INFLUENCE OF GOVERNANCE AND REGULATORY INSTRUMENTS IN PROMOTING FOOD SECURITY WITHIN NAIROBI METROPOLITAN REGION: A CASE OF THE PERI-URBAN ZONE OF MACHAKOS.

BY

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DECLARATION

This research is my original work and has not been presented or submitted for examination in any other university.

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DEDICATION

With special appreciation to my family for their continued support and my supervisors for offering their expertise and extensive knowledge during my research.

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LIST OF ACRONYMS AND ABBREVIATIONS

FAO	Food and Agriculture Organization
GDP	Gross Domestic Product.
GoK	Government of Kenya
NGO	Non-Governmental Organization
RUAF	Resource Centres on Urban Agriculture and Food Security
UA	Urban Agriculture.
UN	United Nations.
UPA	Urban and peri-urban agriculture.
NEFSALF	Nairobi and Environs Food Security, Agriculture and Livestock Forum
UNEP	United Nations Environment Programme
KNBS	Kenya National Bureau of Statistics
SDG	Sustainable Development Goal
KARI	Kenya Agricultural research institute
MOA	Ministry of Agriculture
ROK	Republic Of Kenya

ABSTRACT

Kenya's economy is currently represented by Agriculture at 24% of the GDP. In the country, there are different types of agricultural activities engaged by more than 5 million smallholders. The compounded average growth rate of agriculture was 5.2% between 2001 and 2005 but at 8% as growth in export. However, a one percent growth in formal employment was also witnessed. Four major sub-sectors form the Agricultural sector. These are industrial crops, food crops, horticulture, livestock, and fisheries. Development of these sectors is one of the government's objectives as indicated in vision 2030. Challenges associated with productivity, land use, marketing and value addition, plague the sector despite the central role agriculture plays in Kenya's economy. Peri-urban agriculture is a strategy adopted by low-income households to meet their food and nutritional requirements. The study objective was to examine the current National and County governance regulatory instruments on peri-urban agriculture of Nairobi metropolitan city and their contribution towards achieving food security. The specific objectives of the study included assessing the knowledge, attitude, and practices of farmers towards peri-urban farming in Machakos, examining the effectiveness of national and county governance regulatory instruments. A descriptive survey design was conducted in Machakos County. Both structured and unstructured questionnaires were used to collect data from the farmers, and a response rate of 100% was obtained. A pilot test was administered to ensure the authenticity of the questionnaires before the actual study was conducted and some adjustments were done on the original questionnaires before administering it to the farmers. Data collected was coded and statistical package for social sciences used to analyze. Results are presented using tables, percentages, means, and frequencies. The study revealed that a majority of the respondents at 63.5% did not show recognition of any government policies on urban and peri-urban agriculture

and food security, while a few 14.5 % showed some recognition. The results also indicated that 46% had never received a visit from any extension officers within their locality, while extension officers had visited 27%.The most preferred form of communication was the internet at 39.5%, followed by radios at 36.5% and information from fellow farmers through networking at 14%. A small percentage was also keen on watching the television as a mode of getting relevant information. Farmers should be encouraged to adopt modern methods of farming including the use of covered greenhouses, irrigation systems to improve yields and avoid crop losses. Further, there is a need to improve on the marketing of crop production by opting for contracted farming where the farmers can negotiate the price of their produce tied to the cost of production. The national government, NGOS, and the civil society should participate more in activities promoting peri-urban agriculture from the farm level to marketing and in Extension services, which can enhance food security. The findings are important to all the stakeholders in the agriculture sector because they highlight areas that need an improvement, with the goal of ensuring peri-urban agriculture contributes towards food security.

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

Land use changes associated with the rapid urbanization result in challenges. These challenges include food insecurity, public health hazards, poverty, pollutions, urban waste and environmental degradation (Baumgartner and Belevi 2001; Kutiwa *et al*., 2010). Agriculture has become characterized by use of chemical fertilizers, pesticides, reliance on intensive cultivation, and the mechanization of cultivation and processing. Citizens, governments, and academicians, are continuously in the quest for strategies to help alleviate these problems and encourage cities that are food secure.

It is estimated that global rural populace is expected to decline after 2020, and that future population growth will shift to the urban areas of less developed countries. The larger part of individuals today live in urban conditions (UN, 2015). As the rate of urbanization and rural-urban migration increases so does the population, leading to amplified urban poverty coupled with food insecurity. Urban agriculture plays a role in global food security, and its potential in achieving environmental sustainability is a topic of increasing dialogue and recognition over the years as its importance is evident in other countries where it has been thriving for years. Peri-urban agricultural practices have significantly increased over the years, as well. It is an alternative option, to improve the food security of urban dwellers and to diversify their incomes, due to persistent economic threats and uncertainty.

Peri-urban agriculture is commonly characterized as agriculture attempted in areas on the edges of urban zones. There is no all-around concurred definition, and the use of the term largely relies upon the setting and operational factors (D.L. Iaquinta and A.W. Drescher, 2001). Key actors in overseeing urban sustenance frameworks can incorporate all degrees of government, the private sector (for example huge grocery store chains and assemblies of business), universal benefactors with nourishment programs, NGOs that endeavor to advance food security (for instance, through enabling urban farming), showcasing and circulation systems, brokers affiliations, and local gatherings.

Globally, to enable the expansion of peri-urban agriculture, city governments and food policy councils in cities that include New York City, Chicago, and Baltimore, have explicitly assimilated suggestions for their local food environments (Hodgson, 2011). Farming assimilated into an environment, which is urban, utilizes and re-uses resources such as manual labor and natural resources, and yields agricultural products to consumers encouraging sustainability and reducing health risk associated with urban agriculture. In Latin America as well as in Africa, peri-urban agriculture is gradually being recognized, and different cities are endeavoring to discover innovative ways to confront the issues arising from peri-urban agriculture such as health-related risks, lack of effective enforcement mechanisms and inadequate regulation of the mushrooming of the practice. Sydney's Peri-urban areas are currently undergoing dramatic change, bringing significant growth and opportunities. However, these opportunities are not without their challenges. The ongoing lack of sound strategic approaches to the management of peri-urban areas is contributing to the disappearance of Sydney's rural landscapes and perpetuating the key

issues faced in these areas. The Sydney Peri-Urban Network of Councils comprises 12 Councils on the outskirts of Sydney and was shaped to stimulate discourse and action by all levels of Government (Sydney peri-urban network of councils, 2015).

In Africa, Peri-urban agriculture regularly falls inside the sphere of urban administration, the same number of useful urban zones in Africa incorporate enormous scopes of peri-urban farming area. African urban areas are regularly portrayed by "unregulated peri-urban land advancement" that negatively affects peri-urban farming (Kombe, 2005).
The capacity of the local government to control such unregulated growth is frequently restricted by peri-urban territories being in customary ownership and under traditional proprietorship. The net outcome is the progressive dislodging of peri-urban farming. For instance, in Ghana, "as urbanization expands, farmers are being displaced into less ideal grounds, more remote towns or confined to unapproved open spaces so as to proceed with production. The lack of urban green belts lessens cultivating to flood fields and along public drains" (Kuusaana and Eledi, 2015). Notwithstanding, farming is being uprooted from prolific land into marginal zones, the development of urban areas likewise brings about increased water contamination, which additionally negatively affects farming and the safety of the food that is delivered (Kuusaana and Eledi, 2015).

In Nairobi, Kenya’s capital city, the trend is also at its peak. The metropolitan region is quickly expanding, with the periphery being fluid, giving rise to peri-urban areas that now form the major food baskets for urban areas. The significance of peri-urban agriculture cannot be neglected, and devising proper working governance and regulatory

instruments is imperative to regulate the sector better. The major challenge with peri-urban and urban agriculture in low-income countries as a driver for food security is to balance the pros and cons by wise regulations and policies. This study will contribute to this policy discussion by conveying a comprehensive and multidisciplinary overview of current regulations and policies that govern peri-urban agriculture, with a focus on Machakos County as a peri-urban area, within the larger Nairobi metropolitan region. Every chapter gives an overview of the topic, insights into trends, knowledge of current existing national and county policies on UPA and their overall contribution to food security, opportunities, and challenges.

1.2 Problem Statement

The developing world is the least equipped to deal with rapid urbanization, yet it will encounter the biggest urban growth in the next 20 years, which will be absorbed by urban areas. Making up 81 percent of urban development, where the urban populace will twofold somewhere between 2000 and 2030. This will be seen mostly in Africa and Asia, during those periods, harmful consequences will be experienced on the off chance that legislatures do not get ready now for the coming development (United Nations, 2000). Peri-urban agricultural practices have significantly increased over the years as an alternative option, to improve the food security of urban dwellers and to diversify their incomes, due to persistent economic threats and uncertainty.

Nearby food production from peri-urban regions diminishes reliance on the global food system, which additionally reduces vulnerability to a regions food provision (Morgan, K. 2015). With the increasing rate of peri-urban agriculture, the practice has become unregulated. Since it is not yet fully recognized by officials as a legitimate land use, it does not have codes; hence, farmers cultivate anywhere they deem appropriate which could lead to hazardous practices such as usage of sewerage water and use of abandoned or contaminated land. In spite of the fact that the urban poor keep on utilizing wastewater for irrigation purposes, wastewater reuse in Kenya is illicit. An investigation embraced in 2006 and 2007, for instance, uncovered that only half of the wastewater produced in Nairobi winds up in the treatment facilities, while the rest is utilized on more than 720 ha for cultivation (Githuku, 2009). The investigation built up that more than 100,000 families in and Kariobangi South utilize raw sewage for cultivation.

The lack of official support from the officials makes it difficult to engage in the practice fully as the area is mainly under-financed and uses lower quality inputs such as seeds and feeds. Problems of insecurity of tenure also arise causing the farmers to grow crops that require short periods to grow. Lack of credit is another major problem facing the development of peri-urban Agriculture, as there are few special credit and investment opportunities available and the cost of such credit is high for farmers. Nutritionally safe and adequate food supply to urban residents is therefore a substantial challenge (Nyambura, B. 2008).

With the Nairobi metropolitan region continually re-defining its boundaries it has now extended to Kajiado and Machakos counties (Bosire *et. al*., 2017).Meeting constitutional demands of article 43 is key for the Nairobi metropolitan area, which mainly relies on food imports from peri-urban counties such as Machakos. Despite being highly practiced, Peri-urban agriculture is not a recognized urban land use, and there is no provision for it in land use zoning in Nairobi (Musoga, 2004). The existence of effective regulations to guide and support urban food production and their implementation is still unknown and unclear (Musoga, 2004). This study, therefore, aims to examine the current National and County governance regulatory instruments on peri-urban agriculture within Nairobi metropolitan region and their contribution towards achieving food security.

