

**ACTORS' PERCEPTIONS OF HEALTH RISKS AND EFFECTS RELATED TO  
FOOD SYSTEM ACTIVITIES IN NORTH WEST MT. KENYA REGION**

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**DECLARATION**

This is my original work and therefore has never been presented in any other institution for award of any degree or examination.

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## **DEDICATION**

For my mum **Judy Ayuma** who raised and nurtured me with love and who despite her ill health remained my greatest pillar, even on her death bed she taught me that witnessing the world's troubles isn't depressing but inspiring. She rested on 25<sup>th</sup> July 2016 at a critical time during this study. May you always find peace with the Heavens mama. And to my nieces Gillian and Gael (both 5 years at the time of writing this) for their love and inspiration.

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This study is conducted with only the best intentions. Any shortcomings, interpretations, and conclusions drawn are entirely my responsibility.

## ABSTRACT

Food production through agricultural practices is essential for the survival of humanity in the entire world. It plays a great role on whether there is enough food for human consumption, if the food available is of sufficient nutritional value, and if the food is safe, all of which at the end has an effect on the health and wellbeing of humans. The study was conducted in North-West Mt. Kenya region and specifically in the sub-counties of Laikipia East and Buuri which fall in the Laikipia and Meru counties of Kenya. In the study, a conceptual framework based on the environmental epidemiology theory was used to uncover associations between health risk factors and human disease like cholera, dysentery which are due to poor food handling with a view to bring out the casual link between the two. The framework shows linkages between, institutional and legal frameworks, food system actors, food system activities, health risks and the environmental outcomes. It focused on food producers, food retailers and food consumers as the food system actors with a view of getting their perception on the human health risks and their effects on the food system activities. The study employed qualitative and quantitative approaches to collect and analyse data. Questionnaires, interview schedules, observations and photography were used in data collection. The study used stratified random sampling. In the sampling procedure, the actors were stratified in four sections: the household; the farm managers; the farm workers; and the retailers. The data that was collected was analyzed using Statistical Package for Social Sciences (SPSS) version 23 software. The study generally aimed at finding out how various actors within the food system perceive health risks related to food system activities and how their perceptions affected the food system. This general objective was further broken down to three specific objectives which were: To determine the actors' health risk concerns that influence the food system, to find out how the perceptions of health risks by the actors influence the food system and to find out how the activities in the food system affect human health. The study established that a big number of the actors including their family members had never suffered from any illness related to food consumption. It thus means that the food produced is safe for human consumption.

The study established that the perceptions of health risks by the actors have an influence in the food system in a number of ways such as the rating of food handling from farm to the point of consumption by the actors was poor. The study established that there were enough measures at household level to reduce food contaminations. Actors at the household level indicated that they were ensuring food is totally dry before storing, putting chemicals for preservation among other measures. There were other general observations from the actors as well some of which include current low production due to inadequate rainfall; some crops such as potatoes and cabbages doing better as compared to others like maize; over reliance on rain fed agriculture; dependent on the season; food is not enough to last the whole year, potatoes are affected by earthworms thus reducing their productivity. The study too undoubtedly disapproved that working as a farmer affected the actors' health status.

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## LIST OF ABBREVIATIONS

AIDS.....	Acquired Immune Deficiency Syndrome
CAC...	Codex Alimentarius Commission
DPH...	Department of Public Health
DVS...	Department of Veterinary Services
FAO...	Food and Agriculture Organisation
FGDs...	Focus Group Discussions
GATT....	General Agreement on Tariffs and Trade
HCDA ...	Horticultural Crops Development Authority
HIV.....	Human Immunodeficiency Virus
HPI...	Horticultural Produce Inspection
ISO...	International Organisation for Standardization
KALRO...	Kenya Agricultural and Livestock Research organization
KDB...	Kenya Dairy Board
KEBS...	Kenya Bureau of Standards
KEPHIS...	Kenya Plant Health Inspectorate Services
KMC...	Kenya Meat Commission
MoH....	Ministry of Health
PHI...	Pre Harvest Interval
SARS.....	Severe Acute Respiratory Syndrome
WHO...	World Health Organisation
WMD...	Weights and Measure Department
WTO....	World Trade Organization

# CHAPTER ONE

## INTRODUCTION

### **1.1 Background of the Study**

The objective of this first chapter is to set out the overall study on the subject area of health risks related to food system activities. This is followed by stating the problem under investigation, a list of the questions the research want to answer and objectives to be achieved by the study, justification of the study, and operational definition of terms and closes with an outline of the chapters.

