempt to capture the challenges faced and opportunities present through the implementation of kitchen gardens will use a systematic approach by which some components in the food system such as: natural resources, production, storage and consumption, will be used as indicators in pointing out the fostering and hindering factors of implementing kitchen gardens. Furthermore, the food system approach is crucial in planning interventions aimed at the improvement of efficiency. This can be done using Figure 5 below which also depicts how traditional and local food systems can be enhanced.

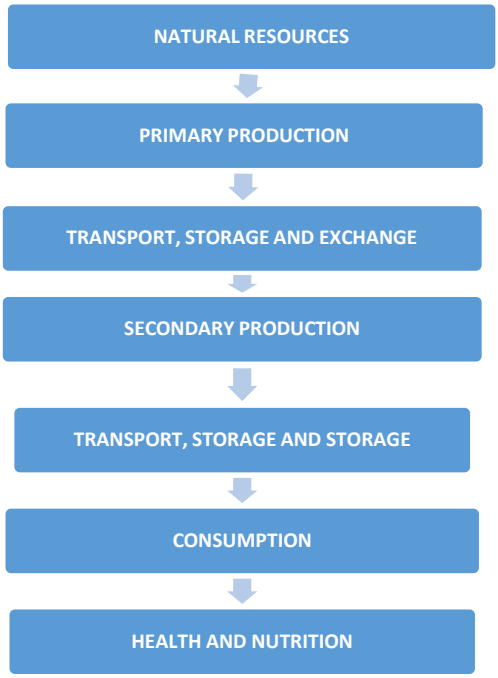


Figure 5 The Food System for Planning Interventions to Improving Efficiency

Source: (Anderson, Molly, DelCarmen 2015)

2.1 Two Key Pathways for Urban Agriculture to Increase Food Security

In spite of the complexity of the definition of Urban Agriculture, the most widely adopted definition is that developed by (Mougeot 2000) with the use of technical criteria for UA where he described that : 'urban agriculture is an industry located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis which grows and raises, processes and distributes a diversity of food and non-food products, (re) using largely human and material resources, products and services largely to that urban area'.

For the purpose of this study, we focus on the definition of UA according to (From Brownfields to Greenfields 2000) who describes urban agriculture using alternative terms such as urban farming and urban gardening to encompass practices involving the cultivating, processing and distribution of food within a village, town or city or around its premises. A wide range of products are derived from UA such as: fruits and vegetables, dairy products, meat, fish, herbs and fire wood and will depend on their methods of production (horticulture, animal husbandry, aquaculture and forestry (Korth et al. 2014).

However the scope within our study will be limited to the horticultural production method with the cultivation of micro-nutrient rich African Indigenous Vegetables with the use of kitchen gardens. In order to assess their influence on household food security, this study will adapt relevant concepts and ideas from the approach of (Korth et al. 2014) by using two main pathways by which urban agriculture increases food security as illustrated in Figure 6 with the assumption that kitchen gardens constitute one of the forms of urban gardening practices.

According to this approach, increasing household security through UA is done using two major pathways: improving food access and increasing income as pointed out in Figure 6 below. Using the first presumed path, it is assumed that foodstuffs grown at home have the ability to increase the overall availability of food of a household which could prevent malnutrition and hunger. Simultaneously, the impact of the availability of home-grown products particularly fruits and vegetables are largely felt on the nutritional status of members of the household, thus their health. Additionally, direct access facilitates household's consumption of diverse diets with a more valuable micro nutrient contribution.

Through the second path, urban agriculture is considered to increase domestic producers cash income in the form of income savings (as households limit food purchases), and or increasing disposable income through the sales of garden products. A positive link is established between income received and food security as the income obtained through the sales of surplus products increases households' access to quantity and quality food.

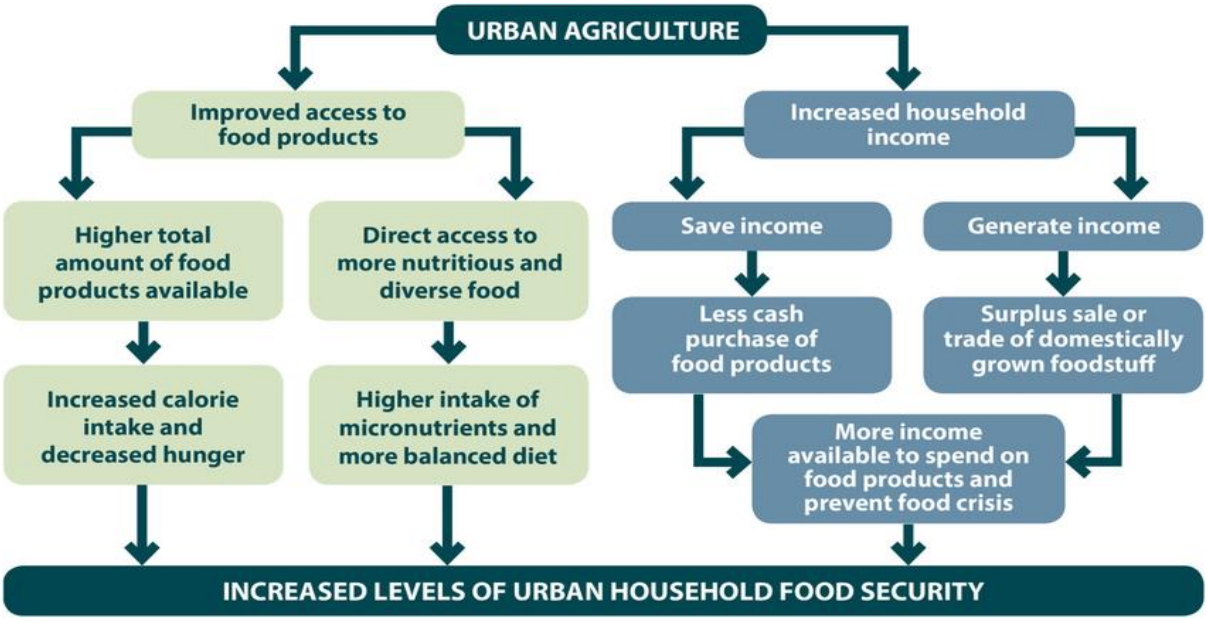
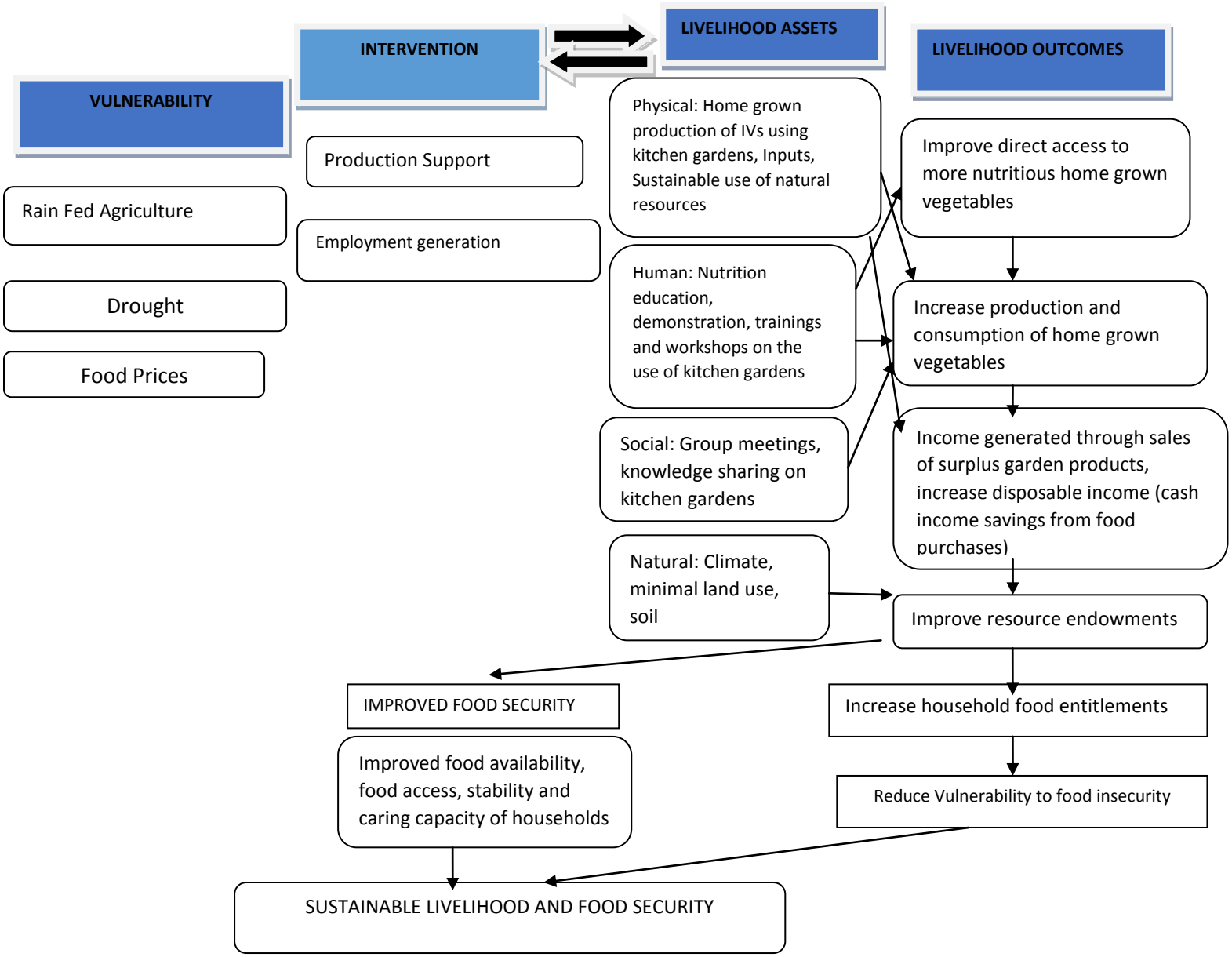


Figure 6 Urban Agriculture's Two Pathways to Increased Food Security

Source: (Korth et al. 2014)

Figure 7 Combined Frameworks to analyse the role of Kitchen Gardens on Food Security and Livelihoods



Source: Adapted from (Korth et al. 2014) (Webb et al. 1992; DFID 1999)

To improve our understanding on the kitchen gardens and their potential in enhancing household livelihoods and food security, this study will employ an adapted Sustainable Livelihoods Framework from (DFID 1999), combined with concepts from the previous framework illustrated in figure 7 above. The employment of an integrated concept within a single framework was due to the difficulty in getting a single framework capturing the contribution of kitchen gardens to food security and livelihoods comprehensively.

The definition of household livelihood security refers to the adequacy in sustainably getting access to income and resources needed to meet basic needs, therefore, food and nutritional security are considered as subsets of livelihood security (Frankenberger et al).

According to our framework, livelihood outcomes are improved through the employment of a combination of physical, human, natural and social assets which are directly influenced by interventions in the form of production support and employment generation possibilities. These interventions are carried out on small and mainly subsistence farmers in food insecure communities of Morogoro and Dodoma, some of which are highly susceptible to droughts, thus increasing their reliability on rain-fed agriculture. The assets are physical assets which include: pocket bags used as kitchen gardens for the cultivation of indigenous vegetables, as well as other inputs; human capital in the form of nutrition education illustrating the benefits of indigenous vegetable consumption, trainings and demonstration on the use of kitchen gardens; natural capital which embodies the favourable climate, soil and minimal use of resources such as land space and social capital which focuses on the organisation of group meetings and knowledge sharing among its members on kitchen gardens.

The above assets identified above are transformed into favourable livelihood outcomes and are influenced through targeted links of the food chain to yield increases to food entitlements which go a long way in improving nutritional status, reducing vulnerability to food insecurity and ensuring the sustainable use of natural resource base (DFID 1999; Webb et al. 1992)

Assets are created through the profound influence of transforming structures and processes which provide physical capital, human capital and enforcing social capital together with the support of people to build on their assets. Hence, the ownership of multiple assets strengthens livelihoods by providing them with multiple strategies to choose from (Webb et al. 1992)

The use of kitchen gardens enables the cultivation of indigenous vegetables which are rich in micro-nutrients and increases households' direct access to home grown food. The nutritive value of traditional or indigenous vegetables is very high and contains reasonable amounts of Vitamin, B, C and proteins found in almost every dark green traditional vegetable when compared to exotic vegetables. Some examples are: Amaranthus (dodo), Solanum aethfioum (Nakati), Manihotesculkna . (cassava leaves) and Ipomea batatas (sweet potato leaves) Some of them like Solanum indicum are believed to have healing properties (Rubaihayo 2002).

Furthermore, gardening through home gardens facilitates a constant supply of fresh and nutritious foods on a day to day basis on households using them. Equally, the gardens accounted for more than 50% of vegetables, fruits, yams and tubers for the households in question (Marsh 1998). In support of this premise, (Wiersum 2006) reports that even though home gardens make available small amounts of subsistence products at household level, the flow is consistent as home gardens ensure the continuity in the availability of household food products.

Through the sales of surplus garden products, direct income is obtained making homestead production using gardens a vital source of additional income especially for households located in both rural and urban areas in the world. Additionally most households rely on gardens as a main food and income source especially in periods of distress such as: poor harvest seasons, lean seasons, in situations of unemployment and economic disruptions especially caused by war and high price seasons. An example of this is the case of Kampala, Uganda where urban agriculture played a substantial role in supplying the non-cereal needs of the population (UNDP 1996). Through the presence of kitchen gardens, households also benefit from indirect income which is derived from less food purchases. Income realised influences the caring capacity of households as some of their household needs are met through it.

Furthermore the cultivation of vegetables using kitchen gardens demonstrates the minimal use of natural resources; cultivation in pocket bags entails the minimal use of land space and inputs. This claim is supported by (Marsh 1998).According to him, there is a possibility of implementing home gardening without the use of nearly no economic resources. To him, home garden practices could be done only with the use of any local available planting materials, green manures, local fencing methods, together with pest control methods that are indigenous in nature.

In all, the framework is an illustration of some of the benefits of kitchen gardens and its contribution to household food and nutrition security, while improving livelihood outcomes. Kitchen gardens play an important role in securing food at household level through the availability, accessibility and utilization component. Subsistence production of indigenous vegetables combined with households capacity of generating income and maintaining food consumption increases household's food entitlement (Webb et al. 1992). According to (Sen 1983) entitlements are used to describe a set of resource bundles and income which could be in the form of assets and commodities which households could use to maintain and control their livelihoods. His theory of food entitlements influenced the paradigm shift in the conceptualisation of famines. According to his entitlements theory, household's food entitlements are gotten from producing their own food, income, gathering wild foods, claims from community support, assets, amongst others. Thus, household's access to food is influenced by a number of socio economic variables (Maxwell, Frankenberger 1992a).