1.3 Research Questions

The research sets out to tackle the question**; "Are there any National and County governance instruments that enhance sustainable food and nutrition security in Peri-urban agriculture?"**

To answer this question, some specific questions were set as follows:

a) What Knowledge, attitudes and practices of farmers exist to promote sustainable food and nutrition security in Machakos peri-urban areas?

b) Which national and county governance instruments exist to enhance sustainable food and nutrition security in Peri-urban agriculture?

1.4 General Objective

To examine the existing National and County governance instruments on peri-urban agriculture for enhanced sustainable food and nutrition security.

1.5 Specific Objectives

1. To assess the knowledge, attitude, and practices of farmers for peri-urban farming in Machakos county.
2. To evaluate existing national and county governance instruments that promote sustainable food and nutrition security in peri-urban areas of Machakos County.

1.6 Justification

Agriculture in Kenya contributes 75 percent of the rural livelihoods and innovations are required to feed the 9.9 million hungry people between 2014 and 2016 (KARI, 2012). Some of the areas requiring constant investigation include the effects of the physical environmental conditions on food security, strategies towards agricultural sustainability, behavioural indicators to food deficits, coping strategies by gender (Maxey 2006) and farming types. The efforts of small-scale/traditional farmers have been underlined (Kipkemboi *et al*., 2007). Besides, market dynamics have driven farmers to identify niche markets for their produce (Blay-Palmer & Donald 2006). The urban and peri-urban poor are most affected by food (in)security due to inability to afford food (Mohiddin *et al*., 2012) leading to several coping mechanisms . More than 800 million people today are expected to be engaged in some type of urban agriculture , giving sustenance to themselves and their families in or near a urban setting (FAO, 2016). As urban issues continue to rise to threaten populations, the rate is expected to rise resulting in restrained urban food security and endangered urban ecosystems.

It is necessary to search for new methods to alleviate the current conditions, and there is urgent need to question the status of cities concerning available food systems (UN, 2012). Thirty percent of the Nairobi County urban residents practice urban agriculture with a majority of the farmers irrigating their crop and fodder using untreated sewage. Confronted with rapid urbanization, thousands of families strive to "improve farming activities in urban and peri-urban regions to advance their access to food and income" (Karanja *et al*., 2009).

Despite the lack of attention on urban agriculture, the practice continues to expand in Nairobi and Machakos County in particular as a peri-urban area. The Nairobi metropolitan region is continually re-defining its boundaries and has now extended to Kajiado and Machakos counties (Bosire *et al*., 2017). There is, therefore, the need to regulate peri-urban agriculture, in order to supply the increasing urban populace with nutritionally safe and adequate food.

The proposed study will examine the existing national and county governance regulatory policies on peri-urban agriculture, within the Nairobi Metropolitan Region, with more focus on Machakos County. Moreover, how these policies and laws contribute toward the realization of food security now and in the future.

1.7 Scope and Limitations

This research confined itself to the peri-urban area of Machakos county because of its proximity to Nairobi city and because it is within the greater Nairobi metropolitan region. It constitutes the area formally used for agriculture by the traditional landowners before the boundaries of Nairobi city extended and the activity still thrives despite encroaching urbanization. Both crop and livestock activities were examined excluding practices such as forestry and flower gardening due to limited time and resources for the study. For purposes of the study, it centered mostly on crops.

Data collected mainly centered on the peri-urban farmers, key government officials and local traders, location and extent of peri-urban agriculture, factors favoring the practice, land status and subdivision, the agronomic practices, marketing and the links created by the practice of agriculture in the peri-urban area.

The existing policies that govern and regulate both urban and peri-urban agriculture within Machakos County were also of concern. Of concern was knowledge of urban farmers of the existence of National and current county policies which either support or hinder the practice and enforcement of the laws.

CHAPTER TWO: LITERATURE REVIEW

2.1 The Concept of Urban and Peri-urban Agriculture

Urban and Peri-urban Agriculture (UPA) is defined in different perspectives and numerous ways, and the context of researches conducted, concerning how it utilizes available resources. Urban agriculture is an industry situated inside or on the edge of a town, or metropolis (Mougeot, 2000).

This definition is not entirely practical to the Kenyan context or any other country. Factors such as the location, scale, activities, stages, stakeholders and what motivates it entails the theory of urban and peri-urban crop growing from a universal point of view (Baumgartner & Belevi, 2001). Resource Centres on Urban Agriculture and Food Security (RUAF), an international urban agriculture agency specifies the location feature as either in the peri-urban parts or inside the cities. Consequently, it can occur within the farm or away from the farm, on public land, on private land, e.g. play grounds, along roads, conservation areas, railways and streams, semi-public land, e.g. school grounds, hospitals, and schoolyards. Urban agriculture in small-scale is a phenomenon that is prevailing in most industrialized or developing countries and has an essential role in household food security and conservation of the ecological system.

Bon *et al*. (2010) stated that two parts constitute the theory of urban agriculture and they involve both rural and urban at the same time. However, the definition of what they each constitute is essential and vary from region to region. Thus, Urban and Peri-urban agriculture (UPA) links to location as a factor. In China, for example, researchers

combine the city planning with real situations when defining the location characteristics of UPA, and indicate that peri-urban agriculture is located outside the urban center but incorporated in and have impacts in the urban context (Yang, 2011). Some studies have argued that the major producers of agriculture are men and women whose main focus is on market activities; others point out that at the household level, women are the main producers. The most active and predominant participants in UPA are women (Kutiwa *et al*. 2010)

In most developing countries, UPA is a strategy to handle food insecurity. Urban agriculture also provides jobs, and this is the case in Kampala, Nairobi, Dakar, and other cities across sub-Saharan Africa. On the other hand, as a case so common in Asian countries, increasing urban population and urbanization links to the emergence of UPA (Nugent, 2000) that results in a rise in population growth in urban areas while the competitive job sector builds redundancy and food scarcity. In Canada and the United States, increasing dependence on food aid and urban poverty have steered many community organizations to create jobs and household food security by developing intensive UA projects. To provide quality food and contribute to community health as well as the local connection between people, economy and landscape, community support agriculture, in the US, was prosperous in the urban fringe (Schnell, 2007).

All these definitions put into consideration that urban agriculture involves food production in cities. As an aspect of urban agriculture, whether or not to include Peri-urban agriculture has been investigated in several ways. In inner areas of cities, some scholars have turned their attention on gardens and farms (Cohen, 2012) other research has included research in peri-urban agricultural activities (Mougeot, 2001). Peri-urban areas are described as the shift zones between urban and rural areas, they are not urban, and also have inadequate amount of agricultural and natural land, and thus cannot be considered rural. An agreed spatial definition for it is not available, being a remaining form of agriculture at the peripheries of developing cities. Also, they are located on fertile soils, have low populations and almost no infrastructure compared to urban areas (Allen, 2003).

Characterized by a social-cultural shift from rural to urban lifestyles, they suffer from urban stressors, however they additionally benefit from closeness to urban regions (Antrop, 2000). Thresholds such as population density or settlement pattern, apply on debates of the distinction between urban and peri-urban areas (Piorr *et al*., 2011). The geographical position alone seems inadequate in distinguishing urban agriculture (UA) from peri-urban agriculture (PUA). Different facets of activities, characterize them both. This study will concentrate on peri-urban agriculture.

2.2 The Benefits of Peri-urban Agriculture

2.2.1 Food Security

Food security is the major purpose of practicing peri-urban agriculture. Kutiwa *et al*., (2010) indicate that urban agriculture is one way of the strategies that can be used to address three components of food security. Fresh product for consumption is of great importance to households that practice urban agriculture and who grow their food. Households can gain access to dietary variety from the money saved from the supplement of food. Additionally, the major products from peri-urban agriculture (PA) are fresh and perishable products for example vegetables, fruits, eggs, and milk, which is a complement of rural agriculture, however, it does not compete with it (Mougeot, 2001). One of the most difficult and urgent concerns that the African continent faces is the achievement of food security for its population. The United Nations (UN) World Food Summit provided the first formal definition of food security as the adequacy and availability of food supplies to cover a steady increase of the consumption of food and to balance changes in prices and production (UN Report of the World Food Conference, 1974).

A more recent description by the World Food Summit that was held in Rome states that "Food security thrives when all people at every time are satisfied and have physical and economic right to nutritious, safe and sufficient food, that meets their nutritional needs and food inclinations for a healthy and active life." In most underdeveloped countries, the problem of food insecurity has its origin partly due to the movement of people from rural to urban settlements, as they search for better working conditions and a good life. Ellis

and Freeman provide the opinion that migration is one of the tactics used by the rural poor to make their lives better (Ellis and Freeman, 2005).

2.2.2 Economic Development

Many urban households depend on peri-urban agriculture (PUA) as an important source of income. The poor who live in urban areas generally spend a part of their income on food, and they can save on household expenditure by engaging in PUA. The production of important agricultural inputs in PUA also enables the development of micro-enterprises (Homem de Carvalho, 2001).

Activities like provision of water, purchasing of chemical fertilizers, and production of organic pesticides, composting and collection of urban waste, are what characterize input production and delivery. Value addition of foods, which may consist of the production of yogurt from milk or making of crisps from potatoes, is usually done at the domestic level, to sell to the local market, and larger entities like hypermarkets or even for trade. Special attention is required for the solidification of the connections between the different types of enterprises. The National and County governments can play an important part in motivating micro-enterprise growth linked to urban agriculture. In Nairobi, there are current provisions that recognize the importance of micro-enterprise development, such as the national agri-business strategy and the micro and small enterprises Act no. 55 of 2012. In Ecuador, marketplaces for urban farmers have been provided by the municipality of Quito. After market days, there are women's group, who compost the refuse to use in their farms; hence a win-win situation for the municipality and the women groups (RUAF foundation).

2.2.3 Social Impacts

Peri-urban agriculture (PUA) is an important occupation in the approach for the alleviation of poverty and the social integration of minority groups, coordinating them more strongly into the urban network by averting social problems such as drugs and crime (Gonzalez Novo and Murphy, 2000). PUA may also provide leisure and learning activities to metropolitan citizens, biodiversity management and community building (Smit and Bailkey, 2006).

Several examples exist of NGOs or municipalities that have commenced urban agriculture developments that consist of disadvantaged groups such as immigrants, women, orphans, disabled people, or older adults, with the intention of community mobilization and empowerment. The individuals in the project may feel a sense of responsibility towards building their community by producing food and other goods for consumption and transaction. Peri-urban agriculture in progressively developed urban areas might be attempted for the physical and/or psychological relaxation it provides, as opposed for sustenance generation perse (Smit and Bailkey, 2006).