In the fight against poverty both good health and productive agriculture are essential as pointed out by Arthur and Bulkeley (2002). Health risks resulting from food system activities are not recent phenomenon, as is evident in literature focusing on the social and environmental related risks. Through practices such as the transportation of food and farm products across the world, processing, safe keeping and eventually consuming food, risks to human health are externalized, contested, mediated and ingested as noted by Arthur and Bulkeley, 2002.

Agriculture faces many challenges since the world is changing rapidly. Some of these changes are old such as constraints in the natural resources, severe weather conditions, and agricultural pests while some are recent like globalization, degradation of the environment, and challenges of keeping up with production in situations of conflicts. At the same time, there are other health concerns, problems and issues that go way beyond the boundaries of a single nation that are emerging like the Severe Acute Respiratory Syndrome (SARS), Human Immunodeficiency Virus (HIV), Acquired Immune Deficiency Syndrome (AIDS), and avian influenza, while the old ones have persisted. Hawkes and Ruel (2006) note that malaria, respiratory infection, tuberculosis, diarrheal diseases, and malnutrition do not only continue to severely affect humanity, but the health quarter has continued to undergo increasing challenges of chronic disease, resistance from drugs and insecticide, and a reducing ways of effective interventions.

With the continued integration of the world, the agricultural and health issues the globe is going through are continuously being integrated too.

Hawkes and Ruel (2006) further note that agriculture and health interact in two ways whereby agriculture affects health and vice versa. This argument is supported by Pinstrup-Andersen (2012) pointing out that human health, nutrition and food systems are so much related such that any shift in food systems accessioned by policy interventions among other drivers of food systems, may end up in either negative or positive health and nutrition effects; and the shift in health and nutrition have an effect in the food systems. Agriculture as noted by Hawkes and Ruel (2006) is essential for a better and proper health and wellbeing of individuals because it results in the production of food though it is linked to a number of major health challenges in the world such as food borne diseases, malaria, HIV/ and AIDS, chronic diseases which are a result of poor diet as well as other occupational health hazards. When such disease occur there is a major effect in the food system activities. (Pinstrup-Andersen 2012). In the public, health risks will affect the need for agricultural products in the market, while within the food production population employees who have an ill health will not be productive, thus cutting on the level of income. This then perpetuates the cycle of poor health and poverty and further leads to food insecurity hence putting in jeopardy the greater public's economic development. What this means is that with poor health of any individual involved in production there is loss of labor and the ability to produce food for human consumption. This can lead to over dependence on the producing population therefore increasing the level of poverty and making economic growth harder as earlier noted.

Food systems following Rastoin and Gherzi (2010) refers to an interdependent networks of stakeholders in an area geographical defined such as a state that are either directly or indirectly involved in the coming up with how goods and services flow aimed at making food available and satisfying people within a geographical area. The food system stakeholders could be financial institutions, public and private organizations or companies. Food systems have changed over time leading and this has made food more available and in very many varieties however there is still a challenge because not

everybody around the globe is able to access this food making access to it not to be universal.

The shifts in the food systems are closely linked with a rapidly urbanizing world, increased flow of money in terms of household incomes, market liberalization and direct foreign investment and because of these this specific study looks at the perceptions of health risks by different actors related to food system activities and the impacts the perceptions have on the food system. This is part of a larger research on food systems “Towards food sustainability: Reshaping the coexistence of different food systems in South America and Africa” which has five work packages and this particular research falls under work package four focusing on environmental performance and social-ecological resilience.

## **1.2 Statement of the Research Problem**

The prevalence of food production related issues such as the ones which have some kind of relationship to genetically modified organisms, Belgian dioxins chickens, vegetables infected with nuclear fallout from Chernobyl or with dioxins from waste burning plants and Chinese rice treated with heavily polluted used oil have become the symbols of an emerging risk facing humanity that most research scientists have to deal with (Arthur and Bulkeley 2002). Similarly Arthur and Bulkeley continue and assert that environmental and health threats like the application of pesticides and, hormones in the production of meat, farming of livestock in large scale and using different types of food additives in the industries dealing in the processing of food are resulting to increased concerns on the present day agro-food system.

At the same time, Arthur and Bulkeley (2002) point that actors globally, under very diverse conditions of food system activities must face and cope with such risks and this has made most actors to come up with routines and institutions on how they handle the inherent risk, for instance, through having a standard on how food should be produced, guided way of transporting and storing the same food, shopping behavior, rules and guidelines of how food is supposed to be prepared and consumed, keeping in check the

quality of foodstuff and labeling plans and practices of conveying information. Presently the large scale commercial food systems have been put side by side by routine exercises and establishments that try to bring down the situations bringing exposure to dangers and bring about firm belief among actors, but the institutions and discourses used do not go unchallenged because the large scale food systems keep on changing, Arthur and Bulkeley (2002).