CHAPTER THREE
RESEARCH DESIGN AND METHODOLOGY

In order to fulfil the main purpose of this, this chapter will provide an overview of the methods of data collection, ways of revising data, and the methodological and analytical steps involved in carrying out this research in the Morogoro and Dodoma regions in Tanzania with the objective of understanding how the food security and livelihood situation of selected farmers and their households are influenced by food security interventions in the form of kitchen garden promotion programs. A greater part of information concerning the case study areas was obtained from a baseline report on the bio physical conditions and rain-fed crop, livestock and agro forestry systems; prepared through the combined efforts of (Kahimba et al. April 2015) and other Trans-SEC officials.

According to (Rajasekar et al. 2013) research methodology describes the science on the study of how to accomplish a research; involving the procedures employed by the researcher in the description, explanation and prediction of phenomena. In other words, research methodology could be defined as studying methods through which knowledge is acquired. The subsequent section will give a brief description about the best ways used to acquire information from households, the methods used for data collection, the analysis and the final report.

3.1 Description of Case Study areas

In order to facilitate the main objective of this study, a field research was undertaken to gather some information in the case study areas to examine the influence of the kitchen garden promotion program on the livelihoods and the households' food security through the provision of direct access of food. This will be supported with some existing literature on the subject matter.

In addition to being target region of intervention rendered by TransSec, the case study regions were chosen based on the following criteria with clear distinctions in both regions; with the most important ones being:

- Both regions represent the overall farming and food systems in Tanzania with differing climatic characteristics; the climatic condition of the Morogoro region (600-800mm) is semi-humid as opposed to the semi-arid region of Dodoma (350-500mm) (USAID 2008).
- Different characteristics in the food systems of both regions (Mnenwa, Maliti 2010).
- Dodoma region is highly susceptible to food insecurity and is more likely to experience situations of drought which is compounded by its heavy reliance on rain fed agriculture However, the selected villages for intervention in both areas contain areas that are particularly sensitive to food insecurity.
- Ilakala village in the Morogoro region was chosen because of its relatively poor market access as compared to Ilolo village in the Dodoma region with a better access to markets.
- The households in both villages range from approximately 800-1500 households.
- Using stunting as an indicator for food security and a major guiding principle, both regions indicated high levels of stunting with stunting rates in both regions above the national average of 60% (Tanzania Food and Nutrition Centre 2014)
- Other criteria included access to facilities such as capital, the availability of land, soil characteristics and population density.
- Both regions demonstrate a high reliance on rainfall and experience some periods of unreliable rainfall, with the Chamwino district in Dodoma being at a greater risk.

3.1.1 Details about the Trans-Sec project in Tanzania

In a bid to ameliorate the food situation of the most vulnerable poor population in Tanzania, the Trans-SEC project was introduced in 2013, reaching out to 1000 households in 4 villages

and 2 case study sites and spans over a period of five years. Its objectives are aimed at: using the Food value Chain approach in the identification and testing of Upgrading Strategies (UPS) taking into consideration site conditions and sustainability and the dissemination and implementation of successful strategies; for the purpose of national outreach, integration into policy, extension and further research (Sieber, Graef 2015; Gómez et al. 2011). Being part the Globe call which aims at improving the food security situation of Africa through the building research networks, Trans-SEC partners with 15 institutions including German and Tanzanian institutions with five central objectives of: establishing a German-African research network which is multidisciplinary in nature, carrying out a comprehensive analysis of the food systems in Tanzania with an identification of their failures and advantages, increasing food security through the identification and testing of innovative strategies through the food value chain and exploring the transferability possibilities of the results in other areas in Tanzania.

Priorities addressed by the project are in line with all of those set out by the Federal ministry of Education and Research in Germany (BMBF) whose strategies address 5 priorities with the end goal of promoting a bio-based economy. Amongst which feature the achievement of food security and sustainable agricultural production.

The project follows a set of procedures beginning with stakeholder mapping along the food value chain taking into consideration: mixed groups, local ownership, gender and pro-poor; defining major obstacles at stage of inventory UPS, selecting UPS based on classification of the FVC and components and prioritizing them on the basis of inventory and capacities; carrying out an impact assessment of UPS and finally out scaling through local, regional and national networks using farmers, schools, groups, and field groups. (Sieber, Graef 2015)

Strategies within the consumption phase of the food value chain are centred on improving the consumption patterns and diets. In this regard, the UPS identified embodied kitchen gardens with the intention of cultivating indigenous fruits and vegetables for diet diversification and through spreading household nutrition education to improve nutrition. Pocket bags were used to facilitate the implementation of kitchen gardens, with 30 beneficiary households in each village per year. Technical support was provided through the establishment of one demonstration plot in every village and the spread of nutrition education through the introduction of new meal recipes, feeding though schools, and the adaption of new food habits; all of which was done throughout the year. In order to ensure an all year round production of vegetables, kitchen gardens were introduced during the dry season.

The stepwise process of the food value chain analytical framework for the case study sites coupled with different environmental and socio-economic conditions; serve as basis in the identification of upgrading strategies with influence from success stories and good practices. Figure 8 provides an illustration of the FVC analytical framework with the components. The Kitchen Garden UPS falls within the consumption phase of this framework.

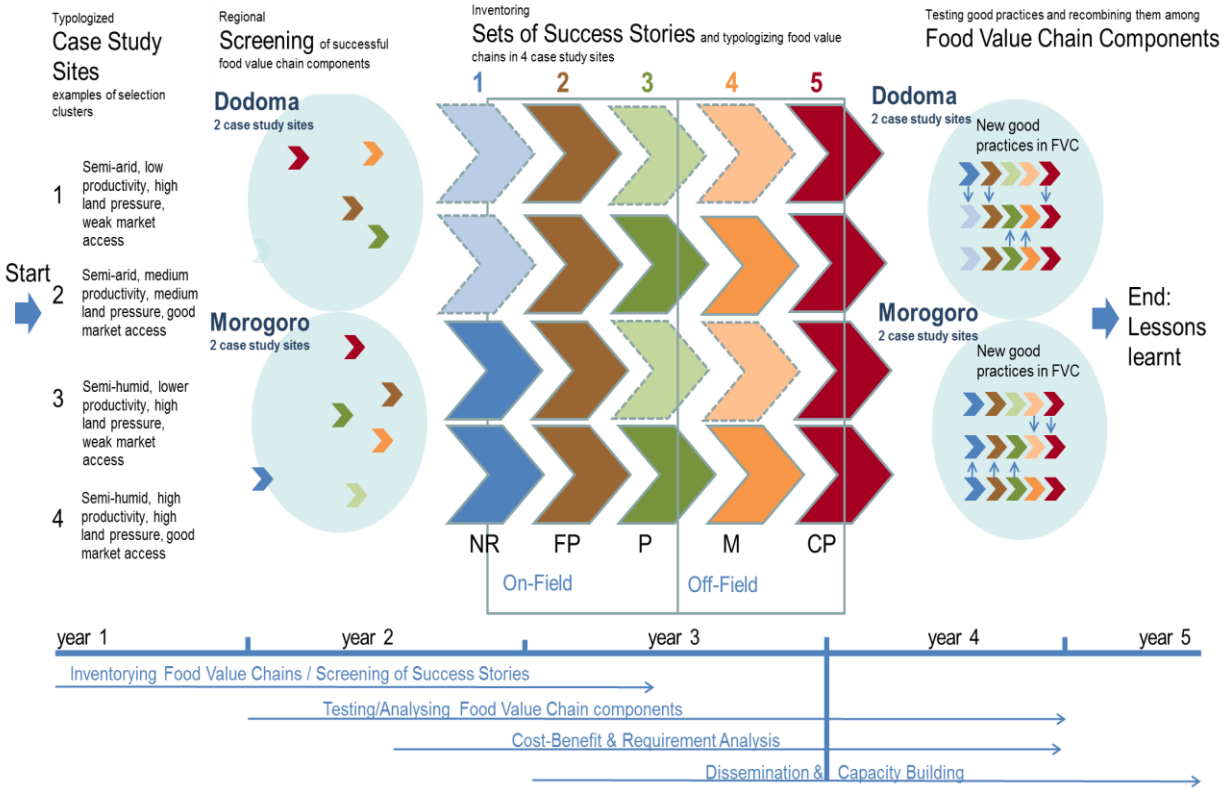


Figure 8 Food Value Chain Analytical Framework and Chronology (Natural resources, FP-Food production, P-Processing, M-Markets and Institutions, CP-Consumption

Source: (Sieber, Graef 2015)

3.1.2 Description of Case Study Site I: Morogoro Region (Kilosa District)

Tanzania's mainland is made up of 20 regions, and the Morogoro region is one of these regions and is located within latitude 5^{o} 58'' and 10^{o}0'' to the South and longitude 35^{o} 30'' to the North. It shares borders with seven regions including: Northern borders with Arusha and Tanga, Eastern borders with the Coast region, Western borders with Dodoma and Iringa and Southern borders with Ruvuma and Lindi (Check morogoro district profile)

The Morogoro region covers a land surface area of about 72,939 kilometres which makes up approximately 8.2% Tanzania's mainland and is ranked the third largest region in the country, with Arusha and Tabora regions occupying first two positions. (District profile). Figure 9 is an illustration of its location with highlights on the case study villages.

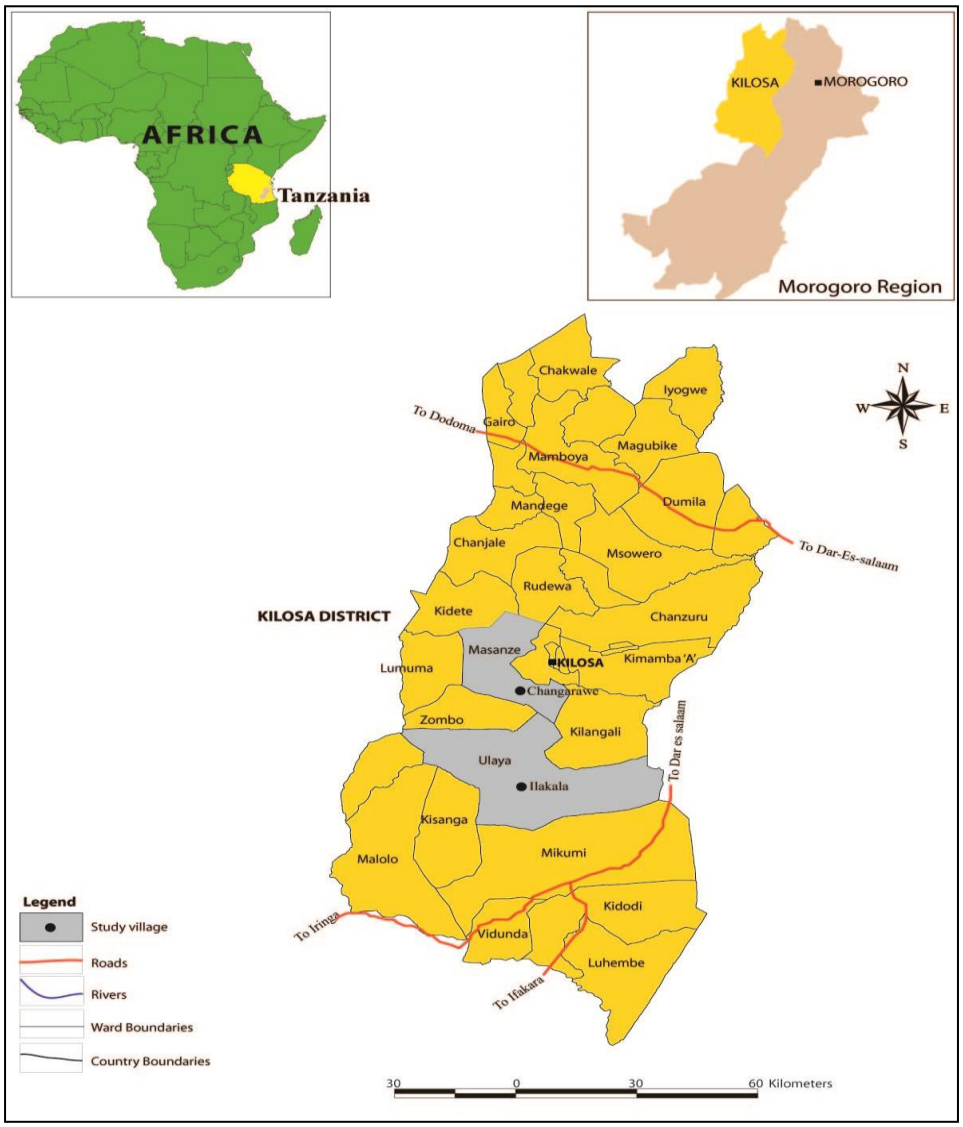


Figure 9 Case Study Site, Kilosa District, Morogoro Region

Source: (Sieber, Graef 2015)

Kilosa district falls among the six districts that make up the Morogoro region and is located in the Eastern Central part of Tanzania and is bordered by Dar es Salaam to the West. It lies within the latidude 5°55' and 7°53' to the South and longitudes 36°30' and 37°30 to the East. It shares Eastern borders with Mvomero district; Southern bothers with Kilolo district; Northern bothers with Kilindi and Kiteto, both found in the Tanga and Manyara district respectively and Western borders with Mpwapra District found in the Dodoma region.

This district covers a land area of 14,245km^2, with 536,590 hectares being suitable for agriculture and the rest devoted to other uses such as: forestry cover, natural pasture, and the Mikumi National Park. Kilosa's climatic condition is largely influenced by its agro-ecological zone with heavy annual rainfall of 1000mm-1600mm being experienced by the highest parts (Rubero and Vidunda mountains) of the district, containing fertile soils which are well drained and sandy in nature. However, less rainfall of 800mm-1400mm is experienced in the central and Southern part, with a moderate soil cover of mostly sandy loamy soils.

The short rain period runs from October to December and longer rains starting in February and lasting till May with normal temperatures ranging between 25°C -30°C. The Ulaya ward falls within the medium to high ecological zone.

Statistics from the Population and Housing Census of 2012 reported a total of 488,191 people in the district; comprising of 243,329 males and 244,862 and an average family size of 4.6. This region also has a sex ratio of 99:100 and for each square kilometre, the population is 34 persons.

Furthermore, the districts economy is highly dependent on agriculture as a greater percentage of more than 80% of its population is employed within the sector and is engaged in agricultural activities. The Population and housing census (PHC) of 2002 indicated that 2.8%, 0.93%, 0.08%, 7.45%, 0.49% and 8.25% were employed in office work, livestock rearing, fishing, elementary occupation, plant operations and other sectors respectively (National Bureau of Statistics 2013).

Brief Description of Ilakala Village in the Kilosa District

Ilakala village makes up one of the villages of the Kilosa district which is located in the Morogoro region. It falls under the Ulaya ward with a total population of 17,354 persons in which 3393 people are estimated to make up the village population of Ilalka (National Bureau of Statistics 2013).

Land, forest and water are natural resources which constitute important components of the villages' local food system. Land occupies a total area of 4277 hectares and village land expands over a vast amount of land, with 2-5 acres of land being occupied by farming households. With respect to water sources, the village depends on two seasonal rivers with a regular flow of water in the rainy season which dries up during the dry season. Traditional

wells are vital water sources especially in the dry season where vegetables in the valley are irrigated based on water gotten from them.