2.2.4 Contributions to Environmental Management

Waste disposal is a continuous problem for most cities. Peri-urban agriculture (PUA) can contribute by turning urban wastes into productive assets (Cofie *et al*., 2006). It can also improve the urban microclimate through forestry and positively influence the greening of the city and the biodiversity maintenance (Konijnendijk, 2004). By producing fresh foods near the consumers, there is a reduction in energy use for transport, packaging, and cooling hence reducing the city's ecological footprint. Peri-urban agriculture can play a vital part in the urban environmental administration system. A budding city will produce tons of organic wastes and wastewater thus Peri-urban agriculture can turn urban wastes into an industrious resource. In many developing cities, home grown initiatives exist to amass household waste and organic refuse to produce animal feed or compost. Nonetheless, urban farmers who use fresh organic waste are hard to locate.

Farmers may utilize wastewater for farm irrigation when they do not have the right to use to other water sources, and without proper guidance, it may lead to both environmental and health problems. Farmers need sensitization in the appropriate irrigation methods and proper crop selection. Treatment and recycling of urban wastewater in food production is important, and partial treatment is usually ideal for agricultural reuse. Development and supervision of municipal wastewater treatment facilities are of utmost importance. However, in most municipalities, the treatment capacity is low, and farmers will continue utilizing raw wastewater a fact that should urge counties and other actors to act appropriately. The role of peri-urban agriculture on poverty cannot be underestimated. The following section reviews how food security results in poverty reduction.

2.3 How Market Linkages of Agricultural Produce Affect Food Security

The flow of produce in the different stages of the markets is meant to facilitate market linkages. The supply, which is usually the input to the process, is the agricultural production and the demand of that produce by consumers is the output. The study interrogated the concept that if the system is efficient, it will have a bigger competitive advantage, and this is tied to the performance of the marketing system thus facilitating economic growth and maximizing benefits to farmers. To achieve the lowest possible cost and with the minimization of loss at every stage, the advertising process needs to be tailored to be as efficient as possible (Kibuikah, 2010). Many peri-urban farmers in Machakos County did not have access to the larger market in the greater Nairobi metropolitan region, only several had access to supermarkets but most had access to local kiosks.

2.3.1 Market Infrastructure

According to Reardon *et al.* (2003), to achieve cost-effective marketing, reduce health risks and minimize post-harvest losses, efficient marketing structures such as wholesale, retail markets and storage facilities are pertinent.

Urban developers ought to be aware of how to choose a suitable site for new market design, a market that meets a community's economic and social needs. In many cases, sites are under-used or even not used due to the infrastructure constructed not tailored to the community's needs. Building a market is also not sufficient: management, monitoring, and maintenance need to be functional.

2.4 The Development of Nairobi Metropolis Region

The periphery of metropolitan areas are fluid, expanding and shifting outwards. It is a transitional area that is an integral part of its food production, not close enough to the city and heavily built up (Smit, 2001). The global population is rapidly on the increase, and the less developed counties are the majority of where this growth is occurring, and whose economies are dominated by agriculture.

Nairobi, Kenya, is among the largest cities in Africa and one of the rapidly expanding areas in the world. Over 80% of the Kenyan workforce is employed in agriculture, and over 50% of people live below the poverty line. These forces have affected the Nairobi metropolitan area, including the satellite town of Machakos. With challenges such as rapid growth and inadequate planning, poor and uncoordinated governance system, poor provision coupled with inadequate infrastructure and utility services exhibit the characteristics of a peri-urban area. Unlike most cases, this rapid urbanization in Africa is also occurring without a corresponding increase in employment opportunities. As most urbanization in the next century will take place in agriculturally dominated developing countries, it is crucial we understand how to better plan for peri-urban places like Machakos today and in the future.

The Nairobi Metropolitan region has four recognized sub-regions with the city of Nairobi being at the core center of the area mostly because of the provision of goods and services, employment opportunities and a market for the food supplies from the rest of the region. On the other hand, the surrounding areas serve primarily as corridors for the population

working in Nairobi City. The four areas, according to the Ministry of Nairobi Metropolitan Development (MONMED) include:

- The central region comprises of Nairobi city
- The Northern area comprises of the Kiambu, Limuru, Ruiru, Thika, Karuri, and Kikuyu
- The southern region includes Kajiado.

The eastern district comprises of Kangundo, Tala, Machakos, and Mavoko. While geographic and political boundaries define states/counties, Metro areas are shaped by economic activity, sometimes across states and national borders.

Nairobi Metropolitan Region (NMR) comprises the following counties; Nairobi, Kiambu, Machakos, and Kajiado. The highest concentration of the population is within Nairobi City, due to infrastructural development and services. Owing to the growth of populations in satellite towns, NMR is the most urbanized region in Kenya; this could pose a challenge if strategies are not set in place (Ministry of Nairobi Metropolitan Development, 2019).

Previously, local authorities reported under local government Act cap 265 to the Ministry of Local Government. Formation, administration, and management of local authorities were some of the structure that the Ministry of Nairobi Metropolitan Development had no directive over. Coordinating activities of these government ministries were challenging. The County Government Act 2012 replaced the former Local Government Act Cap 265, which essentially defines the roles and management of "a county government." Chapter 11 (Devolution) of the Constitution of Kenya (COK) 2010, is given headway with this

Act. It has provisions for county government powers, responsibilities and functions, as well as power sharing and delivery of services. The National government and County government are the two pillars at the local level after the county governments were put in place.

The ministry was able to undertake effective consultation with the public and stakeholders, in two years. The boundaries of the metropolitan region were identified, and the Nairobi Metro 2030 was formulated and prepared in 2008. The ministry recruited qualified personnel and established technical departments. The ministry is underway in the preparation of the Nairobi Metro Spatial Plan (Ministry of Nairobi Metropolitan Development, 2019).

2.5 National Policies Relevant to Urban and Peri-urban Agriculture within Nairobi Metropolitan Region

Successive governments, in the colonial administration, designated agriculture as rural land use and they have upheld the same policy position. Further, the position on urban agriculture has been reinforced in policies such as the Physical Planning Act (1996); it excludes urban agriculture in the land use classification. Bylaws that were prepared a long time ago still govern Nairobi County. However, agriculture is still permitted, under strict conditions of these bylaws that are beyond the reach of many urban farmers within the municipality.

Agriculture still dominates the urban landscape, despite these official prejudices, signifying its continued existence. Its intensity, especially in smaller parcels of land, is

increasing. Exclusion of urban agriculture in the land use classification denies the sector of the required support. However, room for the development of peri-urban agriculture with the passage of several policies is a significant step.

2.5.1 Urban Areas and Cities Act 2011

Article 36 (1) (f) states that a framework of integrated development planning for regulated urban agriculture shall operate within the framework which shall provide every city and municipality established under the Act. Article 40 (I) stipulates that a regulated city and municipal agricultural plan shall reflect a city development plan or a cohesive urban area. Revised on 2016. It is yet to go into details about how to regulate peri-urban agriculture. It is yet to expound more on how farming can be assimilated into city planning. However, this is far from being attained due to lack of assimilation of urban agriculture as land use in the city.

2.5.2 The Local Government Act (Cap. 265)

Local authorities in Kenya have the Powers to allocate, lease or transfer land for temporary use under (Section 144) of the Act. It stipulates that farming on land that is not under occupation, under enclosure or land belonging to the government, private persons and the local authorities by unauthorized persons is barred.

The Nairobi City Council, using some of these Acts has prohibited keeping livestock that causes a nuisance and cultivation on public streets using these powers to enact bylaws.

Section 155 (b) of the Act refers to the Animal Diseases Act concerning prevention of outbreak and the spread of diseases by allowing for agricultural and livestock activities

and provision of services to them. Section 155 (c) also incorporates the likelihood of a shortage of foodstuffs by providing for the planting of famine relief produces by farmers to support themselves across the country. Section 144 (c) and 155 (c) contradict each other. Idle land should be utilized by poor urban farmers for food production so long as they follow the laid down rules and regulations to ensure safety of food products and the environment

2.5.3 The Public Health Act (Cap 242)

In section 157 (1) authorizes the prohibiting of cultivation or irrigation by the Minister for Health within and around townships within. Health issues arising from agriculture within cities is a problem that has been there especially because many urban farmers in cities cultivate crops along riverbanks and use sewage water for irrigation of plants. It was also observed, during the data collection in the KMC area in Athi-river area, where farmers use dirty water from the lagoon, next to a slaughterhouse.

However, this Act, revised in 2012 is still not clear as to how they intend to ensure the health of urban residents in regards to urban and peri-urban agriculture. This law still prohibits urban farming within and around townships, even though urban and peri-urban agriculture is quickly growing.

Sec. 118 (1) (e), explains what a nuisance is" any harmful matter or waste water streaming or released from any premises, whatever situation, into any public street, or into gutters or into any conduit, irrigation channel thereof not approved for the reception of such release." It should also encourage waste recycling programmes, to help reduce

agricultural waste. In addition, provide urban farmers with organic manure and treated wastewater, which would improve crop production.

2.5.4 The Land Control Act (Cap 302)

It states that the minimum agricultural land to be one acre, thus controlling transaction of agricultural land. It is unsupportive of urban and peri-urban livestock and agriculture activities (UPAL) since intensive UPAL activities are practiced on smaller land parcels especially with the growing practice of sack gardening on the backyards. The act directs that the minister must declare any agricultural land in municipalities or townships for land in the Kenyan for land in the Kenyan Gazette.

2.5.5 Nairobi City-county Urban Agriculture Promotion and Regulation Act, 2015

The urban agriculture promotion and regulation act was passed in 2015 after the 2014 Bill was approved and adopted. In section 5, an executive committee was formed to oversee law enforcement on issues regarding urban agriculture and to ensure the inclusion of urban agriculture as a component of zoning, land use, food policy, and marketing infrastructure in the planning process.

Section 7 approves agricultural undertakings within the region subject to any other legislation's concerning to planning, environs, nuisance and community health.

2.5.6 National Food and Nutrition Security Policy 2011

It acknowledged that Urban and peri-urban agriculture holds the potential to improve overall food nutrition and security as well as food access, it also acknowledged that it is increasingly being practiced. Nevertheless, to date, even with the National Food and Nutrition Security Policy. There has been a lacking coordinated exertion, backing and guideline to build up this potential. Additionally, the quality of food produced, sold and consumed in urban and peri-urban areas requires regulatory guidelines in place to guarantee the well-being of consumers.

2.5.7 Sessional Paper No. 3 of 2009 on National Land Policy

The national policy statement made on the Sessional Paper provides the most dynamic and sound proclamation yet on urban agriculture. On section 270, it intends to shape the reason for, and a manual to all other land-related policies and a point for the survey and coordination of land use planning elements of all local authorities, in Section 255. Existing administrative structures for urban agriculture include sections 254, 255 and 270. In section 110, it recognizes that the regulation and facilitation of urban agriculture has not been properly, and proceeds to lay down values upon which it shall be carried out: setting up a fitting legitimate system, which will facilitate and regulate urban agriculture and forestry, advancement of multi-functional urban land-dwelling use. City multifunctional land use as a planning concept promotes synergetic and inter-dependent land use in a specific area, through intensification in the use of urban space (Vreeker *et al*., 2004). Concerning urban agriculture, this corrects the thought that the activity does not have a place in the city and that it is contradictory with other urban land uses.