From the social science literature on the way food production and risk has transformed, Arthur and Bulkeley (2002) points out that the nature of production and consumption has changed within the agro food system, the type of the hazards which are involved in producing and consuming food has also become different in nature and that normal risks which are related to poisoning from food, microorganisms, additives and agro-chemicals are still in place and has kept on drawing attention though a recent category of risk has also come up of which BSE and GMOs are the most common.

Currently, the health and agricultural sectors are commonly disjointed as Hawkes and Ruel 2006, Pinstrup-Andersen 2012 point out. Research that has been conducted over time as well as the policies that have been put in place to guide these two sectors have always been specific to an individual sector for instance health policy interventions have just focused on the health and not incorporating agriculture and vice versa and this means that challenges to do with health are only dealt with by looking at policies and programs regarding health, while when designing and implementing policies related to food rarely do the experts take into consideration health and nutrition goals. Health considerations normally play a very minimal role in the commitments agriculturist make about producing food, or ministries of agriculture make on policy, similarly, the sector concerned with health always never get it right as they do not take into consideration a very important sector which is agriculture. Further, Hawkes and Ruel 2006; Pinstrup-Andersen 2012 agree that this division downplays attempts to better the means of securing the life's necessities of farmers and gives short shrift to the role of food systems in coming up with solutions to the world's very serious health challenges. How the actors



perceive these health risks forms the basis of this research with a focus on how the perceptions affect the food systems. This is particularly important to identify relevant policies for formulation and implementation.

### **1.3 Research Questions**

This particular study attempted to answer the three questions listed below;

1. What are the health risk concerns by the actors from the food system?
2. How do the perceptions by actors on health risks influence the food system?
3. How do the activities in the food system affect human health?

### **1.4 General Objective of the Study**

This study just like many other studies had a general objective which was to find out how various actors within the food system perceive health risks related to food system activities and how their perceptions affect the food system.

### **1.5 Specific objectives of the Study**

1. To determine the actors' health risk concerns that influences the food system.
2. To find out how the perceptions of health risks by the actors influence the food system.
3. To find out how the activities in the food system affect human health.

### **1.6 Justification of the Study**

Food is a basic need for human survival thus we all come into contact with food each and every day. Research however shows that the human food relationship extends far beyond the act of consumption. The journey from its origin to the point of consumption is quite complex as it often passes through the hands of many people involved in different ways. Some of those involved in the foods journey from the farm to the point of consumption include producers, food processors, food transporters, warehouse operators, food retailers, food consumers and waste handlers. This is especially true for the agro-industrial and regional food systems which this research classifies as K1 and K2

respectively. This journey is dependent upon resources such as soil and fresh water and is dependant on people who come in different forms such as inform of an organization, policy makers, businesses, and the public in general. In turn, activities in the food system have an effect on human health, equity and the natural environment both positively and negatively.

Worth noting is that across the globe, the incidences of diseases related to food is really going up and food trade at the international level is interfered with by constant disagreements over the safety and quality requirements of food. In a number of developing countries food systems are not organized so much so that they only depend on a big number of those who produce on a smaller scale. This may have benefits socioeconomically, as a bigger chunk of food go through so many people handling food and those who buy the food from producers and sell them to the consumers, the danger of exposing food to environments which are not clean, poisoning and adulteration goes up. A number of challenges take place due to a substandard way of handling agricultural produce after harvesting, processing and keeping of foodstuff and because of limited space as well as infrastructure like the inexistence or shortage of supply of healthy water, electricity, facilities to store the foodstuff such as the cold stores, and good transport network facilities. In addition, most of those who produce and handle food do not have essential knowledge, expertise or skills necessary to put into place the current practices which are related to agriculture, good food handling practices and food hygiene. This however should never be mistaken to imply that all consumables from such sources is not safe since a number of long established ways of producing food and practices of handling food have existing food safety margins based on years of experience.

Research shows that challenges come about due to the inability to put up with the emergence of rigorous agricultural practices, development of urban areas, and pressure on resources of the earth as well as hazards related to the safety of food that never existed before. (FAO 2003). Food insecurity and obesity have been termed as “wicked problems” because of their complexity and many causes and the solutions to these are also not

simple. To deal with these issues, cities world over are coming up with multi-sector supports as well as approaches that involve the whole food system. Strategies that are already being put in place include programs, policies, and educational media campaigns addressing everything from agriculture to food disposal. The major intention of these approaches is to help in fixing the broken food system, raise the ability to access healthy foods equally and create positive collective impacts on environmental sustainability, health, social equity and cultural and economic vitality. (FAO 2003).