A variety of crops are cultivated in the Ilakala village including: maize, sorghum, paddy, sunflower, pigeon peas, cowpeas, sesame, sunflower, tangerines, oranges and cotton as main crops produced. The villages' agro-climate is favourable for the production of cotton which have however been neglected by most farmers because of its unreliability and lack of profitability on the market. However, maize, sesame, sunflower and pigeon peas were considered the most important crops in the local food system. Maize was noted as the main crop cultivated by a majority of about 98% of the farm households in the village with its average area land occupation of 2 to 5 acres per household. It is usually grown with mixed patterns including legumes and oil seeds with its crop productivity yielding from 1-2 bags per acre.

Majority of the seeds used for cultivation are grown locally and are mostly home seeds; improved seed varieties are utilised by 20% of village famers. Farming is also practised with the use of rudimentary tools such as hand hoes, with only six households in possession of ox ploughs. With the absence of agro dealers in the village, farmers obtain inputs from the town of Kilosa.

As part of the bimodal regime, Ilakala village experiences two seasons; the first season lasting from November and ending in February. With changing climate patterns, the only reliable season is that of March which ends in June with the other season having a greater failure tendency.

Cattle and chicken rearing are the main livestock activities in the village with a smaller number of goats and pigs. Cattle rearing activities are common among native crop producers and only three of these households were in possession of dairy cattle, with average sizes of herd within ranges of 2 and 4 which were gotten from a Heifer international project. Almost 80% of villages on average are responsible for keeping rural chickens and managing a range between 5-50 birds. They have a high market value as the chicken prices ranges from Tshs 8500 to Tshs 15000. The former being the price of a hen and the latter for a cock. Their collection is done by youth middlemen and exported to Mikumi and Kilombero for wholesalers. Thus, chicken rearing was identified as a good upgrading strategy for the Trans-SEC project.

3.1.2 Description of Case Study Site II –Dodoma Region, Chamwino District

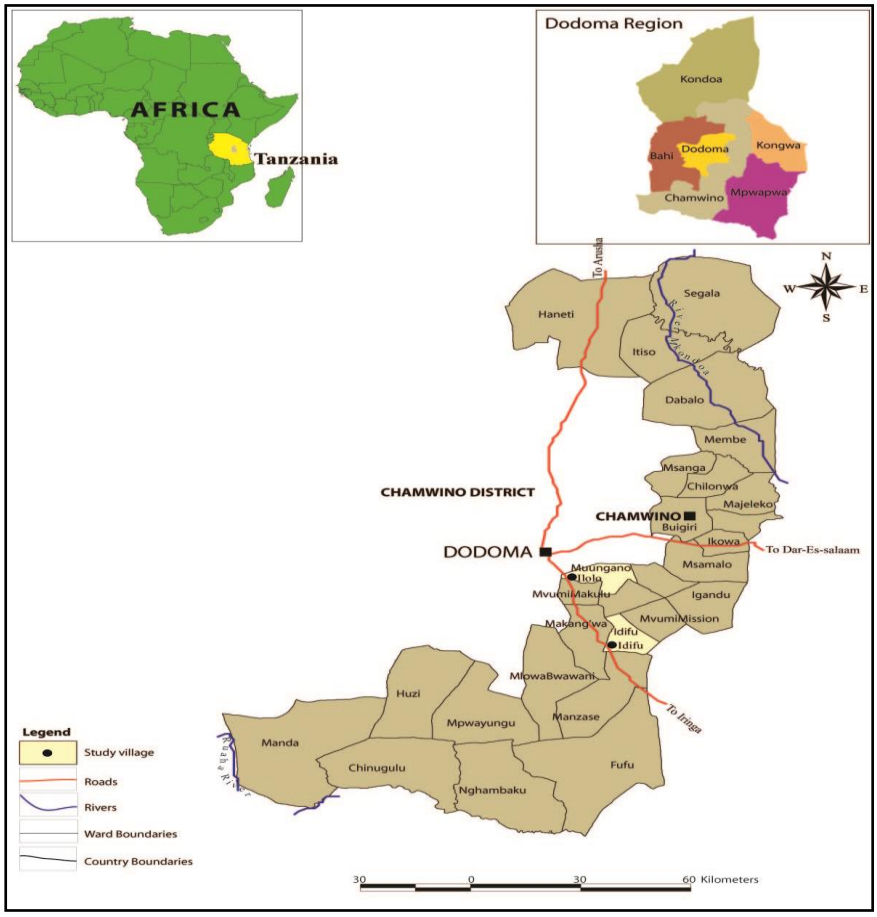


Figure 10 Case Study Site Chamwino District -Dodoma Region

Source: (Sieber, Graef 2015)

The Chamwino district makes up one of the six districts of the Dodoma region and is Central in the plateau of Tanzania and falls within the Latitude 40^{o} and 80^{o} South and longitude 35^{o} and 37^{o} to the East. It contains five divisions, 28 wards and 77 villages, among which the Ulaya ward falls and contains a population of 17,354 persons as revealed by the 2012 Population and housing census.

The national population census of 2002 recorded a total population of 289,959 people in this district out of which were 153,161 females and 136,798 males and a total of 57,992 households. A greater portion of these households (50,293) are directly engaged in production activities related to crop and livestock.

The districts climate is mainly the dry Savannah type and it experiences a long dry season between the months of early April to early December and a short rainy season beginning in

December and runs up till mid April. Rainfall patterns are relatively low in this region characterised with unpredictable occurrences, amounts and distribution especially during high planting season in January. As such, the average annual rainfall is 500mm and 85% of this amount is witnessed during the months between December and March.

Agro-ecologically, the Chamwino district is characterised with dry and flat lowlands with differing climatic conditions and its agro-economic zones are divided based on its soil and climate conditions. Its total land area is 8056km^2 with and equivalence of 805,600 hectares with 70% of its total arable land suitable for agricultural production.

Agriculture is responsible for the district economy's mainstay as it employs most of the people who are engaged in farming activities for the purposes of subsistence and income generation through the sales of cash crops. The main food crops cultivated in this district are; maize, beans, cassava, bananas, with the main cash crops including: sisal, sugarcane, cotton, simsim and sunflower. It should be noted that, crops like rice, maize and beans could be classified under both categories. Land area of about 536, 590 hectares is suitable for both cash and food crop cultivation.

In addition, agricultural and livestock activities are responsible for main economic activities and contribute to its populations' livelihoods through the provision of income, employment and securing adequate food supplies. As such, a smaller percentage of the population are engaged in the industrial and commercial sectors, with the limited scale of industrial activities.

Livestock activities are the second most important activity in this district although their contribution to the districts economy still requires accurate assessment. Through the promotion of improved technologies such as: drip irrigation techniques, draught animals and the use of motorised power tillers, land for cultivation is expanded and yields are increased. However, the food crop production trend of 2009/2010 and 2010/2011 witnessed a drop mainly as a result of increased drought frequencies which affected the district's food adequacy.

Hydro-electricity used in the Chamwino district is partly generated from the Mtera Dam with diesel, petrol and kerosene making up for other sources of energy especially for small industries and domestic use. A greater proportion of more than 95% population depend on firewood and charcoal as principal energy sources

Brief Description of Ilolo Village in the Chamwino district

The second focus village for this study, Ilolo, is located in the Dodoma case study site region. This village falls within the Murungano ward and statistics from the 2012 population recorded a total number of 4015 inhabitants for this village with an average household size of 4 people. The subsequent sections will discuss its current state based on different components of the FVC.

Table 2 Population and Growth rates between 1988 and 2002

	Land Area Square Km	1988	2002	Growth Rate	Population Density
Morogoro	70,799	1,220,564	1,753,362,	2.6	25
Dodoma	41,311	1,235,327	1,692,025	2.2	41
Mainland	883,749	23,095,882	34,443,603	2.9	39

Source: (URT 2006)

Table 3 Projected population trends for the case study regions ad their Districts

	2003	2,012	2025
Morogoro			
Kilosa	501,772	612,072	771,656
Dodoma			
Dodoma Rural	229,816	530,870	588,014

Source: (URT 2006)

Table 3 illustrates the population and growth rates for both case study regions between the year 1988 and 2002. It reveals population growth rates of 2.6%, 2.2%, and 2.9% in the Morogoro region, Dodoma region and the mainland respectively. Although both figures demonstrate population increases, indicative growth rate figures illustrate a higher population growth rate in Morogoro in comparison to Dodoma. According to the (URT 2006) the population in both regions' districts are also projected to increase by 2025. However, there is no much variation in the population figures between the previous year (2003) and the year 2012. This is the same case for the projected year (2025). Table 3 clearly illustrates this trend which could be accounted for by a low population density of less than 50 people per square kilometre as both regions are under populated when compared to other regions. Low population densities especially in the Dodoma region could also be a result of high levels of outmigration in comparison to Morogoro (URT 2006).

The most important natural resources with huge implication on the local food system and FVC include land, natural water from catchment and community water obtained during the period of water harvesting. Regarding land, average sized of landholdings were estimated at 4

acres per household with a great number of households (20%-30%) hiring mostly land specific to reddish clayey soil. Soils in this village are categorized into the Sandy soil accounting for 70%, Clay soils making up 25% and the remaining 5% belonging to Mbuga soils. Crop cultivation activities are largely influenced by the soil type.

The extensive slope of the hill favours the catchment of rainwater in this area with its run off being drained into the Mtera hydro dam. The creation of the water pond in the early 1960s was reported by farmers as a main source of water harvesting serving a double purpose of domestic water provision and the watering of animals. Due to the siltation problems faced by the pond, there exists a limited option for the practice of vegetable irrigation during the dry season which makes up the off season.

All village households (100%) are involved in the cultivation of pearl millet. The cultivation of pigeon peas in done by 40% of village households and depends on the availability of improved seeds which cost 1200 Tshs per kilogram. Groundnut is another crop which is widely grown by all village households engaged in farming and its operation covers an average of 1 to 2 hectares per operating household.

Livestock production activities are usually characterised with the rearing of chicken, about three households involved in dairy farming with one household in possession of a dairy goat.

According to the Tanzania Demographic and Health Survey (TDHS) 2010 regarding child nutrition status, stunting levels have been on an increase and there is a higher percentage of about 80% stunting of children below the ages of five in Dodoma in comparison to stunting rates recorded in other regions. Morogoro also records high stunting rates which are slightly above that of the national average which is approximately 60%. A clear picture of regional stunting rates of children below the ages of five can be illustrated in Figure 11 Severely stunted children below the ages of five make up 18.8% in Morogoro and 28.4% in Dodoma of stunted under fives. The previous TDHS of 2004 indicated stunting levels of 46% and 61% for underfives in Morogoro and Dodoma respectively, this is an indication that there has been increasing stunting levels for under fives of 14% and 20% in both regions, thus, an indication of the rising prevalence of under nutrition (URT 2011).

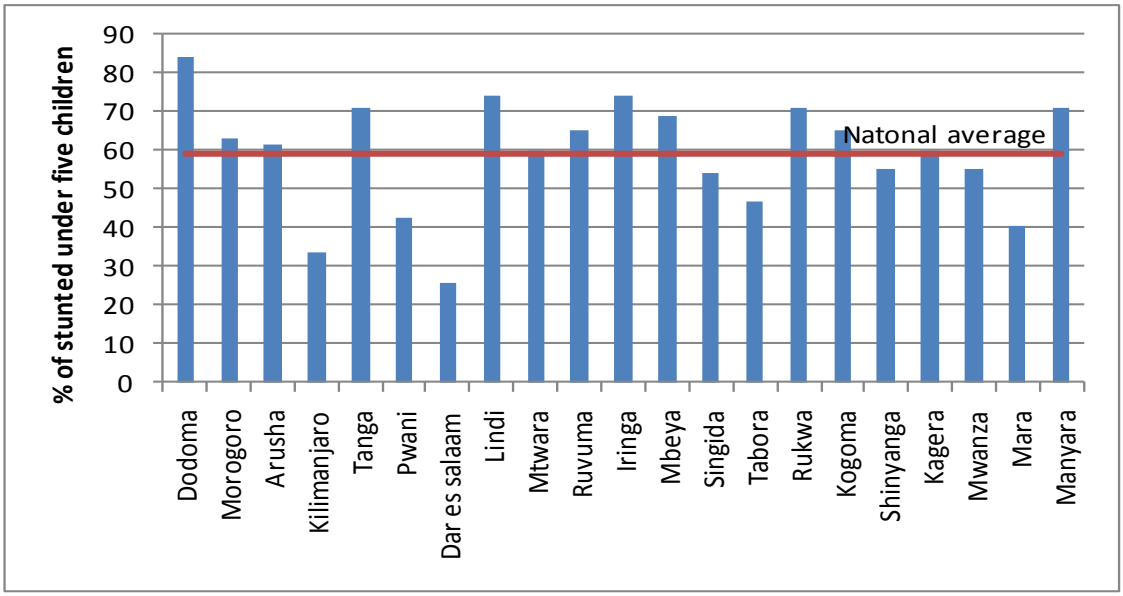


Figure 11 Regional Percentage distribution of stunting of children under ages of 5

Source: (URT 2011)

3.2 Research Methodology

In order to realise the objectives of this research study, Primary data was collected through the employment of both qualitative and quantitative data collection methods whereby field surveys were conducted and focus group discussions were organised.

The study was carried out in the Ilolo and Ilakala villages of the Chamwino and Kilosa villages respectively. A purposive sampling technique was applied and the samples included 30 respondents drawn from each village, comprising a total of 60 respondents. The respondents were farmer beneficiaries of the Trans-SEC kitchen garden promotion program. The study objective was facilitated through the preparation of a semi-structured questionnaire which was administered to the respondents sampled in both villages. Also, Focus Group Discussions were organised in both villages each comprising of 11 kitchen garden participants to get an in depth analysis on the crucial role as well as difficulties faced in using kitchen gardens. In addition literature concerning the role of home gardens in different study areas was reviewed which supported the discussion of our findings. Data obtained from the questionnaire was subject to analysis.

3.3 Design of Survey

This study was carried out within farming communities of the Ilakala and Ilolo villages in the Kilosa and Chamwino district. Between January and March 2016, a field survey was

conducted to gather specific information on kitchen garden practices and its influences on the households' food security situation with respect to ensuring direct and continuous access to food. The study employed a mixed research design, combining both qualitative and quantitative data concurrently. Both methods were used with the aim of providing a more comprehensive analysis on the role of kitchen gardens and their relevance on household food security. In order to minimise risks and overcome the limitations of using a single research design, mixed research designs are recommended and they provide the researcher with different design choices and strategies which could either be sequential or concurrent. Results gotten from one of them enable researchers to explore from one understanding to the next or be able to confirm findings.