2.5.8 The Agricultural Act (Cap 318)

It states that the conservation, administration, and the improvement of natural resources. It is aimed at agricultural growth and development. Objective 5 provides for stable agriculture and production of special export crops (GOK, 1994). It is for rural agriculture and does not provide for urban agriculture. Agro-processing and value addition activities are quickly becoming dominant in urban areas as well, and as such should be provided for with the regulation.

2.5.9 Physical Planning Act (Cap 286)

Sec.16 indicates the land that should be in the plan, and it does not categorize agriculture as urban land use. In this way, as per planning legislation, agriculture is not a legitimate land use.

Sec.29 does not define what is proper and orderly and this is left at the discretion of the local authorities. It may not favor UPA and thus the need to integrate UA into urban planning and development.

2.5.10 The National Agriculture and Livestock Extension Programme Implementation Framework (NALEP-IF)

In collaboration with the government of Sweden, the ministry of agriculture has facilitated the implementation of extension programmes in the urban environment. It is a good step towards training and linking farmers to markets. The program offers capacity building and training to farmers. This framework holds alot of promise, as far as acknowledging the changing urban environment.

2.5.11 National Agricultural Sector Extension Policy (NASEP) 2012

Intended to take a sector-wide approach and address key sectoral issues in the delivery of extension services. After the national agricultural extension policy (2001) did not achieve the intended goals, the NASEP took over as the new policy. A well-working agricultural extension service operated by the public and private sectors is one of the basic efforts required for increased agricultural productivity to change subsistence farming into modern and commercial farming, achieve food security, improve wages and diminish neediness. It is, accordingly, essential to ensure that agricultural extension services are satisfactorily supported, all around facilitated and managed. Powerful linkages between extension service providers (ESPs) and different partners engaged with innovation improvement and provision of facilitating factors are fundamental (National agricultural sector extension policy, 2012). With adequate institutional arrangements, and a legal framework, peri-urban farmers can benefit from such a policy.

2.6 Relevant County Policies and Legislation

2.6.1 Machakos County Integrated Development Plan [CIDP]

Article 183 (b) and (d) of the constitution, requires County governments to implement national public legislation and policies and enact the same policies and laws to the county on matters of implementation and enforcement. The County Integrated Development Plan is a plan in which each county government is mandated to develop and ensure implementation of county-level policies that are integrated into the policy, programmes, and projects and in the plan. The plan is under section 108 of the County Governments Act, Number 17 of 2012 (Machakos county integrated development plan).

The county government of Machakos has relevant policies related to food security and agriculture within its county. However, there are still gaps, when it comes to supporting peri-urban agriculture, as they do not explain in detail how they intend to provide necessary support towards achieving food security.

2.6.2 Nairobi County Integrated Development Plan [2018-2022]

The sector objectives in the previous CIDP 2013-2017 included stimulating urban food security and safety, promoting urban forestry, creating an empowering environment for urban agricultural development, increasing dissemination of agricultural information.

Promoting output and productivity of crops, enhancing investment in value addition and value chain development of the crop, livestock, and fisheries for market access; enhance market access of crops, livestock, fisheries, and their products; Animal control and welfare; and rehabilitation of degraded ecosystems (Nairobi county integrated development plan, 2018).

2.7 Organizations that Govern Peri-urban Agriculture

2.7.1 National Government

The Kenyan government plays a very significant role in support of food security and peri-urban agriculture (PUA). Its role in facilitating the proper channels to improve PUA, by passing the correct policies and laws to regulate and facilitate the sector cannot be overlooked. In acknowledgement of the significance of peri-urban agriculture, the government has also provided agricultural extension services. As promising as it is, however, it has not yet been passed into law. Recently, FAO in collaboration with the Nairobi city county government launched a pilot project in 2016 to assist municipalities to meet their commitments on the food system. The project known as NADHALI has been implemented in three cities namely Nairobi, Dhaka, and Lima (NADHALI). With the key aim of supporting responsible authorities in urban areas on building the foundations for developing food systems planning as the key pillar for SDG 2 and 11; 'making towns and human surroundings inclusive, resilient, safe, and maintainable and achieving food security and nutrition by reducing hunger. The main objectives of the NADHALI project were to develop a tool for the rapid appraisal of urban food systems, develop a participatory food governance mechanism that would facilitate effective and inclusive food systems planning and capacity-building programme that would link analysis to governance and empower stakeholders in food system planning (FAO, 2016).

Cuba, Argentina, and Brazil are countries where the development of peri-urban agriculture (PUA) is given substantial government support. Countries such as Zambia, Botswana, China, and Benin are preparing legislations favorable to peri-urban agriculture, frequently as a component of a more extensive methodology with the end goal of poverty reduction (Kisner, 2008). Rosario (Argentina), Kampala, Dar es Salaam, Bulawayo (Zimbabwe) are formulating policies or programmes on PUA (IDRC, 2004).

Cuba was unable to feed itself, and the government encouraged the use of abandoned public and open spaces for food production in every potentially appropriate space with the aim of promoting agricultural production (IDRC, 2004). Even urban plots like Havana were converted to agricultural production (Kisner, 2008). The country was able to feed its population and not rely on imports. Kampala had a relatively vague UA policy framework previously but has advanced significantly (Mwanga and Makumbi, 2003). Despite the positive contribution of UPA, it had been banned for a long time as it was considered economically unimportant, illegal, and health concern (Urban harvest, 2004).

In Harare, the city was not well equipped to cope with the large-scale growth in recent decades, even though there was a record of regulatory and planning steps for agricultural land use for both private and public land (IDRC, 2004). UPA is now widely accepted, and the city council has begun to change its attitude (Kisner, 2008). In, Kinonduni, one of the municipalities in Dar es Salaam, UA was widely supported and practiced, there were policies and regulations governing UA.

In Dakar, Senegal, and NGOs study on wastewater management that steered to a minister's conference of urban agriculture (UA) and consequently to legislative proposals in the national parliament. In 2003, a minister's conference was hosted in Harare, Zimbabwe. The event was convened by the local development partnership for East and Southern Africa (MDP-ASA), a regional NGO and supported partly by IDRC (IDRC, 2004).

The Harare declaration was a success and all participating nations supported it strongly supporting the promotion of urban and peri-urban agriculture (UPA) (http://www.idrc.ca/in focus). Peri-urban agriculture happens under changing socio-political conditions and policy regimes, urban policymakers and backing can add to the development of safe and sustainable urban agriculture by creating a conducive policy environment and formal acknowledgement of peri-urban agriculture as urban land use (Veeinhuzen, 2004).

The first step is to define the complex interaction between different urban systems and involve all stakeholders in the formulation of the agricultural process (Urban Harvest, 2007). Peri-urban agriculture (PUA) happens in a multi-sectoral environment and addresses an enormous number of urban management areas. PUA usually involves a wide scope of regularly disengaged actors or partners required for successful policymaking, execution, and monitoring (IDRC, 2004). An understanding of the role PUA plays in various policy areas is important to formulate policies that maximize the benefits of PUA while preventing or reducing the associated risks (Veenhuizen, 2007).

2.7.2 County Government

The county government is also a major player in peri-urban agriculture sector. Devolution of functions such as agriculture brings into focus the role that local governments play regarding food security and agriculture. The county government of Machakos has made significant strides towards that end, with policies in subsidized fertilizer prices, facilitation of tractors for those with large parcels of land, extension services among many others (Machakos county integrated development plan, 2018)

2.7.3 Agriculture and Food Authority (AFA)

The Agriculture Fisheries and Food Authority is responsible for the regulation of all the crops listed under the Crops Act, 2013. Some of the Key mandates of AFA's Legal Department is to encourage the plan and drafting of the guidelines, standards and rules in consultation with the county governments for the various scheduled Crops controlled by AFA for gazettement by the Cabinet Secretary. Tracks County legislations to ensure that they do not conflict with national enactment, national strategies, and international protocols. Composes and Coordinates Stakeholder counsels, sensitization discussions on Agriculture Fisheries and Food Authority Act, 2013 and Crops Act, 2013, guidelines and other Legal issues in accordance with the arrangements of Article 10 of the Constitution. Directing farmers' training programs planned at expanding their insight on production technologies and prospects for different types of crops, through farmer training institutions. (AFA, 2019).

2.7.4 National Environmental Management Authority (NEMA)

The National Environment Management Authority (NEMA) is the principal instrument of Government for the implementation of all policies relating to environment. Of importance to this study was use of wastewater by farmers for irrigation purposes. NEMA's Water Quality Regulations apply to water utilized for household, industrial, agricultural, and recreational purposes; water utilized for fisheries and wildlife purposes, and water utilized for some other purposes. Various measures apply to various methods of use. These guidelines accommodate the protection of lakes, rivers, streams, springs, wells and other water sources. (NEMA, 2019).

2.8 Instruments used by governing institutions to regulate peri-urban farming

2.8.1 National Government

The government uses control instruments such as policies and legislations to regulate behaviour and achieve a desired result, however legal instruments usually have a reactive character, and this means that action is taken only in the form of sanctions in case the actors do not follow rules and regulations. General financial and social policies are intended to impact overall monetary development, exchange, business, accomplished predominantly by using money related and financial instruments (FAO, 2011).

Policies identifying with agricultural and rural development are frequently planned to affect such factors as the agricultural resource base, agricultural production, consumption of agricultural products, rural incomes and the quality of food. They are generally actualized by means of instruments, for example, taxes and endowments, and direct control through guidelines. Policies relating to markets, including the foundation of market establishments and standards. Policies premeditated explicitly to influence natural resource use and protect the environment. These policies utilize: (i) Order and control (ii) financial incentives such as taxes and subsidies; and (iii) persuasive measures such as training and publicizing (FAO, 2011).

The national government also has monitoring and evaluation mechanisms, e.g. the National Integrated M&E System (e-NIMES) to ensure the Government of Kenya generates real-time evidence for decision-making. The system serves as a dashboard to demonstrate performance across the two levels of government. The e-NIMES tool is at the piloting stage where various agencies and counties are uploading their strategic plans and work-plans (The national treasury and planning state department, 2019).