Quantitative data was collected through the use of questionnaires. Household data was collected with the use of facilitation techniques such as: face to face interviews through the administering of a semi-structured questionnaire containing both open-ended and closed ended questions. A major advantage of using this technique is that of providing clear and reliable data which could be used for making comparative analysis.

However, a major problem faced when using questionnaires is dishonesty where respondents may not be 100% true in their responses because of protection of privacy or avoiding embarrassments.

Selection of survey participants

Data used for this study was obtained primarily by the researcher through a household survey under the framework of the Trans-SEC project. Participants used for this study included the beneficiaries from a kitchen garden project implemented by Trans-SEC. The sample size summed up to a total of 60 households in both regions who were selected using the purposive sampling approach, to include the beneficiaries of the Kitchen Garden program implemented by the project. Households were visited individually by the researcher with the assistance of a research assistant.

Survey materials, approaches and data description

As earlier indicated, the study employed a mixed research design with the employment of both qualitative and quantitative methods. Data collection instruments included the use of questionnaires which were administered to the concerned households and were facilitated

using face to face interviews and focus group discussions. The questionnaire was divided into three sections including: general characteristics of kitchen gardens including main reason (s) for their use at household level; in section 2, households were required to answer questions regarding the contribution of kitchen gardens in improving their food security situation. Questions in this section covered households' sources of acquiring vegetables before and after the adoption of kitchen gardens, contribution of gardens to the weekly ration of households and the level of importance households' attached to kitchen gardens as a source of providing direct access to food after its adoption.

In section three, households were required to answer questions related to the contribution of kitchen gardens in improving their livelihoods with regards to: the generation of both direct and indirect income and its usefulness during off seasons particularly stress periods (droughts, bad harvest, high prices). Satisfaction levels were obtained in this regard.

The questionnaire was written in English and Swahili translations were done by the research assistant to enable a greater understanding on the part of the participants. A review of the questionnaire to enable a better understanding at local level by farmers was done with a few key informants at the Sokoine University of Agriculture (SUA) located in the Morogoro region. The key informants included a research officer and five Trans-SEC correspondences in Tanzania with some knowledge and experiences on the situation of food insecurity as well as the practice of kitchen gardens in the concerned areas. Information collected from key informants were adapted and used as an addition to the original questionnaire for a clearer understanding on the part of the respondents.

For every questionnaire administered, a personal presentation was done on the part of the researcher; briefly stating the objectives of the survey and its relevance for the involved households. Respondents were reminded on the confidentiality and anonymity of their responses.

Household surveys were collected from the field through face to face interviews lasting for an average duration of 25 to 30 minutes per household. Some of the information gotten was conducted as part of the monitoring activities conducted by Trans-SEC in the case study sites. Due to the inability of capturing the potential of kitchen gardens on household food security and livelihoods using a single framework, questions listed on the questionnaires were framed and facilitated using a combination of relevant concepts listed in the analytical framework.

The sequencing of data analysis was done in a way to address the sub problems stated by the study. Data collected from household surveys was organised using a coding structure developed by the researcher taking into consideration important information gotten from the entire data set.

With respect to household data, descriptive statistics were performed on the demographic characteristics after coding its data and analysing it using the SPSS program and this data yielded the overall characteristics of the respondent households which were later on used in explaining some findings in the applicable areas. Results obtained were presented using frequencies, percentages and other measures of central tendency.

In the case of focus group discussions, the interviewer started with a short description of the research and its objectives and the main purpose of organising the discussion. The use of information gotten from the discussion was clarified by the researcher and expectations were explained.

Focus Group Discussion

Focus Group Discussions were organised to include 11 participants in each of the case study villages, which were selected on the basis of their sound knowledge of the kitchen garden practices as well as their level of involvement including their ability to generate surpluses from its product sales. Clarifications on the use of information obtained from the discussions were provided and questions about the research topic were read out by the researcher. The discussions were organised in English and directly translated to the audience in Swahili by the research assistant. The discussions sought to obtain details on the obstacles faced by kitchen garden farmers in the implementation of kitchen gardens as well as their existing and potential opportunities present in the same light.

Responses from FCD were categorised using components of the food value chain and analysed using a SWOT analysis

3.4 Data analysis Quantitative

Quantitative methods were used to analyse the first two research questions of this study. In order to pursue the first two research questions of this study, data was collected regarding households' sources of obtaining vegetables before and after the implementation of kitchen gardens. Responses were coded and descriptive statistical analysis was applied using the IBM SPSS Statistics 20 program in combination with the Excel statistical program. We applied descriptive statistics based on our data set and variables used for our study. Results were

presented using frequencies, percentages and bar charts. The percentages obtained were used as an indication on various ways in which households secure their food and show us the extent to which kitchen gardens are used in securing direct access to households' food for both regions.

Cross tabulations were used to facilitate analyses concerning categorical variables. Bar charts with percentages are used to illustrate households' frequency of weekly vegetable consumption in both regions before and after the implementation of kitchen gardens.

3.5 Qualitative data analysis

Qualitative data was obtained through organising focus group discussions with selected kitchen garden farmers. The discussions captured the major obstacles and opportunities encountered by kitchen garden farmers and the questions posed were framed using components of the food value chain. According to ODI (2009), a focus group discussion is a medium which enables the gathering information on specific topics of interest among group participants. One of the main advantages of a FCD is their ability to provide deeper insights and the exploration of the meanings of findings obtained from surveys especially those where statistical explanations could not be provided. (ODI, 2009).

In order to analyse qualitative data from the FCD, audio recordings gotten from responses of participants during the discussion were transcribed and relevant phrases and quotes that shed more light on the constraints, opportunities and benefits of using kitchen gardens were sorted out and presented using narratives. The major findings were summarily presented using the SWOT analysis under the themes based on the respective components of the Food value chain.

The third and fourth research questions of this study were analysed qualitatively. Thematic and SWOT analysis were used in grouping responses concerning the fostering and hindering factors of using kitchen gardens as well responses related to income utilisation from savings and surplus sales.

The results obtained from qualitative analysis will be used in complementing quantitative analysis for a better understanding on the potential and contribution of kitchen gardens in reducing household food security and livelihoods.

3.6 Limitations of Study

The study failed to use a control group of non beneficiaries as a unit of comparison. Capturing the effectiveness of an intervention on a treatment group requires a control group

to determine the existence of a cause-effect relationship. In this regard, it will be worthwhile to formulate hypotheses to determine whether the implementation of kitchen gardens have a significant impact on household food access using a treatment and a control group. Analysis will require the performance of statistical significant tests such as: correlation analysis and linear regression analysis. Control groups are also important in determining whether there is a significant difference in the production and consumption of food between a treatment group and a control group.

Secondly, it was difficult to determine the influence of kitchen gardens on dietary diversity of households using them. Information on consumption patterns was gotten only from a single food group (vegetables), without the inclusion of other food groups. Information from other food groups permits the calculation of a total dietary diversity score which is a determinant for household dietary diversity. As such, limited data did not permit the calculation of this score.

Furthermore, it is worthwhile to analyse the nutrient composition and measure the calorie content of the vegetables consumed per individual or per household to determine the effect of kitchen gardens on household nutritional security.

CHAPTER FOUR
PRESENTATION OF RESULTS

The main results of this research are summarized and structured into 5 main parts according to the research objectives and questions stated in the first chapter. The findings obtained appear to be consistent with the results gotten from literature and will be presented according to our two case study sites: the Morogoro and Dodoma region.

4.1 Socio-Economic and Demographic Characteristics of Households

The households sampled for this study were male and female farmers who were beneficiaries of the Trans-SEC program aimed at promoting the utilisation of kitchen gardens for nutrition and the consumption of indigenous fruits and vegetables. Findings from the results revealed that majority of the interviewed households were females (76.6%), while male households made up 23.3% as seen in Table 5 below. Thus, women are more involved in kitchen gardening activities than men. Similar findings were realised from a survey conducted in Mgeta village in 2001 the Morogoro region where more female households were involved in the cultivation of root crops, oil seeds, maize and horticultural crops while male members were more involved in the production of paddy and oil seeds; 53% of the females cultivated horticultural crops as opposed to 20% of males and 27% of both males and females were involved in joint cultivation. According to this study, there is strong preference of males in the engagement of cash crops aimed mostly in generating income and female members in the cultivation of food crops mainly for consumption at household and family level (Lyimo-Macha et al, 2002).

Generally, 71.7% of the households in both Morogoro and Dodoma regions are headed by males and 28.3% are headed by females. These results seem to be consistent with those of the National Panel Survey (2009) in Tanzania where households headed by males constituted more than 75% in the Central and Eastern parts of rural Tanzania. In general, about half of the 25% of households headed by females in Tanzania are widowed (URT 2006).

Our findings also revealed an average household size of 4.6 in both the Dodoma and Morogoro region with a maximum size of 10 and a minimum size of 1 member. These findings appear consistent with the Tanzanian NPS (2009) that had an average household size of 4.8 persons in the Mainland of Tanzania.

In the male population, the pyramid shows a gap of 5 percentage points in the 15-19 and the 20-24 age groups. This could indicate the presence of a significant flow of outbound

migration of young men in recent years. Although Tanzania's net (out) migration decreased between 2005 and 2010 from – 345 thousand to – 300 thousand16, as a percentage of total population, Tanzania's net (out) migration is high when compared to other sub-Saharan African countries.

With respect to age groupings, the overall results in both regions as indicated in Table 5 below reveal that 35.7% (male) and 21.7% (female are found within the age group ranging from 41-50years. This clearly shows that older men are more involved in kitchen garden activities than older women. However, 34.8% (female) and 14.3% (male) of the household respondents are found within the age group of 21-30years which is an indication that the younger females than males are into activities related to household kitchen gardens. Also, an almost equal number of males (21.4%) and females (21.7%) of the respondents fall within the range of 31-40years. Furthermore, a smaller proportion of respondents are recorded within the age range of 51-60 years comprising of male respondents (7.1%) and 19.6% of females; and 21.4% (female) and 2.2% (male) respondents fall within the ages above 60 years. The older household heads (61 and above) still have garden that is under the care of their sons or daughters.

A study carried out by (HelpAge International 2011) in collaboration with its Tanzanian partners in the Morogoro and Songea region (2011) showed that a greater proportion of older persons (94%) together with their households were reliant on agriculture with a greater involvement in small scale farming (HelpAge International 2011). Thus agriculture was regarded as a primary means of existence. Also, some findings gotten from the URT (2003) indicated an involvement of 98% of rural women in agriculture, producing great share of food crops to be consumed at home and also for export.

With regards to education, findings as presented in **table 5** below show that a greater proportion of females (50%) than males (42.9%) have informal education; 42.9% of males and 39.1% of females attained a secondary level of education; Lower percentages of male (7.1%) and females (8.7%) respondents were reported to have achieved primary education. Research carried out on the returns to education indicated lower benefits of primary schooling for Tanzania when compared to expectations from international research data. Meanwhile, another study carried out from 1995 in the Kilimanjaro, Tanzania revealed that there was a positive and significant effect on the productivity of farmers resulting from four or more years of education (Maarifa ni Ufunguo 2002). Evidence from Tanzania also

highlights the threshold effect of secondary education which is usually accompanied with numerous benefits such as increases in income and a more visible reduction in fertility). In a study carried out by (Mhango et al. 2014) in the Morogoro municipality, a great majority of farmers attained a certain level of education which was enough for them to properly allocate their resources concerning their vegetable production in order to make allocation for income sufficient enough for the households. They further revealed that literate farmers stand at a better position in accessing technical information such as: application of agricultural input than farmers who were illiterate.

Regarding the marital status of the respondents, the data as illustrated in table 4.1 shows that 7.1%, 85.7%, 7.1%, 0%, and 0% of male respondents were single, married, divorced, separated and widowed, respectively. On the other hand, 17.4%, 67.4%, 4.3%, 8.7% and 2.2% of female respondents were single, married, divorced, separated and widowed respectively. The above results are a clear indication that most respondents who participated in kitchen gardening activities were married. Similar results were obtained by a study carried out by Mhango et al. (2014) in the Morogoro municipality. It was evident from this study that the majority of vegetable producers (65.7%) were married, 20% were single, 2.9% were widowed and 11.4% were divorced. This is an implication of married people having more access to vegetable production related activities than the other marital groups. Their results were however not surprising in that, there was a greater decision making impact in vegetable production on the part of a couple.

Table 4 Socio-Economic and Demographic Charactristics of Respondents

	Male (%)		Female (%)
	Total		Total
	N(14)		N(46)
Household Characteristics			
Sample Size	23.30%		76.70%
Family Size (mean)		4.6	
Gender(Household Head)	71.70%		28.30%
Education Level			
Informal	42.90%		50%
Primary	7.10%		8.70%
Secondary	42.90%		39.10%
Tertiary	7.10%		2.20%
Marital Status			
Single/Never Married	7.10%		17.40%
Married	85.70%		67.40%

Divorced				7.10%		4.30%
Seperated				0%		8.70%
Widowed				0%		2.20%
Age Distribution						
21-30				14%		34.80%
31-40				21.40%		21.70%
41-50				35.70%		21.70%
51-60				7.10%		19.60%
above 60				21.40%		2.20%

Source: Computed by Author from Household Survey (2016)

Kitchen Garden Characteristics

Kitchen gardens as identified in the first part of our study were in the form of vertical pocket bags and were mainly used for the cultivation of vegetables in the household. A typical example of a kitchen garden used for our study is illustrated in **figure 12** below as captured during the household survey. Results from our household survey revealed the average size of a pocket garden to be 1.58; with a majority of respondents (47.5%) in possession of 1 pocket bag, 40.7% households having 2 bags 6.8% using 3 gardens and 1.7% of respondents having 5 pocket bags. The average number of vegetable species stood at 1.87; implying that households cultivated an average of approximately 2 vegetable species on their kitchen gardens. Out of 60 respondents 78.3% realised output from their gardens, with the remaining 21.7% realising no output.

As indicated in **Figure 15** the main vegetable species cultivated in both regions were spinach and sukumawiki. Sukumawiki was the most dominant vegetable specie cultivated in the Ilolo village with 34.7% of respondents involved in its cultivation; with spinach and Chinese cabbage the second most cultivated each comprising of 24.5% of participants involved in its cultivation. 10.2% of respondents cultivated Mchincha (Amaranth) and other vegetables such as Mnafu, and green leaves made up for the remaining 6.1%. In Ilakala, Spinach was the most dominant vegetable specie cultivated with 31.4% of households involved in its cultivation. 31.3%, 20.3%, 7.8%, 4.7% and 1.6% of households cultivated Sukumawiki, Chinese cabbage, Mchincha, Cassava leaves and other vegetables (pea leaves) respectively. A survey conducted in June 2012 with 160 AITV sellers in Dodoma, Morogoro, Arusha and Iringa concerning information on vegetable types identified Cassava leaves, Sukumawiki, Mchincha as the most commonly sold AITVs sold in public markets of Tanzania. However, the Chinese cabbage was identified as one of the main non-indigenous vegetables sold (Lotter et al. 2014). Spinach is also recognised as a widely grown crop in East Africa characterised by a

deep green colour even after cooking with a boiled 60g containing approximately 1.9mg of iron and significant amounts of Vitamin A,C,E,K, magnesium and anti-oxidants when eaten raw (Maina, Mwangi 2008).