2.8.2 County Government

According to the National Government Coordination Act of 2013, each county government is supposed to ensure uniformity to national standards in the agricultural sector through guidelines and administrative actions in harmony with the national policy guidelines. Machakos County like most of the Kenyan counties lacks elaborate policies and legislation that directly address peri-urban agriculture as well as in other sectors. However, the county borrows from the national level policies in designing programmes intended to incorporate peri-urban agriculture into the development agenda and build resilience. One of the reasons for this is that the policies at the national level are more cognizant of peri-urban agriculture compared to the county legislations which address it in a piecemeal manner or indirectly. The county government of Machakos has policies relating to storm water management, water conservation, and other related purposes. It achieves this through ensuring adequate water supply for domestic, livestock, and agricultural purposes; promotion of water harvesting and recycling; and promotion of efficient water use and management among other functions. The legislation also has a gap in enforcement, one of the reasons why water scarcity remains a major problem in the county (MoALF, (2017). Climate Risk Profile for Machakos County. Kenya County Climate Risk Profile Series. Nairobi, Kenya.)

2.8.3 Agriculture and Food Authority (AFA)

The Agriculture Fisheries and Food Authority is charged with the regulation of all the crops listed under First Schedule of the Crops Act, 2013. AFA uses statutes and legislations as instruments for regulation of agriculture. It also has several department that work together in ensuring compliance and enforcement of these legislations. The departments include; Legal department, research, planning and strategy department and the technical and advisory services department. One of the Key mandates of the Legal Department is to encourage the definition and drafting of the guidelines, rules and standards in discussion with the county governments for the various scheduled Crops managed by AFFA for gazettement by the Cabinet Secretary. Tracks County enactments to guarantee that they do not contradict national legislation, national approaches, international conventions (AFA, 2019).

The research, planning and strategy department is mandated to complete checking and assessment on the presentation of the Authority in connection to the Strategic arrangement, administration sanction, Board and the management decisions and the yearly execution contract and audit the current strategies for utilization. The technical and advisory services department is tasked with conducting farmers' training programs aimed at expanding their insight on production innovation and prospects for different kinds of crops, through farmer training organizations (AFA, 2019).

2.8.4 National and Environmental Management Authority (NEMA)

NEMA uses laws and guidelines to ensure compliance. Of importance to this study is one of the gazette regulations on water quality regulations. Water Quality Regulations apply to water utilized for domestic, industrial, agricultural, and recreational purposes; water used for fisheries and wildlife purposes, and water used for some other purposes. Various standards apply to various modes of utilization. These guidelines provide for the protection of lakes, rivers, streams, springs, wells and other water sources (NEMA, Water quality Regulations. Legal notice No. 121, 2006).

2.9 Theoretical Framework

2.9.1 Rational Choice Theory

Rational choice is a choice made out of many alternatives through rational thinking. Rational choice theory makes several assumptions. First, it adopts the notion that human beings are purposive and objective oriented. Every move made is guided by a plainly distinguished objective or purpose. Speculations of normal decision are guided by the presumption that individuals are objective and base their activities on what they see to be the best methods for their objective. It involves weighing up alternative means to alternate ends and choosing between them. Rational choice theorists advocate that to understand more about how and why people behave in a certain way whether individually or socially then we have to see them as rational decision-makers in a world of scarcity. Scott (2000) has presumed that individuals are inspired by cash and by the likelihood of making a profit. Sociologists and political researchers have attempted to build speculations around the possibility that all activity is on a very basic level 'normal' in character and that individuals compute the feasible expenses and advantages of any action before choosing what to do.

This current study found out that the behavior of the urban household can be directed by this theory when making decisions in the adoption of the intervention. Therefore, with this approach in mind the theory of rational choice become relevant to this study based on assumption that the urban dwellers take up the agricultural interventions with multi-facet of goals. These include food, nutrition, health security and income generation.

2.10 Conceptual Framework

In this conceptual framework there are three independent variables selected for this study namely; peri-urban agriculture production, farmer's knowledge, attitude and practices of peri-urban agriculture in Machakos county and the typologies of market farming. These variables were selected to check their influence on peri-urban agriculture and food security of farmers in Machakos County. In the conceptual framework, we also have one modulating variable, which also behaves like the independent variable in that it affects the relationship between dependent and independent variables, which can be contributory or contingent. Being aware of the influence that government policies have on peri-urban agriculture and food security this study took into account their effects by asking farmers in the questionnaires to list any government policies in their county related to peri-urban agriculture.

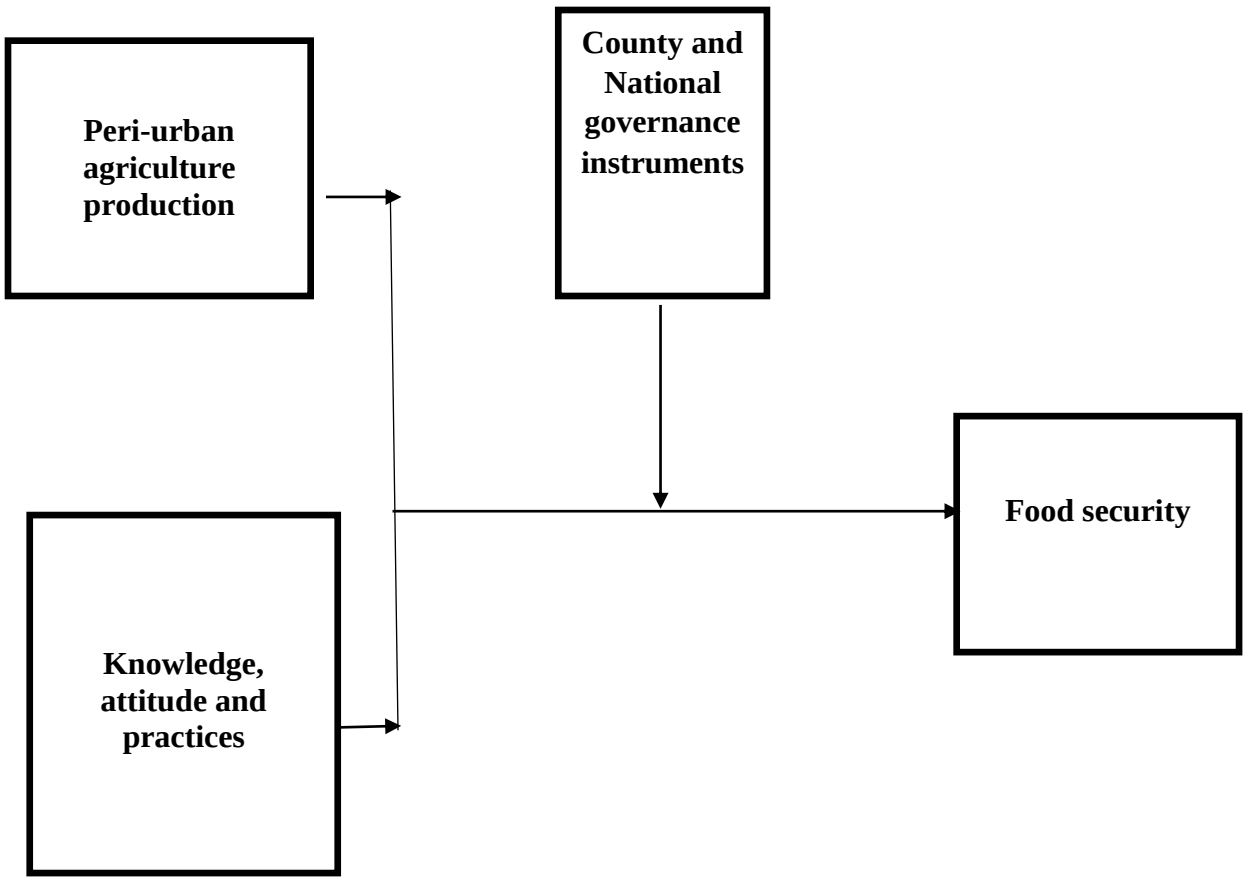

Figure 2. 1 Conceptual framework

Source: Researcher (2018)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers the study area, research design that was utilized during the study. It also focuses on the sampling technique and sample frame chosen for the study.

3.2 Study area

3.2.1 Location and Size

The study was carried out in Machakos County, Kenya. The sites selected for Machakos County were Mua, Mutituni and Athi River. These sites were selected for two main reasons: proximity to Nairobi metropolitan area and their popularity with the practice of a broad spectrum of urban agriculture. Machakos County borders seven counties strategically. To the west, it borders Nairobi and Kajiado counties, to the north Embu, Muranga and Kiambu Counties, to the south Makueni County and to the East Kitui County. The County covers a total area of 6208.2 Km^2 with Machakos covering 925.2 Km^2 (Machakos County Integrated Development Plan, 2015).

3.2.2 Biophysical features

3.2.2.1 Climatic Conditions

Generally, the annual rainfall of the County is unevenly distributed and unreliable. Concerning temperature, July is the coldest month while October and March are the warmest. The local climate is semi-arid with hilly terrain and an altitude of 1000 to 2100 meters above sea level. (Machakos County Integrated Development Plan, 2015).