Figure 12 Illustration of a typical KItchen Garden of a framer growing Sukumawiki in the Ilolo village in the semia rid Dodoma Region

Picture taken by author during household survey (2016)

Figure 13 Successful kitchen garden of farmer cultivating Sukuma wiki in Ilolo Village

Picture captured by author during household survey

Figure 14 Successful kitchen garden of farmer in Ilakala cultivating Sukuma wiki and Chinese Vegetable species

Picture taken by author during houshold Survey (2016)

Table 5 Kitchen Garden Characteristics of Respondents

Kitchen Garden Characteristics			
	Frequency Total	Mean	Percentage
Number of Pocket Gardens	**N(59)**		
0	2	1.58±0.82	3.40%
1	28		47.50%
2	24		40.70%
3	4		6.80%
5	1		
Number of Garden Species			
0	5	1.87±0.97	8.20%
1	12		20%
2	34		56.70%
3	4		6.70%
4	5		8.30%

Source: Computed by author during household survey (2016)

Figure 4.4 Main Vegetable Species cultivated on kitchen gardens

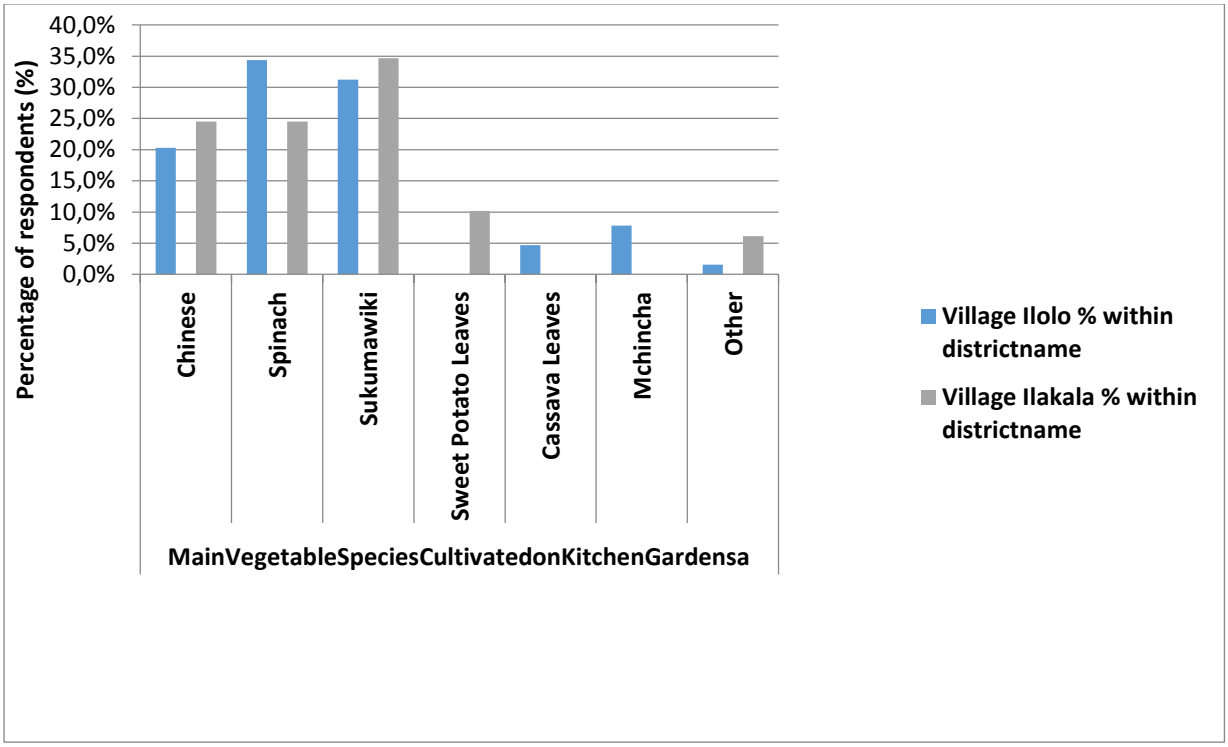


Figure 15 Main species cultivated on Kitchen Gardens

Source: Computed by author from household survey (2016)

In Ilolo, 36.1%, 33.7% and 24.1% comprising majority of respondents indicated that their main motivation for using gardens were for purposes of home consumption, improving

household nutrient composition and providing direct access to home grown vegetables respectively. A smaller percentage of 6% of respondents used home gardens for income generating purposes. Similarly, in Ilakala, 31.9%, 31.9%, 28.6%, 7.7% utilised kitchen gardens for purposes of subsistence, improving household nutrient composition, providing direct access to home grown vegetables and income generation respectively.

4.2 Quantitative Analysis

4.2.1 Contribution of Kitchen Gardens to Household Food Security and Improved Livelihoods

A total of 41 respondents out of 60 respondents from both villages generated indirect income from savings on vegetable purchases; providing an average income amounting to Tshs 945.1 through savings. However, only 10 respondents generated direct income through the sale of surplus vegetables; with an average income of Tshs 1220 generated from direct sales of kitchen garden products with the lowest amount of Tshs 400 and highest amount of Tshs 3000 being gotten from its sales. One bundle of vegetable, equivalent to 200grams (a handful) was valued at Tshs 200.

As illustrated in **Figure 16** below, 56.4% and 55.6% of respondents in the Ilolo and Ilakala villages respectively spent their combined garden income in purchasing food such as: cooking oil, fresh tomatoes, onions, maize flour, sorghum, meat, fish, other fruits vegetables; 20.5% and 27% of respondents in the Ilolo and Ilakala villages respectively spent their garden income in the purchase water to enable them irrigate their kitchen gardens; with 12.8% and 16.7% respondents in the Ilolo and Ilakala villages respectively spending their garden income in catering for health and sanitation needs of the household such as: buying washing soap/powder, paying hospital bills and buying medicines Meanwhile, a smaller portion of 5.1% of respondents in the Ilolo village spent their garden income on education through the purchasing of exercise books for their children and the remaining 5.1% respondents in Ilolo devoted their garden income to other household needs, for instance in hiring an Ox plough for farm use and buying kerosene oil for cooking.

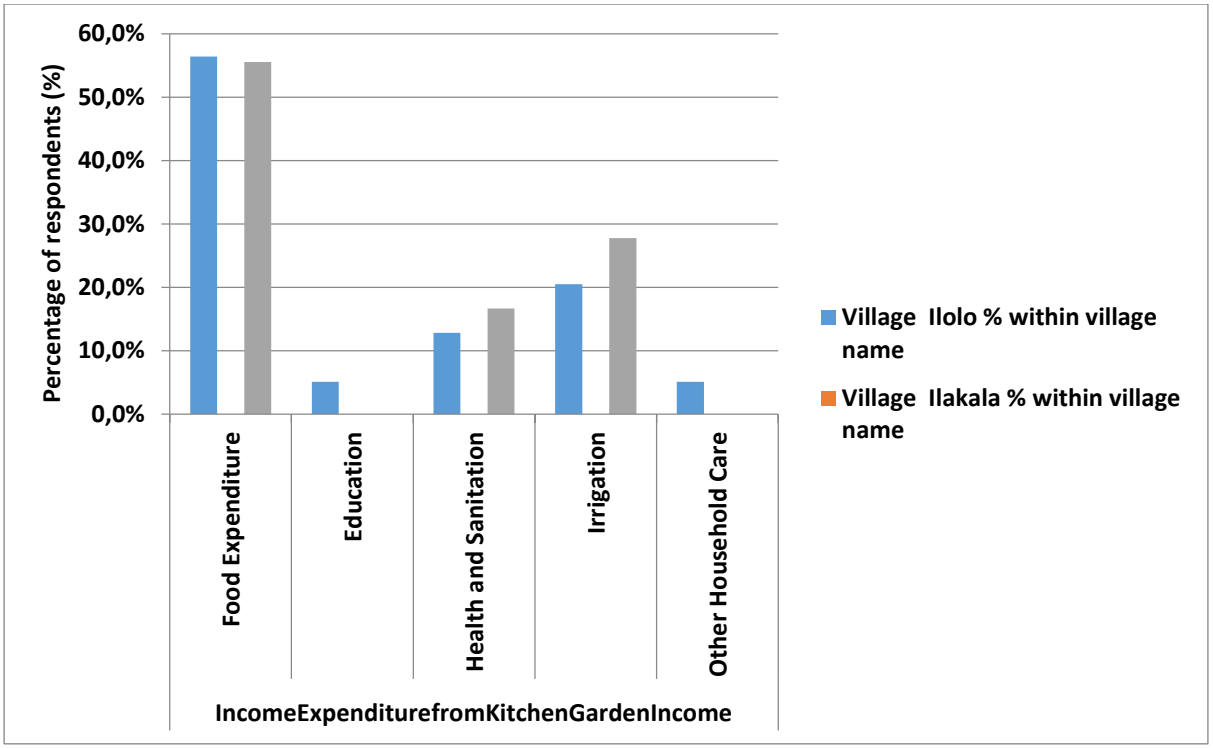


Figure 16 Expenditures and Items purchased with Garden income (Direct and Indirect) among households

Source: Computed by author from Household Survey (2016)

As indicated in Figure 16 above majority of the household respondents spent their garden income in the acquisition of food which illustrates its relevance in accessing food and thus food security. As pointed above, the ability of households to obtain more food strengthened through the income acquired from the sales of garden produce illustrates its importance in accessing food, thus a vital dimension in the achievement of household food security.

4.2.2 Sources of Vegetable Acquisition before and after implementation of Kitchen Gardens

During the household survey, questions related to household acquisition strategies were asked in order to find out their different ways of securing food. Different strategies of obtaining food were gotten before and after the implementation of kitchen gardens. Our results revealed that before the adoption of kitchen gardens, 63.3%, 14.6%, 7.3%, 14.6% of households' respondents in the Ilolo obtained vegetables through market purchases, home production, borrowings from neighbours and friends and collection from the wild respectively. Similarly, in the Ilakala village, 38.3%, 10.6%, 6.4% and 44.7% obtained vegetables through purchases, home production, and borrowings and from the wild respectively.

After the introduction of home gardens, there was a significant reduction in the households who purchased vegetables on the market in the Ilolo as only 9.1% of the respondents still relied on that option. However, there was no significant drop in Ilakala as 27.7% of respondents still relied on obtaining vegetables through market purchases from middlemen. Also, in Ilolo, a greater portion of 39.4% of the respondents relied on home grown vegetables from their kitchen gardens as a vegetable source as compared to 23.1% of the respondents in Ilakala village. However, 37.9% and 29.2% of households in the Ilolo and Ilakala villages respectively still depended on vegetable collection from the wild as supplementary vegetable sources even after the implementation of kitchen gardens.

This is illustrated in **Figures 17 and 18** below. Also, the figures depict a significant reduction in the percentages of respondents who relied on market purchases for vegetable acquisition before the introduction of gardens and an increase reliance on their own home production. This illustrates the crucial function of kitchen gardens regarding household food security in the Ilolo village. Nevertheless, this major difference was not clear in the Ilakala village.

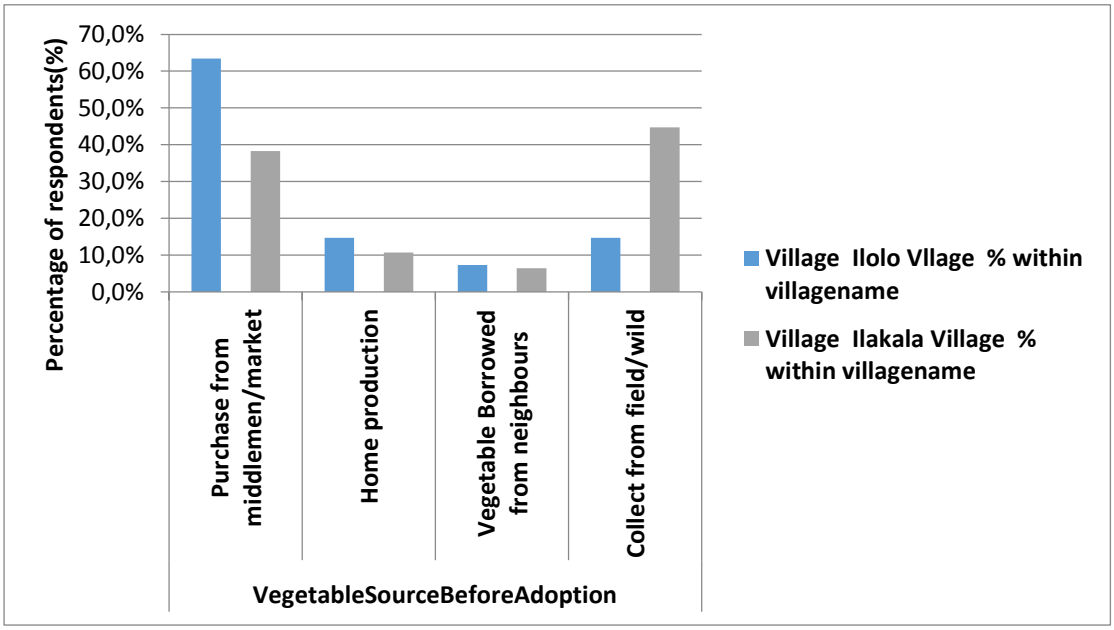


Figure 17 Sources of Vegetables acquisition before implementation of Kitchen Gardens

Source: Computed by Author from Household Survey (2016)

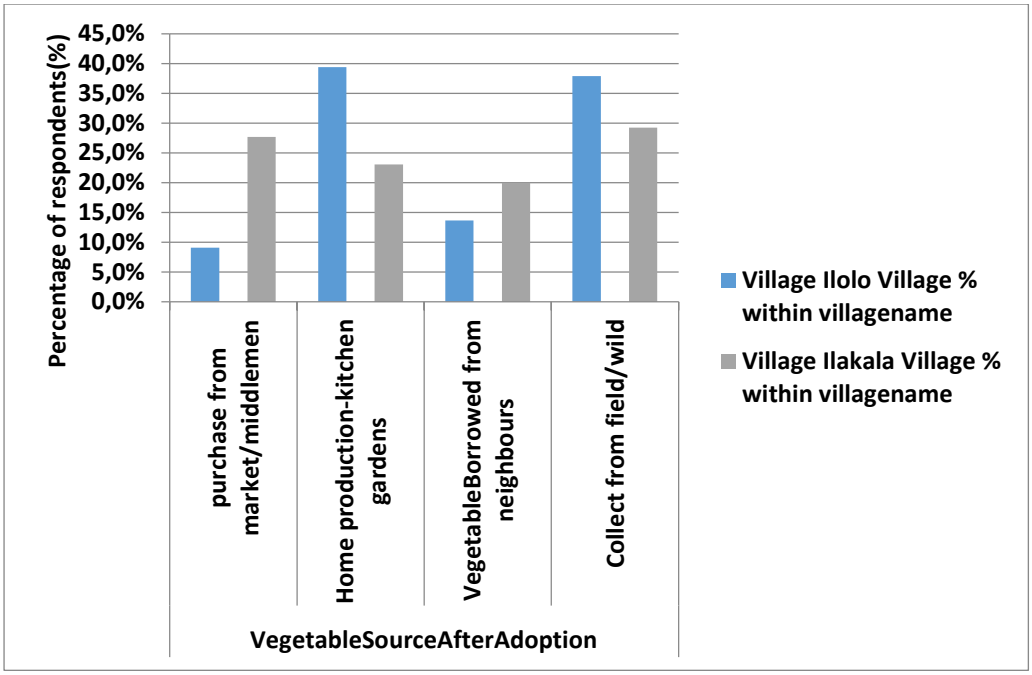


Figure 18 Sources of Vegetable Acquisition after implementation of Kitchen Gardens (Household survey 2016)

4.2.3 Frequency of Weekly Vegetable Consumption before and after implementation of Kitchen Gardens

In order to capture the vegetable consumption patterns of households using kitchen gardens, this study employed the frequency of vegetable consumption as a variable in order to make analysis on the weekly consumption of vegetables and find out the extent to which the implementation of kitchen gardens influenced its patterns. A classification of weekly vegetable consumption was made on the basis of 'less than once a week', 'once a week', 'twice a week', 'three times a week' and 'more than three times a week'.

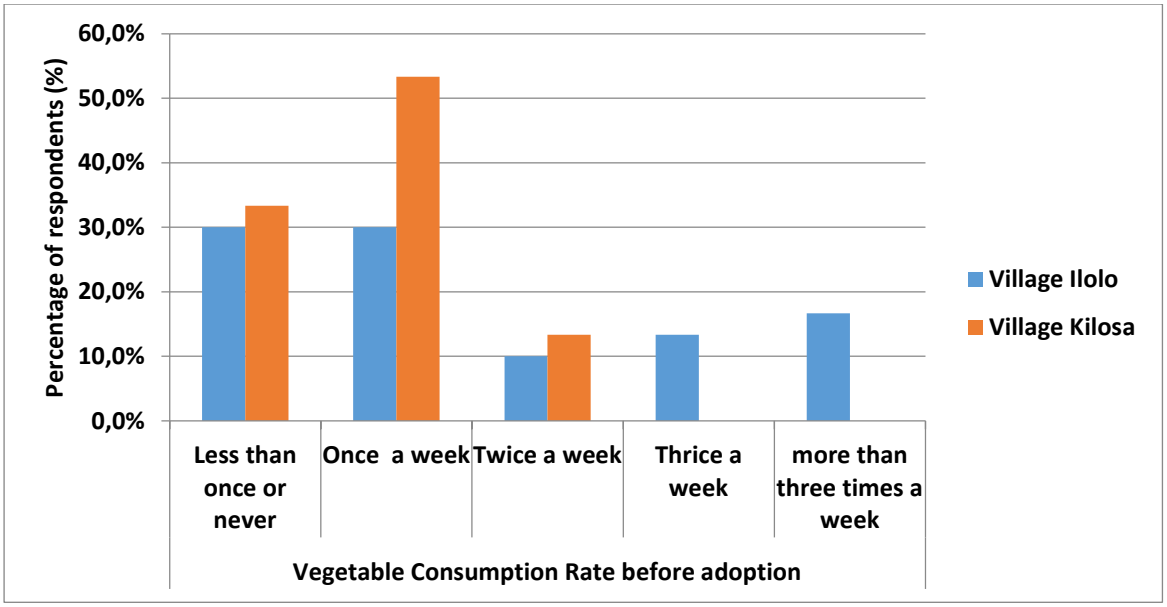


Figure 19: Frequency of Vegetable Consumption after Adoption of Kitchen Gardens

Source: Computed by author from household survey (2016)

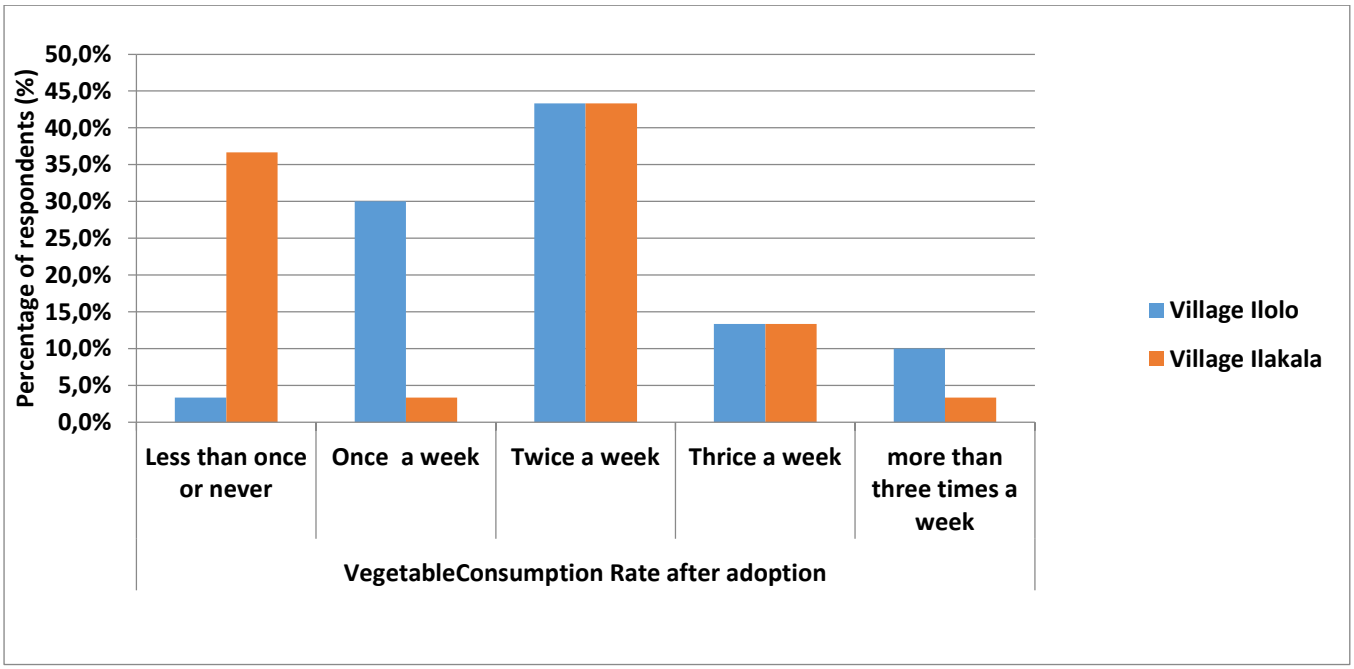


Figure 20: Frequency of Vegetable Consumption after Adoption of Kitchen Gardens

Source: Computed by author from household survey (2016)

As illustrated clearly in **Figures 19 and 20** above, the percentages of households consuming vegetables less than once a week dropped from 30% to 3.3% after the adoption of kitchen gardens in the Ilolo village and increased from 33.3% to 36.7% in the Ilakala village. Also,

the percentages of respondents who indicated vegetable consumption frequency of 'two times a week' increased from 10% to 43.3% in Ilolo and 13.3% to 43.3% in Ilakala village. Fewer percentages were recorded in the range of 'three times a week' and more than 'three times a week' as the percentages of respondents of 13.3% and 3.3% respectively fell within these categories for both regions. However, the number of respondents who consumed vegetables once a week dropped from 53.3% to 3.3% in the Ilakala region. This could partly be explained by the fact that 36.7% of respondents in the Ilakala region realised no output from their kitchen gardens as compared to 6.7% of respondents in Ilolo village where a greater proportion of 93.3% realised vegetables from their kitchen gardens.

Notwithstanding, the **figures 19 and 20** as well as percentages show that there were changes in the frequency of vegetable consumption from 'less than once a week' to at least 'once a week' and 'twice a week' for the respondents in both villages; although these changes were more visible in the Ilolo village.

In order to get a better understanding of the consumption patterns, information on the amounts of vegetables produced weekly were gotten from the respondents. Results obtained indicated that household respondents produced a median of 600 grams of vegetables on a weekly basis during the period the interview was conducted and consumed a median of 400 grams of vegetables weekly during the same period.

Nevertheless, the average weekly vegetable consumption of 666.1 grams was obtained for households after the adoption of kitchen gardens indicating an average daily per capita vegetable consumption of 94.4g; implying that households obtain 47.2% on average of the daily per capita vegetable consumption required by the WHO and FAO.

4.3 Qualitative Analysis

4.3.1 Fostering and hindering factors in the Implementation of Kitchen Gardens

In order to get a deeper understanding on the obstacles faced by kitchen farmers and the potential and existing opportunities present for households implementing them, focus group discussions were organised in both the Ilakala and Ilolo village with a total of 11 participants in each session and per village.

As indicated in **Appendix II**, The first question ('what are the problems you encounter in using kitchen gardens?') was asked and there was an interactive session between the

researcher and the respondents. The second question posed by the researcher was: 'what are the existing or future opportunities of using kitchen gardens?' the third questions asked was 'what are the major benefits derived from the presence and use of kitchen gardens in your households'? And the last question ('how could the above identified problems be solved?') was related to the way forward for kitchen gardens. After collecting all the required information from the focus group discussions for the two regions, a SWOT analysis was developed based on the responses gotten from the participants, where responses gotten were categorized into headings according to components of the food value chain namely: Natural resources, Production, Processing/Distribution/Transporting, Marketing and Consumption. However, there is a slight difference in the SWOT analysis used in this study from that used within the business context as considerations were made regarding the process of the establishment and usage of kitchen gardens. Thus, the strengths and weaknesses in this light referred to current issues surrounding the kitchen garden practices and the opportunities and threats related to the potential situation.

The analysis was done in the light of a regional context and presented in **table 7** and **table 8** below:

Table 6 SWOT ANALYSIS OF KITCHEN GARDENS- Kilosa District (Ilakala Village)

NATURAL RESOURCES
Strengths • Semi-humid climate coupled with strong natural base ensuring the continuous moisture content of the soil even in less rainfall seasons; Morogoro region is characterised by loamy soils and sandy loamy soils.
Weaknesses • Irregular rainfall patterns with some seasons of prolonged dryness making it difficult for vegetables to survive. • Limited water for irrigation.
Opportunities • Regional advantage enabling the conservation of water during heavy rainfall seasons to be used in dry season, thus carrying out rain water harvesting techniques by locals.
Threats • Over reliance on rain fed agriculture on the part of most respondents

increasing vulnerability to climate change impacts.

PRODUCTION

Strengths

- Kitchen garden using pocket bags occupy small land space around homestead.
- Strong social network among group participants enabling group dynamics and the sharing of new kitchen garden cultivation techniques.
- Cultivation of vegetables on kitchen gardens during both rainy and dry seasons.

Weaknesses

- Lack of inputs such as improved seed varieties, water; pesticides limiting the survival chances of vegetables grown on kitchen gardens.
- High cost of water leading to limited purchases by farmers (Tshs 500 for 3 buckets of water in most cases)
- Increase prevalence of pests and diseases leading to the destruction of vegetable leaves resulting to limited agricultural yields for farmer respondents.
- Lack of financial capital to purchase more pocket bags and conventional pesticides which are expensive and less environmentally friendly in comparison to organic fertilisers which are less damaging.
- Limited protection of kitchen gardens, increasing susceptibility of destruction by pests and livestock (chickens), birds and dogs.
- Extreme rainfall during extreme seasons leading to the occasional destruction of pocket bags.

Opportunities

- Possibility of more vegetable cultivation on smaller land space and with additional pocket bags.
- Creation of initiative for development of annual planting plan, wherein vegetable species adapted to different seasonal conditions could be identified and fitted into the plan; enhancing possibility of planting different vegetable species in different seasons.

- Availability of local pesticides in village area to deal with pests and diseases. ('Marobaini'), otherwise known as Neem tree.
- Creating complementary food sources on the same garden space such as: multipurpose gardens with the inclusion of other vegetables (using tray gardens), fruits (paw paw, banana), food crops and other vegetables (tomatoes).

Threats

- Overdependence on inputs provided by Trans-SEC project, and limited prospects on the future of kitchen gardens after project completion.
- Overdependence on kitchen gardens as vegetable source results in disappointments during failed harvest periods.
- Limited choice of vegetable species.

PROCESSING

Strengths

Weaknesses

- Limited or no knowledge on local processing facilities for vegetables.

Opportunities

- Possibility of processing vegetables obtained from gardens to be used in periods of food shortages.

Threats

- Excessive rainfall during heavy rainy season limiting the possibility of direct drying vegetables for preservation.

MARKETING

Strengths

- Proximity to market and sale possibilities thus generating income from sales of surplus garden products.

- Direct market sales, through rendering direct door to door services to customers.

Weaknesses

- Limited or no market information on customer's wants (preferred types and quantities of vegetables.
- Too much familiarity prompting some customers to buy vegetables on credit with little possibility of repayment.
- Different packaging strategies for different farmers with some farmers tying bigger vegetable bundles than others resulting in loss of customers.

Opportunities

- Increase possibility of group members pooling their resources and capabilities and creating linkages with agro dealers in Kilosa town for seed supplies and other contract farming possibilities with other vegetable wholesalers.
- Proximity to Kilosa with greater market possibilities.

Threats

- Fear of competition and possible conflicts arising among other group members if all farmers involved decide to sell surpluses from gardens.

CONSUMPTION

Strengths

- Direct and easy access to fresh vegetables in both rainy and dry seasons.
- Stable weekly source of food supply from kitchen gardens

Weaknesses

- Large household and family sizes for some respondent households' limit the weekly frequency of vegetable consumption of vegetables.
- Complaints arising from some household members about the bitter taste of some vegetables such as: cassava leaves easing its disposal.
- Inadequate nutrition knowledge to sensitise other non-beneficiary farmers on nutritional benefits of adequate vegetable consumption.

Opportunities

- Strong social capital among participants could facilitate knowledge and experience exchange among group members on better cooking practices to minimise the better taste of vegetables (for instance the use of spices such as ginger and coconut milk to improve taste of vegetables).
- High nutrient content of vegetables grown on kitchen gardens.

Threats

- Uncertainty about the quantity of output to be realised.

Source: Compiled by author from responses gotten from Focus Group Discussion participants in Ilakala Village

Table 7: SWOT ANALYSES OF KITCHEN GARDENS- Chamwino District (Ilolo Village)

NATURAL RESOURCES
Strengths • Kitchen gardens occupy small land space. • Kitchen gardens are environmental friendly and require little or no chemical fertiliser for its cultivation; thus preserving soil properties and protecting environment from damage.
Weaknesses • Poor access to water and irregular rainfall patterns slowing down growth of vegetables.
Opportunities • Great possibility of vegetable survival in semi-arid area.
Threats • Location of Ilolo village in semi-arid climate increases the vulnerability of households to negative impacts of climate change such as droughts.