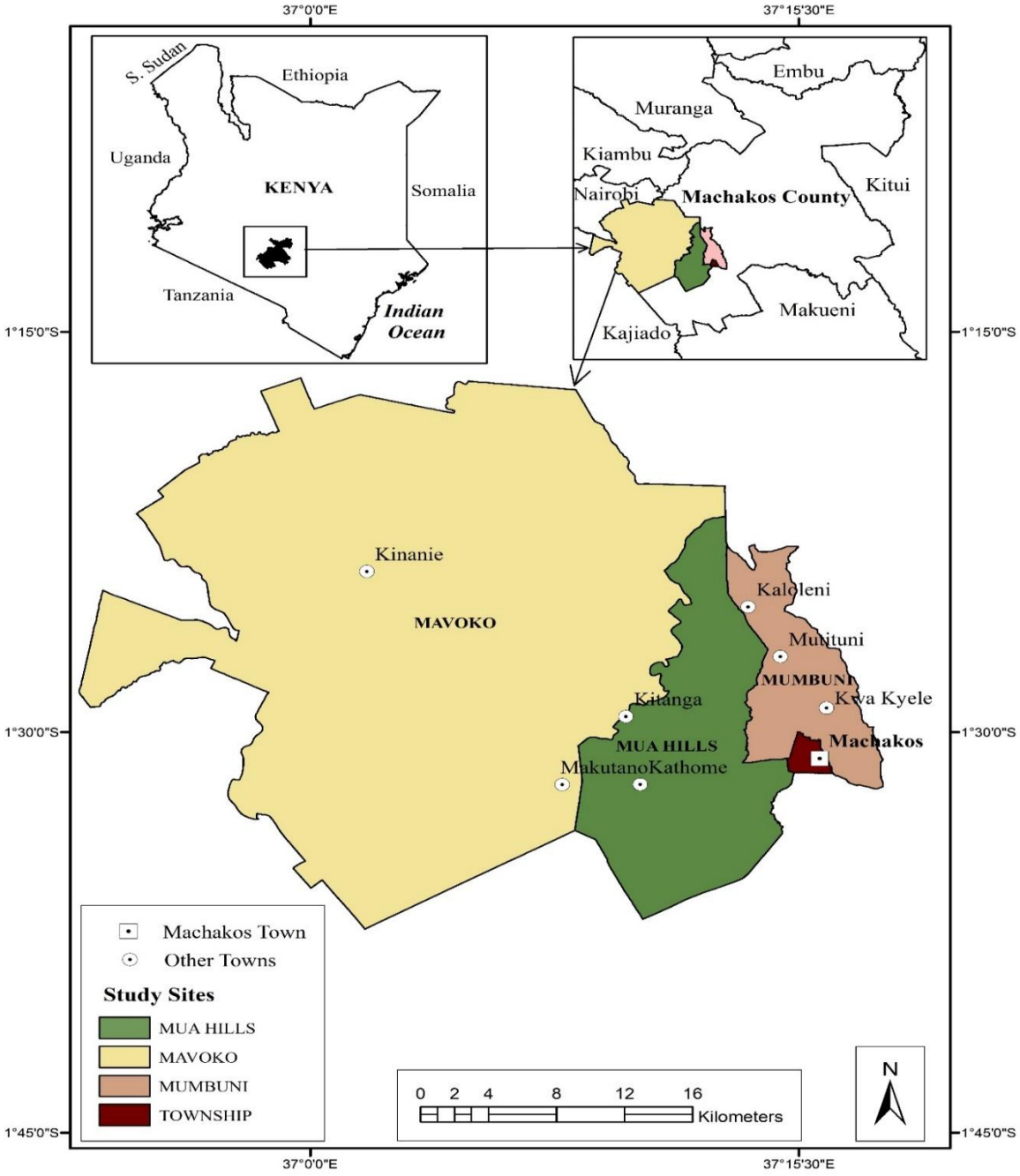

Figure 3. 1 Map of Machakos County

Source: (Department of Geography and environmental studies)

3.3 Research Design

The study emulated a descriptive survey design. Concerning factors or conditions in a circumstance, descriptive research is utilized to obtain data concerning the status of the phenomena, which is under scrutiny to describe, what exists (Chandran, 2004). Kothari (2004) also defines it as a research study that is concerned with portraying the qualities of a particular individual or a group. For data collection to be relevant and sufficient in a descriptive survey, research objectives are premeditated to the study problem. This research design, therefore, enabled the researcher to draw implications about the policies influencing peri-urban agriculture and food security of Farmers in Machakos County through studying a small part of the population.

It involved both qualitative and quantitative methods of data collection so that both methods could complement each other. The instruments used were the researcher's questionnaire, Focussed Group Discussion (FGD), and key informant interviews. The questionnaires were issued to all the 200-targeted respondents in the study area with the aim of gathering data on the sustainability of the agricultural practices, typologies of agricultural activities and understanding of current legislations surrounding peri-urban farming.

One focused group discussion (FGD) was also carried out to cross-check and clarify issues that were not adequately tended to by the respondents since the FGD members have in-depth knowledge of urban and peri-urban agriculture (UPA) practices in the study area and the discussion was conducted mainly to explain, reinforce and enrich the

survey results. Thirteen key informants were interviewed in areas that required technical expertise such as legal matters that were pertinent to urban agricultural practices. The thirteen interviewed were form different state departments, with pertinent information on peri-urban farming.

3.4 Target Population

According to Mugenda and O. Mugenda (2009), a target population is a population to which the researcher would like to sum up the outcomes. In this study, the target population was households from Machakos County in Kenya who engage in peri-urban agricultural practices.

3.5 Sample Size

Table 3.1 (CENSUS DATA 2009)

REGION	POPULATION				AREA (KM^2)	DENSITY
	Males	Females	Total	Households		
Athi-River	27,238	24,055	51,293	17,949	77.8	659
Mua	3,857	3,896	7,753	1,756	50.3	154
Mutituni	2,540	2,594	5,134	1,258	2.8	1,839

Sample size was derived using the Cochran's Formulae. Census data from 2009 was used (Table 3.1). $n= \{Z^2 *P*(1-P)\}/e^2$

Where;

n= Sample Size

Z= Z-score

P = Sample proportion

e= Margin of error.

In this case, with a confidence interval of 95%, Z-score of 1.96, sample proportion of 0.846 and margin error of +/-5%. Using the Cochran's formulae, the study arrived to the sample size of 200. $= \{1.96^2 * 0.846 * (1-0.846)\}/0.05^2$

$= \{3.8416 * 0.1303\}/0.0025$

$= 200$

3.6 Sampling Procedure

Purposive sampling procedure was used to select households who engage in peri- urban agricultural practices to participate. The method came in handy when selecting households that had been engaging in peri-urban farming in the area for a reasonable period. Denscombe, (2008) also posited that, purposeful sampling is useful when one wants to access a particular subset of people.

3.7 Research Instruments

This study utilized a semi-structured questionnaire as a primary tool for data collection. The questions were systematic and pre-determined and were presented with the same wording and in the same order to all respondents. It was pre-tested before use.

3.8 Data Collection Techniques

Data collection was done using different methods depending on the specific objectives;

For the socio-economic effects of urban agriculture, the research survey relied on both primary and secondary sources of data. The primary data were derived from field surveys using questionnaires, key informant interviews (Appendix) and focus group discussions (FGDs). The interview schedules were administered to respondents with the aim of bringing to light the socio-economic and benefits of the urban agricultural practices. The focus group discussions were carried out to get in-depth information from experts in the field of UPA. The respondents may not have addressed that. The FGD members had in-depth knowledge of UPA practices in the study area, and the discussion was conducted mainly to explain, reinforce and enrich the survey results. The key informants were

interviewed through a tailor-made interview schedule to give information on specific areas of interest. Secondary data was also synthesized from textbooks, periodical, journals, newsletters, electronic media (internet), County Development Plans, as well as other related articles. Both qualitative and quantitative research techniques were utilized. The questionnaires were both close-ended and open-ended. The open-ended questions gave an opportunity to the respondents to express their views, thus yielding qualitative data.

On policy analysis, secondary data was obtained from relevant policy documents. These were scrutinized to establish gaps which hindered sustainable urban agriculture. Some policy papers were also analyzed and included Vision 2030, Draft National Land Policy (DNLP), ERS, SRA, PRSP, NALEP-IF and the new constitution. Interviews were also conducted from key Informants in some selected institutions such as the Ministry of Agriculture (MOA).

3.9 Data Analysis Techniques

Completed questionnaires were revised for completeness, consistency, checked for mistakes and oversight. Both qualitative and quantitative data was yielded. A thematic structure was created, where qualitative data collected were analyzed through content analysis using the Statistical Package for Social Sciences (SPSS) version 20 the quantitative data generated were analyzed using descriptive statistics. The findings are presented using tables, frequencies, and percentages.

CHAPTER FOUR: RESULTS

4.1 Introduction

This section breaks down the interpretation and presentation of the findings obtained from the field. The chapter exhibits the response rate, background information, Descriptive analysis, and inferential statics that have been utilized to discuss the findings of the study.

4.2 Knowledge, Attitude and practices of farmers

4.2.1 Awareness of Government Policies relating to peri-urban agriculture

The research wanted to investigate the awareness of respondents on matters of policy either national or county relating to peri-urban agriculture and food security within their locality. 85.5% of the respondents were not aware of any government policies on peri-urban agriculture and food security, while a few 14.5 % showed some recognition. The results are shown in table 4.2 below.

Table 4. 2: Awareness of government policies

	Frequency	Percentage
Yes	29	14.5
No	171	85.5
Total	200	100.0

Thirteen key informants from various institutions, relevant to agriculture in the county, were interviewed and only a minority were aware of government policies directed at improving smallholder market based farming within the county. Some showed recognition of the county level policies relating to subsidized fertilizers, free tractors, and free seed policies under food production in Machakos County.

However, out of the selected key informant respondents, none was aware of any national policies on either urban or peri-urban agriculture. It became clear that there was no trickling down of policies up to the sub-county level. It is important that knowledge dissemination and sensitization of relevant policies to peri-urban farmers should start with the government officials in charge of the relevant institutions.

4.2.2 Practices of farmers in relation to policies governing peri-urban agriculture

The research wanted to investigate the compliance level of respondents in relation to policies in place on peri-urban agriculture, both at the national or county level. The results are shown in table 4.3 below.

Table 4. 3: Compliance to government policies

	Frequency	Percentage
Yes	9	4.5
No	191	95.5
Total	200	100.0

95.5% of the respondents did not comply with any government policies on peri-urban agriculture and food security, while 4.5 % agreed to complying one way or the other. For farmers to be able to comply to set rules and regulations pertaining to peri-urban farming, the organizations mandated with encouraging public participation, information dissemination and capacity building should collaborate.

4.3 Capacity and training of farmers

4.3.1 Visit by Extension Officers

The researcher also sought to find out the number of times extension officers visited the farmers. Extension services are one of the priority functions of the agricultural sector within core poverty alleviation programmes. The findings reveal that majority at 73% had never received a visit from any extension officers within their locality, while 27% had been visited by extension officers. The results are as depicted in Table 4.4.

Table 4. 4: Visit by extension officers

	Frequency	Percentage
Yes	54	27.0
No	146	73.0
Total	200	100.0

These findings indicate that most farmers were not receiving the much-needed guidance from extension officers that would boost the agricultural productivity of their land. There is, therefore, the need for the government and other relevant stakeholders to fast track the deployment of more agricultural extension officers to provide expert advice regarding the latest technologies in peri-urban crop and livestock production. If done, food security will be easily realized for the farmers and the larger metropolitan area**.**

4.3.2 Modes of Communication Utilized by Farmers

The study sought to find the mode of communication that favored the dissemination of agricultural information to farmers. The findings showed that the most utilized method of accessing information was via mobile/internet services at 39.5%, followed closely by radio at 36.5%. At 14%, farmers preferred networking and disseminating relevant information amongst themselves, 6% utilized the television. Moreover, a constant percentage between those that get their information from newspapers and Sacco's. Extension officers also formed a source of information for farmers at 2%. The results are as listed shown in table 4.5.

Table 4. 5: Modes of communication utilized by farmers

	Frequency	Percentage
Networking on farms	28	14
Mobile / internet services	79	39.5
Extension officers	4	2.0
Newspaper	2	1.0
Radio	73	36.5
Sacco's	2	1.0
Television	12	6.0
Total	200	100.0

To some extent, this means that farmers are in touch with the outside world. Thus, it will be practical for them to be encouraged to harness the Internet as a key source of very recent information regarding how they can boost productivity.

4.4 Land Ownership

The research wanted to establish the respondents land ownership status as shown. The study exposed majority of the respondents as shown were men at 48.6%, whereas 18.5% of the respondents were women, 31.2% of the respondents both had equal shares to land ownership (Table 4.6).