PRODUCTION
Strengths • Local protection initiative of kitchen gardens using local materials such as

leaves, bamboo sticks.

- Provision of input (seedlings, pocket bags, soil, sand, manure) and technical support in the form of trainings, nutrition education and demonstration of kitchen gardens by project (Trans-SEC).
- Households benefit from cheap cost of water (Tshs 50 per bucket in most cases).
- Strong social capital existing among kitchen garden farmers creating possibility of knowledge sharing during weekly group meetings).
- Proximity to kitchen gardens around homestead, with cultivation requiring less effort compared to other vegetable farming methods.

Weaknesses

- Prevalence of pests and diseases in addition to limited number of pocket bags leading to the realisation of less output.
- Poor access to financial capital such as: credit to purchase extra bags.
- Joint nursery utilised by almost all households not sufficient for the timely satisfaction of all households.

Opportunities

- Additional livelihood source and coping strategy for poor households.
- Organise trainings on effective nursery practices.
- Availability local pesticide trees (‘Marobaini’, ‘Chunga’, use of ashes) in village area in some households of members.

Threats

- Possible loss of project support for kitchen gardens after completion.

PROCESSING

Strengths

- Available processing tools and knowledge from experience of processing other vegetables obtained from fields and wild.
- Utilization of local knowledge to maintain the green colour of vegetable for the next day.

Weaknesses

- Limited yields from kitchen gardens and less possibility of processing.

Opportunities

- Innovative processing techniques for drying vegetables.

Threats

- Loss of nutrients due to prolonged exposure to sun.
- Long processes involved in processing.

MARKETING

Strengths

- Close distances between households advancing ease in reaching households to sell vegetables directly.
- All round season cultivation of vegetables.

Weaknesses

- Competition faced by other middlemen and other street hawkers involved in vegetable sales who quickly reach households first because of position of bicycles.
- Limited market information on buyers' content.
- Credit purchases by customers.

Opportunities

- Possibility price hiking during the dry season characterised by vegetable shortages.

Threats

- Less time available to dry vegetable output from kitchen gardens because of more time devoted to vegetables obtained from the wild which are usually in bulk.

CONSUMPTION

Strengths

- Direct access to fresh vegetables even during dry season.

- Time saved from frequently obtaining vegetables from market and fields.
- Ability to diversify diet through additional food purchased using kitchen garden income.
- Buffer against food shortages.

Weaknesses

- Large family sizes plus less output generated limits ability of households to reap nutritional benefits of vegetables consumed by households.

Opportunities

- Creation of opportunities for the spread of nutrition education.

Threats

- Possibility of more diverse species available in the fields/wild during rainy season.

Source: Compiled by author from responses gotten from Focus Group Discussion participants in Ilolo Village (2016)

Tables 7 and 8 above illustrate responses gotten from selected kitchen garden farmers in the Ilakala and Ilolo regions respectively; analysed using a SWOT Analysis.

From the above figures, the most important constraints highlighted by farmers common to both regions were: the high prevalence of pests and diseases, limited financial resources to acquire extra pocket bags and other inputs, poor knowledge on kitchen garden nursery practices, limited irrigation water, limited consumption quantities and unreliable weather conditions; amongst other constraints. Much emphasis was placed on pests and diseases as a constraint inhibiting the survival of most vegetables grown on kitchen gardens. As a 47 year old female participant from the Ilakala village put it:

'For me, my main problem is pests and I had no pesticides, the pests are really destroying the vegetables. Sometimes, the pests eat up all the leaves and leave only the branches so this really destroys the growth of the vegetables'.

In a similar view, another year old 30 year old male female farmer, from the Ilolo village went on to say:

'*this season is not the favourite season because we tried to prepare a nursery for the gardens and because of this water problem, pests came and took all of our seedlings but it worked during the first round'.* Majority of the participants supported their views on the frequent

occurrence of pests and diseases. Regarding the vegetables from kitchen garden's inability to satisfy large family households, a year 40 year old female farmer in Ilakala went on to say that *'if you have a large family, you can't even sell these vegetables, because you have to satisfy your family first; imagine if you harvest twice a week, you eat everything in one day and there is nothing left to sell'.*

Regarding the poor receptive behaviour of some the vegetables such as: cassava leaves, another female 49 year old farmer in Ilakala described: *'when you plant cassava leaves in your garden, harvest and cook, you find out that people don't like the taste. You will end up throwing a huge quantity of cassava leaves because no one likes it, but we like Sukumawiki'.*

A 43 year old female farmer expressed her views on the issue of poor nutrition knowledge being one of the weaknesses of using kitchen gardens by saying:

'*You sometimes find this little knowledge of nutrition tricky because the neighbours ask more adversity questions and we cannot answer because we are not scientists and we don't know much about this nutrition so it gets hard to answer and sometimes these guys ask the questions in a very negative way, so when they realise that we cannot answer, they think we don't know what we are saying'.*

Farmers were also informed about the possibility using local pesticides accessible within the village vicinity and present in the home garden area in the households of some of their colleagues. A typical example is the 'Marobaini' as highlighted by one of their colleagues. It is grown in some of the households of the participant farmers; as the name implies, it has the ability of curing about 40 pests and diseases simultaneously. However, its effectiveness is more pronounced during the early stages of vegetable growth.

In spite of the obstacles encountered by most of the farmers, majority of them advanced several positive benefits of using kitchen gardens with majority of respondents agreeing to: the provision of direct and easy access of vegetable supply to households, time saved from collecting vegetables from field, possibility of sales and additional income generation sources, securing an all year round vegetable supply and the use of less land for cultivation as the key benefits of using home gardens.

As a 30 year old farmer from the FCD in Ilolo says: *'before the establishment of gardens, me and my family were consuming vegetables once a week, because of long distances it took us*

to collect vegetables from the field. Now, we have the opportunity of consuming vegetables at least 5 times a week because of the use of our kitchen gardens'

Furthermore, most of the participants present at the focus group discussion agreed that kitchen gardens provided them with the opportunity of consuming vegetables which could only be purchased on the market with rare chances of their existence in the wild. This highlights its major role in enhancing the household vegetable and food diversity situation.

A 40 year old farmer in Ilolo says*: 'Kitchen gardens have improved vegetable variety in my household. Before their introduction, I wasn't able to easily consume certain vegetables like Chinese cabbage and Sukumawiki without buying on the market. But today, I am able to eat Chinese cabbage and sukumawiki obtained directly from my gardens. Also, the money I save from not buying them gives me the chance to buy other foodstuff such as: fish and other vegetables which I cannot grow on my gardens.'*

4.3.3 The role of kitchen gardens in enhancing continuous food access and stability

During the FCDs, households were asked whether kitchen gardens have enhanced food access stability over the year with the question 'What are the benefits of kitchen gardens as a source of food throughout the year? As stated in Appendix II below.

Majority of the respondents in both villages indicated that kitchen gardens have been beneficial to them in securing a steady food supply throughout the year and in both rainy and dry seasons. Their importance was highlighted particularly in off seasons such as: dry seasons which most participants expressed as the season characterised with poor harvests manifested in the form of food shortages leading to high food prices. Supporting statements obtained from some respondents during the Focus Group Discussions to further elaborate our findings on the importance of kitchen gardens in maintaining stable food supplies throughout the year will be presented in the form of narratives. Some of them can be found below:

A 30 year old gardener in Ilolo, owner of five pocket gardens explained that:

'There was a lot of rain in the last three months; this was the time in which the kitchen gardens were very important. Also, in the dry season, there was a lot of vegetables scarcity and prices were high, yet I was still able to collect vegetables from my gardens but this all depends on the care given to them'

Another 43 year old farmer in Ilakala says: *'Kitchen gardens are also good for dry seasons to cover the needs of the people. It requires less water and we can manage to irrigate. It is a very small portion and someone can just use two buckets of water to irrigate and therefore I use these types of gardens because during the dry season, I can irrigate my Chinese and Sukumawiki only with two buckets of water, now it is rainy season and the rains are helping me to irrigate. But the main goal of using this garden is during the dry season when there is vegetable scarcity in the village. So how can you survive? With these gardens, you can manage them yourself and still get vegetables.*

Another 42 year old farmer having two pocket gardens, cultivating Pea leaves, Amaranth and Spinach shared a similar view by saying:

'In every season and every time, kitchen gardens are useful. They have contributed in improving vegetable variety of my household in addition to other vegetables collected from the wild. Although there is the problem of pests in the rainy season and extreme dryness in the dry season, cultivation using kitchen gardens is still possible with irrigation options'.

Figure 21 depicts the kitchen garden of a gardener in Ilolo who cultivates four different vegetable species during the rainy season and in the dry season with the use of irrigation techniques.

Figure 21: Kitchen Garden of farmer cultivation four different vegetables species in Ilolo Village

Picture captured by author during household survey (2016)

4.4 Mixed Analysis (Qualitative and Quantitative)

In order to support the claim of the prevalence of pests and diseases encountered by majority of respondents during the focus group discussion, results from quantitative data recorded during interviews were used; in which 96.6% and 66.7% of respondents in Ilolo and Ilakala respectively indicated the occurrence of pests and diseases as one of their major obstacles faced in using kitchen gardens in growing vegetables.

Furthermore, results deducted from quantitative data indicated the extent to which kitchen gardens were important to households in the cultivation of vegetables during both the rainy and dry seasons. Out of 29 respondents who responded in Ilolo, 69% remarked that kitchen gardens were very important in securing food in both seasons, 20.7% agreed to them as being important and the remaining 6.9% were indifferent, meanwhile 3.4% deemed kitchen gardens as very unimportant in securing food in both seasons.

In Ilakala, out of 23 participants who responded to the question, 60.9% acknowledged kitchen gardens as important in securing food in both seasons; 8.7% of respondents were neutral, 4.3% and 17.4% indicated kitchen gardens as unimportant and very unimportant in securing

food in the rainy season and dry season. The above findings are illustrated in **Figure 22** below.

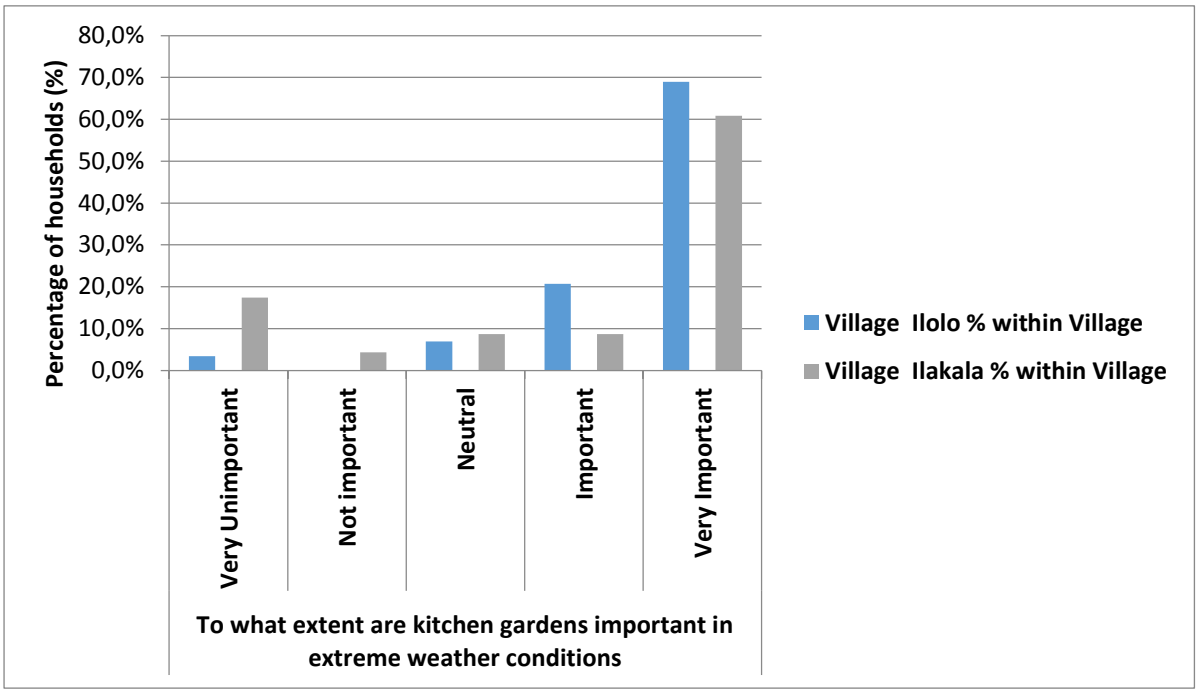


Figure 22: Level of Importance of Kitchen Gardens in Securing Food in Both Seasons

Source: Computed by author from Household Survey (2016)

The above statements point out the important role kitchen gardens play in securing food in both on and off seasons usually characterised by food shortages, failed harvests and high prices. Spinach and Sukumawiki were identified as the most resistant species adapted to conditions in the rainy and dry seasons with high chances of crop survival. However, most of the respondents acknowledged the possibility of all crops surviving depending on care given to them. As such, suggested recommendations by kitchen garden farmers present at the FCDs in a bid to overcome some of the obstacles included:

- Collective action on the part of the members of the kitchen garden group by jointly organising themselves, pooling their resources and buying improved seed varieties and more pocket bags from agro dealers.
- The supply of more pocket bags on the part of Trans-SEC and other partner organisations taking family sizes into consideration.
- Organise workshops and trainings by kitchen garden experts to impart knowledge on the use of better techniques to use pocket gardens in the midst of extreme rainfall and in order to withstand extreme weather conditions.

- Need for policymakers to set up alternative and sustainable water conservation strategies.
- Setting aside other alternative vegetable cultivation strategies near the homestead to diversify risks of crop failure from kitchen gardens and reduce households' over reliance on them. Examples cited were: tray gardens in order to complement pocket gardens.
- Training on effective nursery practices to avoid delays in planting time when seedlings leave the nursery.
- Providing more education on nutrition knowledge.
- Sharing local knowledge among group participants on the use of local pest control methods and other integrated pest control management tools in dealing with pests and diseases. For instance, using leaves from the Neem tree popularly known as 'Marobaini' to counter the prevalence of pests. **Figure 23** depicts a clear image of this tree which has a strong capacity of dealing with pests.

Figure 23: Illustration of Local Pesticide tree 'Marobaini'- Neem tree in the garden of one Kitchen garden farmer

Picture taken by author, Ilakala Village, 2016

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

In this chapter, our main results obtained during household surveys, focus group discussions and observations will be discussed in relation to the research objectives of this research and will be compared and contrasted with literature reviewed on home gardens, food security and livelihoods. The conclusions and recommendations will be presented in the last section.