Table 4. 6 Land ownership status

		Frequency	Percentage
	Wife	32	18.5
	Husband	84	48.6
	Wife & husband	54	31.2
	Government	3	1.7
	Total	173	100.0
	No response	27	
Total		200	

In the case of Slota area in Athi River, the land was mostly owned by the government under the EPZ [export processing zone] that is set aside by the government specifically for farming purposes in the area. In KMC, Athi River, the land was owned mainly by the Kenya meat commission but had been allocated to farmers to help them be food secure and sustain their livelihoods. It brings out the importance of institutions in supporting farmers. Out of the 200-selected sample size, 27 respondents did not answer this question, mainly because some of those encountered at the households at the time were casual laborers who did not know about the land ownership.

4.5 Off-farm Income

To seek further clarification on the inference that peri-urban agriculture is mostly practiced as a supplement to the farmers on farm income, the study researched on other opportunities that the farmers engaged in apart from agriculture that acted as a supplement to their farming income. Of those interviewed, 2.5% acknowledged that they were engaged in various businesses as add-ons to agriculture, at 2%, some were employed e.g.as teachers, as drivers, were employed and at 2.5% others had businesses. The majority at 95.5% were engaged in farming as a sufficient way of acquiring income (Table 4.7).

Table 4. 7: Off-farm Income

	Frequency	Percentage
Business	5	2.5
Employed	4	2.0
Total	9	4.5
	191	95.5
Total	200	100.0

To some, farming was mostly for home consumption this was to act as a buffer against the rising food prices amidst the rising rate of the economy and other aspects of quality of life.

4.6 Type of Crops Cultivated

Farmers in the area had a wide variety of crops that they cultivated, and the study investigated the type of crops cultivated. There was an array of crops grown by the farmers, with the highest cultivated crop being Maize at 39.5%, followed by beans at 15%. These two are the preferred cultivated crops because they form a local staple food for the Kamba people called *Muthokoi*. Nonetheless, many farmers had diversified to other crops such as spinach at 10%, 7.5% grew kales, and at 2.5 % cowpeas and tomatoes were cultivated by farmers respectively. Fruits cultivated included melons, mangoes, apples, oranges, and pawpaw's (Figure 4.2).

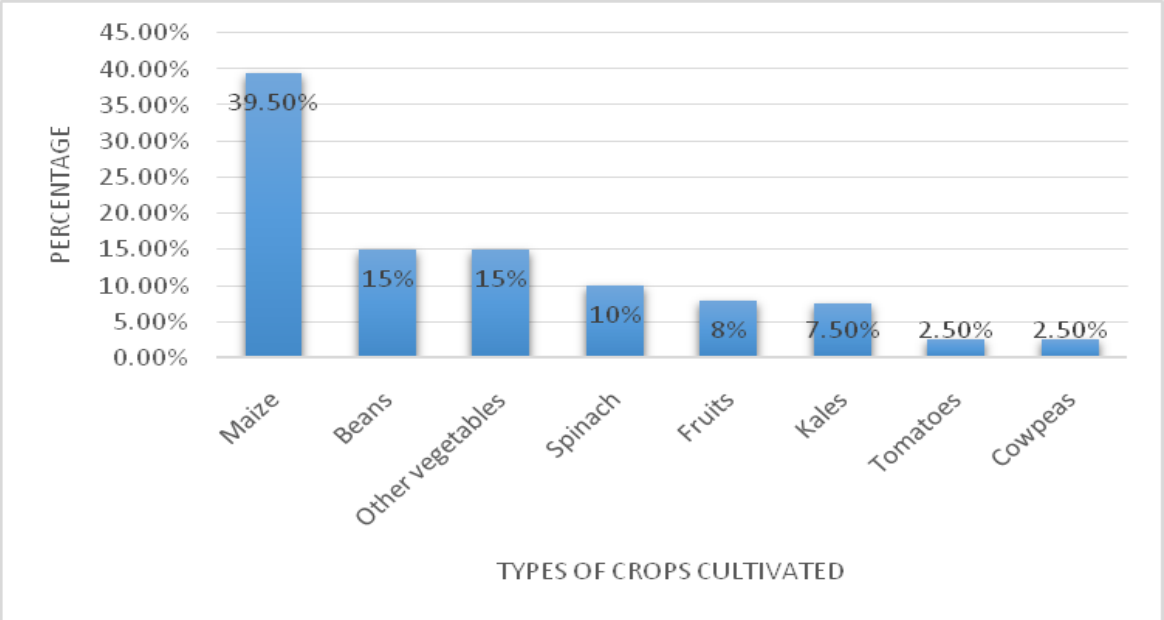

Figure 4. 2: Types of crops cultivated

It is important that while extension officers disseminate useful information and training to farmers, they should also encourage farmers to diversify their crops. Crop diversification improves resilience, especially with the ever-changing climatic conditions. The government should put in incentives such as easy market access, subsidized prices on farm inputs and good market infrastructure, to encourage crop diversification.

4.7 Cultivation Methods

The study sought to establish the growing methods employed by farmers. Methods employed usually differ with the results mostly being linked to whichever method that can give higher yields and good quality products. Many of the farmers practiced conventional farming constituting 42%. At 36% were those that practiced organic methods of farming, mostly attesting to the fact that farm inputs were expensive. However, it was not without challenges from pests and diseases. Permaculture is a method that imitates the no waste strategy. It was the least practiced at 22% (Table 4.8).

Table 4. 8: Cultivation Methods

	Frequency	Percentage
Permaculture	44	22.0
Organic	72	36.0
Conventional	84	42.0
Total	200	100.0

Farmers need to understand the importance of the no waste strategy, encouraging a stable system of farming, ensuring they stably utilize the ecosystem.

4.8 Sourcing agricultural products from government institutions

The study sought to establish whether farmers sourced any of their agricultural products from any government institutions. 20.5% had a government institution they had sourced from once or twice but not as frequent. The institution mentioned was KALRO, but others received their seeds from local organizations supporting farmers within their locality. 79.5% did not source from any government institution; instead, most had access to agrovets within their localities (Table 4.9).

Table 4. 9: Sourcing from government institutions

	Frequency	Percentage
Yes	54	27.0
No	146	73.0
Total	200	100.0

The county government of Machakos under its policies for food production in eradicating the *Mwolyo* [food aid] system had stated their intention to provide free tractors, seeds, and fertilizers to enable them to reduce expenses for the farmers.

However, in the study sites, some farmers had challenges on purchasing of seeds and fertilizer due to high prices. The right programs are already in place. However, the implementation is lagging.

4.9 Source of Food

The study sought to establish the level of household food security. Many farmers sourced their food from their home gardens, these constituted 40% of the respondents interviewed and followed by 39% of those who had a garden plot away from home on either private or public land to sustain their household food consumption. As was the case in KMC area in Athi-river where farmers had garden plots on public land, an EPZ area set aside specifically for farmers around KMC and Slota area. At 21%, some sourced their food by buying from the nearest marketplace (Figure 4.3).

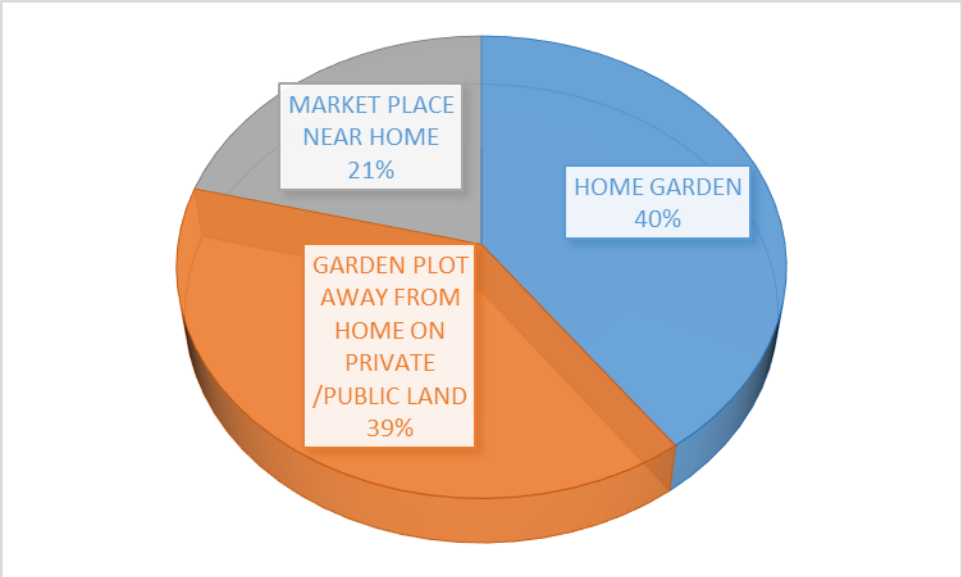

Figure 4. 3: Source of food

It brings out the importance of setting aside land for agricultural practices whether in peri-urban areas or the ever-growing urban areas. Planners should include urban and peri-urban agriculture as possible land use, when planning and designing cities.

4.10 Source of Water for Agricultural Needs

Water scarcity is one of the problems plaguing peri-urban farmers. The study sought to establish where farmers source their water for agricultural needs. Most farmers at 49.5% used harvested rainwater, followed by 31.5% who had access to water from a borehole, 0.5% had to buy water from vendors, those living at KMC area sourced from the lagoon, which is mostly sewage water and constituted 6.5%, those who had access to tap water were at 1.5% (Table 4.10).

Table 4. 10: Source of water for agricultural needs

	Frequency	Percentage
Borehole	63	31.5
Vendors	1	.5
Tap water	3	1.5
Dam	6	3.0
Pond	3	1.5
Harvested water	99	49.5
Waste water	13	6.5
Well	12	5.5
Total	200	100.0

Most agricultural activities within urban areas involve the utilization of wastewater from sewage outlets, with farming occurring along riverbanks. In Machakos, it was also noted that especially around the KMC area, farmers used sewage water from the slaughterhouse. It is pertinent that, farmers are sensitized on the dangers of using sewage water for farming; however, it is also important that the county government enable the provision of water to residents for farming.

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

This section offers discussions of the main findings as well thought out under every objective.

5.2 Knowledge, attitude and practices of farmers

The research wanted to investigate the awareness of respondents on matters of policy either on the national or county level relating to peri-urban agriculture and food security within their locality. 85.5% of the respondents were not aware of any government policies on peri-urban agriculture and food security, while a few 14.5 % showed some recognition (table 4.2).

From the research findings, majority of the respondents were not, aware of any government policies on urban and peri-urban agriculture and food security, and from observation the farmer's perceptions towards peri-urban farming policies, they did not understand the importance of such policies in ensuring safe production of food. Thirteen key informants from various institutions, relevant to agriculture in the county, were interviewed and only a minority were aware of government policies directed at improving smallholder market based farming within the county. Some showed recognition of the county level policies relating to subsidized fertilizers, free tractors, and free seed policies under food production in Machakos County. However, out of the selected key informant respondents, none was aware of any national policies on either urban or peri-urban agriculture. It became clear that there was no trickling down of policies up to the sub-

county level. It is important that knowledge dissemination and sensitization of relevant policies to peri-urban farmers should start with the government officials in charge of the relevant institutions.

The research also wanted to investigate the compliance level of respondents in relation to policies in place on peri-urban agriculture, both at the national or county level. 95.5% of the respondents did not comply with any government policies on peri-urban agriculture and food security, while 4.5 % agreed to complying one way or the other (table 4.3). For farmers to be able to comply to set rules and regulations pertaining to peri-urban farming, the organizations mandated with encouraging public participation, information dissemination and capacity building should collaborate.

A minority of the farmers had received visits from extension officers; this presents a challenge because there were some knowledge gaps noted when it came to pertinent information, which would benefit the farmers.

Where farmers lacked access to extension officers, they had communication modes that seemed to be working for them, these included: Television stations like kilimo biashara, most of them relied on radios, others on social networking.

5.3 Examining and evaluating existing National and County governance instruments

Prerequisites for success include; predominant policies and adequately strong institutional frameworks .Stakeholders should embrace effective inter-sectoral coordination mechanisms. Effective policy implementation needs systems in place, systems that remain dynamic as needs and conditions change over time. On policy gaps analysis it was evident that peri-urban agriculture has not been recognized as an urban land use and this has serious implication on the state of the environment and human well-being (Table 5.11).

Table 5. 11 : Policy gap analysis and suggestion of possible solutions.

POLICY STATEMENT	GAPS	POSSIBLE SOLUTIONS
Urban Areas and Cities Act of 2011 Article 36 (1) (f) states that a framework of integrated development planning for regulated urban agriculture shall operate within the framework which shall provide every city and municipality established under the Act.	Revised on 2016. It is yet to go into details about how to regulate peri-urban agriculture.	It should expound more on how agriculture can be integrated into city planning.

The Local Government Act (Cap 265) Section 144 (c) stipulates that farming on land that is not under occupation under enclosure or land belonging to the government, private persons and the local authorities by unauthorized persons be barred. Section 155 (b) of the Act refers to the Animal Diseases Act concerning prevention of outbreak and the spread of diseases by allowing for agricultural and livestock undertakings and provision of services to them. Section 155 (c) also incorporates the likelihood of a shortage of foodstuffs by providing for the planting of famine relief	There is contradiction between Sec. 144c & Sec. 155c. The local authorities use Sec. 144c to harass and destroy any agricultural activities in the urban areas and disregards Sec 155c which supports urban agriculture (UA).	Peri-urban agriculture should be recognized as an urban land use. Idle land should be utilized by poor urban farmers for food production so long as they follow the laid down rules and regulations to ensure safety of food products and the environment

produces by farmers.		
The Public Health Act (Cap 242) section 157 (1) authorizes the prohibiting of farming or watering by the Minister for Health within and around townships	Is still not clear as to how they intend to ensure the health of urban residents in regards to peri-urban agriculture. This law still prohibits urban farming within and around townships, even though urban and peri-urban agriculture is quickly growing.	The City Council of Nairobi whose mandate is to keep the city clean should provide a designated area for waste disposal. As well as a framework for wastewater recycling for purposes of farming.
The Land Control Act (Cap 302) states that the minimum agricultural land to be one acre, thus controlling transaction of agricultural land	It is unsupportive of urban and peri-urban livestock and agriculture activities (UPAL) since intensive UPAL activities are practiced on smaller land parcels. Especially with the growing practice of sack gardening on the backyards.	Institutions should be put in place at the local level to allocate vacant land temporarily to poor urban farmers for food production purposes without gazetting of agricultural land.

The Nairobi City-county Urban Agriculture Promotion and Regulation Act, 2015 Section 7, approves agricultural undertakings within the region subject to any other legislation's concerning to planning, environs, nuisance and community health.	It is yet to be implemented. Contradicted by other Acts that prohibit agriculture within the city.	If properly implemented, it can be the change needed to enable safe food production through peri-urban agriculture.
The Agricultural Act (Cap 318) This provides for conservation, management and development of natural resources for agricultural growth and development. - Objective 5 provides for	This is for rural agriculture and does not provide for the growing rate of peri-urban agriculture. In the peri-urban areas currently, there is a lot of agro-processing and value addition activities taking	Cottage industries and agro-processing should be encouraged if the country is to achieve vision 2030, which envisions Kenya as a middle industrialized economy by the year 2030.

stable agriculture and production of special export crops (GOK, 1994).	place, this should be provided for.	
Physical Planning Act (Cap 286) Sec.16 of the Physical Planning Act (Cap 286) indicates the land that should be in the plan, and it does not identify agriculture as urban land use. Therefore, according to planning legislation, agriculture is not legitimate land use. Sec.29 does not define what is proper and orderly and this is left at the discretion of the local authorities	-Sec.16 of the act clearly indicates the land that should be in the plan, and it does not identify agriculture as an urban land use. Therefore, according to planning legislation, agriculture is not a legitimate land use. -Sec.29 does not define what is proper and orderly and this is left at the discretion of the local authorities. This may not favor peri-urban agriculture and thus the need to integrate peri-urban agriculture into the urban planning and development.	Peri-urban agriculture should be identified as an urban land use and be well integrated into the urban planning and development.

The policy documents relating to Peri-urban agriculture are conflicting and the status of peri-urban agriculture practice unclear, however it continues unabated and is a survival strategy. Its implications will continue to be a challenge as rate of urbanization increases in Kenya. Developing and enforcing an implementation framework, clear coordination mechanism and commitment to fund the implementation of activities is what is needed to achieve food security within the larger Nairobi Metropolitan Region.

5.4 Conclusion

The study examined the current National and County governance regulatory instruments on peri-urban agriculture of Nairobi metropolitan city and their contribution towards achieving food security. And the following conclusions were made:

Agricultural productivity has a significant impact on household food security. The number of crops cultivated by farmers was diverse. The income realized by farmers on a yearly basis was not that high, as it would have been expected, and hence farmers had other businesses to diversify their income. Most farmers made use of the soil medium to grow their crops with a majority of them relying on the rain-fed method of watering their crops. Furthermore, most farmers utilized open fields to cultivate crops with very few of them employing the use of machinery during crop production.

Extension services to farmers were minimal if not rare. Likewise, NGO support was uncharacteristically limited. Most farmers were utilizing radios, televisions and phones to

obtain information that could be used to boost crop production. However, there's a low number of farmers utilizing the Internet in securing information about productivity.

Marketing played a significant role in determining the difference in the food security of households. More specifically, marketing difficulty, value addition, pricing of farm produce, persons involved in food marketing system and targeted buyers, played an integral part in contributing towards food security. These included some of the challenges experienced by farmers in the marketing chain.

5.5 Recommendations of the Study

These recommendations were presented from the study findings:

- There is a need to stop-over-reliance on rain-fed crops, as well as implement the use of machinery during production to boost productivity.
- Farmers should be sensitized on climate-smart agriculture.
- Diversification of crops from the current monotony will encourage food nutrition and food security.
- The Government of Kenya, NGOs, and other stakeholders should improve their support for farmers if food security is to be realized.
- Farmers should also be enlightened about the importance of maintaining relevant, accurate and updated records pertaining to crop production activities.
- The government should ensure farmers get adequate extension services they need to boost productivity.

- Farmers should also embrace the use of the Internet as a means of receiving information regarding the most recent technologies in crop production.
- Effective marketing channels should be established so that farmers can earn more income from the sale of their produce. It is to enable the farm produce to reach the market on time. In addition, they need to learn strategies of adding value to their produce before so that it can earn them more income.
- Government policies at the National level should reduce duplication and fragmentation of many laws, in order to pave way for the trickling down of these policies to the county level in a concise manner, not forgetting those county governments also have policies relating to Urban and peri-urban agriculture, which also need to trickle down to the sub-county level.

5.6 Suggestions for Further Studies

The study identified various gaps, and hence further research should be done in the following areas.

1. A study on the role played by Non-Governmental Organizations in promoting food security among the low-class population.
2. An investigation into strategies to be encouraged in the adoption of peri-urban agriculture to enhance its productivity.
3. A study on the impact of peri-urban agriculture on the environment

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APPENDICES

APPENDIX 1: RESEARCH QUESTIONNAIRE FOR THE FARMERS IN MACHAKOS COUNTY

SECTION 1: PERSONAL DATA

101 Questionnaire no. ……. 102 Date of interview: …….

103 Photo no: …….

104 Name: ……. 105 Plot no: ……..

106: County: ……..

107 Location: ……. 108 Village: …….

109 Marital status: ……..

110 No of children: …….. 111 Other HHD members: ……

112 Year farm acquired: ……

113 Farm acquired from: …… 114 Size of farm/space: …….

115 Farm income: ……..

116 Off farm income: …….. 117 Tel. No: ……..

SECTION 2: TYPOLOGIES OF MARKET FARMING

202 What are production (tonnes) and acreage (where applicable) for selected crops?

Crop: …… 203Hectarage (HA) (where applicable): ……..

203 Production/Kg: ……

206 Is there conscious value addition to any of the crops?, If yes, please explain: ……..

207 Where do you source your food from?

A) Another home garden

B) Garden plot away from home on private land/public land

C) A bigger market in another town

D) From other regions

E) Others (please specify)

211 Which market(s) do you take your produce or where do you sell produce e.g. neighbors, supermarkets, kiosks, schools, offices?

225 where do you buy seeds to plant from?

…….

227 What crop varieties do you sell?

…….

232 Do you source from government institutions like KARI?

…….

233 What factors affecting marketing channels for crop varieties in this area?…….

234 Which persons are involved in the food chain systems of agricultural produce? …….

SECTION 3: LAND OWNERSHIP AND GENDER VARIABLES

301 Who owns the farm? Wife: ……..

Husband: ……..

SECTION 4: TRANSPORT

How does the food get to the market?

A) On foot

B) Public transport

C) Pick up

D) Mkokoteni

E) Bike/boda boda

F) Other

SECTION 5: CROP AND LIVESTOCK RESOURCES CONSERVATION

819 Are you aware of any government policy promoting the conservation of crop varieties for food security and agriculture in Kenya?

……

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SECTION 6: ASSESSMENT OF AGRONOMIC PRACTICES AND EXTENSION SERVICES

1001 Which agronomic practices do you use to guard against pests and pathogenic attack?

……

……..

1002 Do you have extension services in this area?/ Have you ever been visited by an extension officer?……

……

1010 What are your growing methods? Organic, Permaculture, conventional etc

……

…….

1012 Where do you get your water from……

SECTION 7: COMMUNICATION

1301 What communication model favors your market farming?……