5.1 DISCUSSION

Our results demonstrated that most of the respondents generated income either through sales of kitchen garden products or through savings from less food purchases. Through the possibility of generating direct and indirect income and its use, our findings demonstrate the contribution of kitchen gardens in improving livelihoods of households. Similar studies carried out in Bangladesh by (Saskia, De, Pee et al. 2005) evaluated the impact of homestead gardening on household food security. The results revealed that majority of household participants in the active and former participant groups significantly generated more income of 490 and 347 taka respectively through the sales of garden produce than the participants in the control group who generated 200 taka. In the same study, more households who owned gardens in the active and former participant groups significantly purchased more food, and could pay for education, productive assets and health care as compared to participants in the control group. The income expenditure devoted to food was used to acquire items such as oil, salt, spices, fish, meat and rice (Saskia,De,Pee et al. 2005).

In a similar way, reports from studies conducted in Nepal, Cambodia and Papua Guinea prove that income was gotten from selling home garden products such as: garden fruits, vegetables, livestock products which permitted households to buy extra food stuffs for their households and enable savings and payment for education as well as other services (Iannotti et al. 2009).

Another study carried out by (Chazovachii et al. 2012) in the Mberengwa ward of Zimbabwe aimed at assessing the contribution of community gardens on the livelihood development of some participants in the ward demonstrated that income was derived from selling garden produce. However, the meagre nature of the income did not permit the annual purchase of huge assets; nevertheless, it was helpful in buying mainly food and groceries and paying for other emergencies, fees, clothing, and livestock and for mill charges. A greater proportion of 35% of garden income was spent in acquiring food and groceries for household use.

Concerning the sources of food acquisition before and after the adoption of kitchen gardens, our findings show that there was a significant reduction in the vegetables purchased on the market after the adoption of kitchen gardens. However, this difference was clear only in the Ilolo village. Additionally, more households in Ilolo village relied on their home gardens as a source of food acquisition after the implementation of kitchen gardens than before. Nevertheless, a good number of households still relied upon the wild for acquiring food. This observation could be backed up by Sen's entitlement's theory which postulated the acquisition of household food entitlements from households' own production of food and gathering wild foods from the wild (Sen 1981; Sen 1983). In the same manner, (Regmi et al. 2006) agree with the assertion of the crucial contribution of wild foods to the rural people of Bangladesh as they serve as survival strategies particularly in periods where the involved communities experienced food shortages and in periods of food deficits. Interviews conducted with the farmers in the Kholagaun area in Tanahun revealed that of 40% of food was gotten from wild food sources.

In a similar study conducted by (Adekunle 2013)in the Nkonkonbe municipality in South Africa, 60% of the respondents obtained food from their own production on their home gardens which enabled them to consume crops and vegetables all year round; 30% of respondents purchased food they could not produce on their home gardens from supermarkets located in town; and 10% of the interviewed respondents purchased food within local shops in their communities. The significantly high percentages of dependent households on home gardening portrayed its significance for household food security in the Nkonkonbe municipality.

Also, our findings show that there was no major improvement in the weekly consumption patterns of vegetables of households after the implementation of kitchen gardens. A similar method of categorisation of vegetable intake was done by (Carney et al. 2012) in a study carried out on Hispanic farm workers families involved in maintaining organic gardens with the objective of evaluating the impact of a community gardening project on vegetable intake and food security. Nevertheless, Categories such as: 'several times', 'sometimes' and 'frequently worrying about running out of food' were used to measure the daily intake of vegetables. Contrary to our findings, their results indicated that there was a significant increase in the frequency of adult daily consumption of vegetables from 18.2% to 84.8% and that of children from 24% to 64% for the 'several times' category. Furthermore, there was a significant drop in perceived hunger. The frequencies of 'sometimes' and 'worrying of food

shortage' categories significantly dropped from 31.2% to 3.1% after the period of community garden participation. To get a better understanding of the slight change in the vegetable consumption frequency of households, the average weekly quantities of vegetables produced and consumed were gotten and indicated households consumed fewer vegetables from their kitchen gardens which fall below the FAOs minimum intake of 200grams per day. Also, as shown in **figures 17 and 18**, there was no major difference in the frequency of vegetable consumption before and after the introduction of kitchen gardens; an indication that kitchen gardens influenced the vegetable consumption patterns with the introduction of kitchen gardens.

In contrast, production results obtained in Bangladesh by (Saskia,De,Pee et al. 2005) revealed significant differences between active and former participants of household gardens when compared to control participants. With a median of 135 kg and 120 kg of vegetables respectively whereas, control households produced 46 kg of vegetables (Saskia,De,Pee et al. 2005).

Furthermore, our results obtained during FCDs and interviews indicated that kitchen gardens play a critical role in enhancing food stability during the year. Majority of the respondents indicated that kitchen gardens helped them in securing steady food source especially in lean seasons, which are usually characterised with food shortages and high food prices. In support of this premise, (Adekunle 2013) study in the Nkonkonbe municipality of South Africa showed the possibility of an all season planting of crops and vegetables such as: tomatoes, spinach, potatoes and onions as a result of home production. Their findings further reveal that through home production by using home gardens, 60% of all interviewed respondents could secure an all year consumption of fruits and vegetables. Also, (Chazovachii et al. 2012) acknowledged the possibility of securing an all year round production of crops as one of the significant factors in fostering the use of community gardens for food security in the livelihoods of participants of the Mberengwa ward.

Also, a number of constraints faced by farmers and opportunities present as a result of kitchen gardens were gotten during the FCD. Most of the constraints encountered were similar to those faced by a number of respondents in a similar study carried out by (Chazovachii et al. 2012) in the Mberengwa ward of Zimbabwe, where a great number of respondents indicated lack of knowledge and skills in the management of gardens, destruction of crops by wild animals, poor harvests due to limited inputs, and finances as

some of the main challenges faced by participants of community gardens in the area. Also, in a review provided by (Hoogerbrugge, Fresco 1993) and (Mitchell, Hanstad 2004b) on the key obstacles on home gardening, most of the studies indicated: limited access to capital, water access, seeds, poor extension services and limited market access as limiting factors to the successful operation of home gardens. Pests and diseases and weather related damages were also seen as some of the most important constraints for home garden production.

In a SWOT analysis conducted by (Galhena 2012) on home gardens in Sri Lanka, some of her findings coincided with some responses obtained from our study. Similar strengths recorded were those of: its relevance in the direct provision of diverse fresh fruits and vegetables as an additional source for households containing rich nutrients, and as an extra source of household income. Similar weaknesses were seen in the light of poor extension services and poor information related to the markets. Opportunities related to our results were the provision of extra home garden income and strategies on innovative techniques. Finally similar threats encountered were the possibility of losing support from the government in relation to agricultural support and the exposure of participants risks associated to climate change.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

Overall, results obtained from our findings support that kitchen gardens have a great potential in improving food security with respect to ensuring direct and continuous food access of households especially those located in semi-arid areas. Our results show that a great number of households acquired indirect income through savings on food purchases as a result of the presence of kitchen gardens in their households, implying its pivotal role in improving household livelihood outcomes.

However, results from our case study areas reveal a low influence of kitchen gardens in the household vegetable consumption patterns. This could partly be attributed to the fact that the vegetable yields obtained from the gardens were not sufficient to meet their vegetable demand compounded by large family sizes. As such, improving household food availability will require strategies that enhance agricultural production at household level.

Dietary diversity enhances nutritional intake. In developing kitchen gardens, households' food access can be enhanced as an additional source of acquiring food and, hence, a supplementary source to households' food supply. Thus, kitchen gardens play a major role in improving the nutritional diversity of households.

However, key constraints limiting the implementation of kitchen gardens were identified such as: poor access to improved seed varieties, prevalence of pests and diseases poor access to water for irrigating gardens, inadequate nutrition knowledge and poor yields. These setbacks hamper households' ability to maximise the full potential of kitchen gardens. In spite of these limiting factors, agro-ecological and economic advantages including, minimal input use, generating additional disposable income for households' and maintaining a stable supply of food through all seasons, were portrayed as direct benefits and key fostering factors of kitchen gardens.

In this regard, the practise of kitchen gardens can be augmented and improved through devising alternative water conservation strategies for households' especially to those located in semi-arid areas, availing more pocket bags to gardeners and providing improved seed varieties to enable direct sowing; all of which will enhance productivity of vegetable cultivation. The development of integrated pest management control and irrigation methods could foster higher yields. In addition, building the capacity of households on the nutritional benefits of kitchen gardens through nutrition education could further improve the practise of

kitchen gardens. This will also require the dissemination of nutritional knowledge which could be carried out effectively through agricultural extension bodies; through their close ties with local households, small holder farmers and their communities. Additionally, demonstration gardens could be used to enhance knowledge transfer to would-be kitchen garden farmers. All of the above recommendations will necessitate the combined efforts of the government, households, and other stakeholders such as: Non-governmental organisations and the involvement of private bodies.

In this light, future research could be channelled towards evaluating the impact of kitchen gardens on the nutritional diversity of beneficiary households in comparison to control households. It would also be wise to analyse the nutrient composition of vegetables grown on kitchen gardens and their relevance for nutritional security of implementing households.

APPENDIX 1

QUESTIONNAIRE

Analysing the Potential of Kitchen Gardens in enhancing Household Food Security and Improving Household livelihoods:

Case Study: Subsistence farmers in the Morogoro and Dodoma Region

Introduction

My name is Marie Estelle Bumah Ateh, a Masters student at the Humboldt University of Berlin, Germany specializing in Rural Development. I wish to beg on your cooperating in answering questions relating to the contribution of kitchen gardens in enhancing food security and livelihoods of your household. The information you provide will be relevant for my research study as well as in monitoring the progress of your kitchen gardens by members of the Trans-SEC project members to enable them develop appropriate innovations for the improvement of the wellbeing of you and your household. This exercise will last for a period of approximately 30 to 40 minutes and I do beg on your cooperation as the information you provide will be strictly treated confidentially.

Date of conducting monitoring …….

Serial Nr. (1-30) ……

HH-survey ID. …….. Name of HH head ……... Age of HH head……..

Name of kitchen garden farmer ……. Age of farmer……

Village: ……..Sex of farmer……..

SECTION ONE: Socio-Economic and Demographic Information and Characteristics of Kitchen Gardens

1. What is your marital status?
    - Single/Never married
    - Married
    - Separated

- Divorced
- Widowed

2. What is your level of education?
    - Informal
    - Primary
    - Secondary
    - Tertiary
    - Others (please specify)
3. What is your main reason (s) for using kitchen gardens? (Possibility of multiple responses)
    - Home consumption
    - Immediate access to home grown vegetables
    - Improve nutrient composition
    - Income generation
    - Other (please specify)
4. How many pocket bags do you have for your kitchen gardens?.....
5. What types of Vegetable Species do you cultivate on your kitchen garden ?.....
6. Do you realize output from your kitchen gardens?
    - Yes
    - No

7. If yes, what type of vegetable do you cultivate on your kitchen garden

   .....…….

SECTION II Kitchen Gardens and the Contribution to Food Security

8. What is the weekly amount of vegetable you harvest from your garden and what proportion do you consume? ……

9. Do you distribute any surpluses to friends/neighbors?

   - Yes
   - No

If yes, what amount do you distribute .....

10. Is the remainder sufficient to satisfy your household demand?.....

    If yes, how satisfied are you on a scale of 1 to 5? (5 is the highest)

    - 1
    - 2
    - 3
    - 4
    - 5

11. How many days per week do you harvest vegetables from your pocket garden/s? ……

12. What is the frequency of vegetable consumption per week?

    - Less than once
    - Once a week
    - Twice a week
    - Three times a week
    - More than three times a week

13. Are you satisfied with your output you harvest from your kitchen garden?

    - Yes
    - No

14. If yes, how satisfied are you? (on a scale of 1 to 5 with 5 being the highest level of satisfaction)
    - 1
    - 2
    - 3
    - 4
    - 5
15. How many times did you consume vegetables before kitchen gardens were established?
    - Less than once
    - Once a week
    - Twice a week
    - Three times a week
    - More than three times a week
16. What were your sources of acquiring vegetables before the implementation of kitchen gardens? (possibility of multiple choice responses)
    - Purchase from market/middlemen
    - Home production
    - Borrowing from neighbors /friends
    - Collect from field/wild
17. How did you obtain vegetables after the implementation of kitchen gardens?
    - Purchase from market/middlemen
    - Home production/ kitchen gardens
    - Borrowing from neighbors /friends
    - Collect from field/wild

18. Do you experience any pest or disease on your garden?.....

SECTION II Kitchen Gardens and their contribution in improving livelihoods

19. Do you sometimes sell surpluses obtained from your garden?

    - Yes
    - No

20. If yes, how much do you generate from its sales? (in Tshs)……

21. Do you save money from fewer or no purchases of vegetables you bought from the market before?

    - Yes
    - No

22. If yes, how much do you save weekly? (in Tshs)…….

23. How do you spend the money you obtain from less vegetable purchases?.....

24. Has the implementation of kitchen gardens improved the variety of food for your household?

    - Yes
    - No

    If yes, how satisfied are you with this improvement?

    - Very unsatisfied
    - Unsatisfied
    - Neutral
    - Satisfied
    - Very satisfied

25. Did you experience any harsh weather conditions (extreme dryness, extreme rainfall)?

    - Yes

- No

26. In relation to question 22, what kind of weather extremities did you witness?

To what extent are kitchen gardens important in supplying your food needs during extreme weather conditions?

- Very unimportant
- Unimportant
- Neutral
- Important
- Very important

27. Which vegetable specie (s) is better cultivated during the rainy season? .....

28. Which vegetable specie (s) is better cultivated during the dry season?.....

Appendix II

Focus Group Discussion Screen Play

The Potential of kitchen gardens and their Contribution in enhancing household food security and improving livelihoods:

Case Study: Subsistence farmers in the Morogoro and Dodoma Village

My name is Marie Estelle Bumah Ateh, a Masters student at the Humboldt University of Berlin, Germany specializing in Rural Development. I wish to beg on your cooperating in answering questions relating to the contribution of kitchen gardens in enhancing food security and livelihoods of your household. The information you provide during this discussion will be relevant for my research study as well as in monitoring the progress of your kitchen gardens by members of the Trans-SEC project members to enable them develop appropriate innovations for the improvement of the wellbeing of you and your household. This exercise will last for a period of approximately one to two hours and I will like you to express your mind in every possible objective way and every participant will be given a chance and right to speak freely. One more time, I beg on your cooperation as the information you provide will be strictly treated confidentially.

Energizer/Introduction	
What are the problems you encounter in using kitchen gardens? To simplify your responses, what problems do you face at the following various stages? ➢ Natural Resources (land, water, soil) ➢ Production (Inputs,financial capital, Output) ➢ Processing ➢ Marketing (Selling) ➢ Consumption	
Using the same answering format above, what are the main benefits of using kitchen gardens and what are the existing/foreseen opportunities of using them? Please answer	

with respect to: ➢ Natural resources ➢ Production ➢ Processing ➢ Marketing (Sales) ➢ Consumption	
Short Break	10 minutes
What are the benefits of kitchen gardens as a source of food throughout the year?	
Could you provide some solutions on what you think could be the way forward to reducing some of the obstacles identified above?	

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