Healthy food is important to better health and wellbeing therefore lack of access, availability, and affordability of healthy food have serious health, economic and social consequences for individuals and society. FAO 2003 noted that some of the most vital public and environmental health problems of the 21<sup>st</sup> century are food security, obesity, and environmental sustainability. The food system and related agricultural policies that intersect with these health problems are coming under increased scrutiny and are broken.

Understanding the perceptions of health risks and impacts of the actors is important to understand how the food system activities operate. This research therefore aimed to look at how different actors within the food system perceived the negative effects that accrue from the food systems activities and what their perception mean to the activities. This is done covered by the study's broad objective which was to find out how actors perceive health risks related to food systems and how this perception affect the food system. It goes further to answer some key questions which at the end may inform policy formulation to help in dealing with the challenges the agricultural and health sectors currently face. It is imperative that the health risks concerns by the actors are clearly known and understood and whether or not they have any effect on the food system. Further, actors may also have perceptions about the health risks, and whether or not this perception has an influence on the food system is something that would be really interest those who come up with policies. Additionally, the activities that take place within the food system may have an influence on human health and the environmental outcomes.

The study attempts to find out which activities majorly take place and the effects on the health of people and the environment.

## **1.7 Scope of the Study**

### **1.7.1 Selection of the Study area**

The study area is north-west Mount Kenya region in Kenya. This region was selected based on a number of factors which were of great interest to the study. Some of the factors considered in selecting the study area were: the role the area plays in ensuring food security in Kenya and beyond; the existence of the five ideal typical food systems that Colonna et al. (2013) consider to be the most relevant from a global perspective (i.e. agro industrial, regional, local, domestic, and differentiated-quality food systems); the likelihood of studying conflicts, competition and synergies in the currently coexisting food systems context; existence of rapid agrarian change leading to upheaval in local agricultural systems and activities, impacting the livelihoods of local rural people, and affecting urbanization processes; since a number of studies have been previously conducted it was going to be easy to draw upon the work done by other scholars in the past.

### **1.7.2 Selection of the Food Systems**

The selection of food system that were studied was guided by the following criteria: their spatial, economic, social, and cultural relevance within the study region; representation of all five ideal-typical food systems (agro industrial, regional, local, domestic and differentiated-quality food systems) defined by Colonna et al. (2013) in the overall sample; and coexistence of several food systems in the study region making it easier to study the effects of their interactions.

### **1.7.3 Limitations of the Study**

The food systems that were studied were limited to three. This was in accordance with the resources that were available. (Both human and financial resources) This led the study to end up settling for the following food systems;

### **1.7.3.1 Agro-industrial food system**

This is key in the study region and was one of the food systems selected as a case study. It incorporates producing and trading in vegetables and fruits, and links the study region with consumers which mainly reside in Europe.

### **1.7.3.2 Regional food system**

The project settled for one regional food system which involves maize value chain and incorporates mainly those who own small or medium parcels of land who are part of a larger network of shareholders residing in the rural areas but these areas highly produce food and are majorly in the counties of Meru and Laikipia and actors living in peri-urban and urban sites involved in processing, trading, retailing, and consuming food in the county capitals of Meru and Nanyuki, the municipality of Nyeri, and Kenya's capital Nairobi.

### **1.7.3.3 Local food system**

One local food system which includes a short food value chain of producers, processors, traders, and consumers of fruits, maize, potatoes, vegetables, in the area of study was selected. This creates an important part of the local non formal trade sector, which links smallholder households and the local markets.

## **1.8 Operational Definition of Terms**

Before delving into the finer details about data acquisition and data analysis, and in order to prevent misunderstandings, the core concepts of 'food systems,' 'food quality,' 'food safety,' 'health risks,' 'actors,' 'perceptions,' and the 'impacts' are clarified and defined.

### **1.8.1 Food Systems**

Refers to interdependent networks of actors who may include but not limited to public organizations, private organizations, companies, financial institutions within a defined geographical area that take part in a way whether it is in a direct or in an indirect way to create a flow of goods and services which is aimed at providing and ensuring enough food for people within a geographical area or even in some other place. It incorporates all the activities related to food, the health, and biophysical environment, social and economic factors and demographic environments within which these occurrences take place and the outcomes from the socioeconomic, environmental and health. (Rastoin and Ghersi 2010; Pinstруп-Andersen 2012)

### **1.8.2 Quality of Food**

This is defined by Oloo, 2010 as all the characteristics of the products related or linked to food which have an effect on them being able to satisfy each and every legal, customer and the needs of the consumer.

### **1.8.3 Food safety**

This is defined by WHO (2007), as every danger or risk be it chronic or acute, that can lead to food being harmful to the health of the person consuming it. Food safety and quality are however and the terms mean different things, even though there can be an overlap as quality of food involves all product attributes that affect the value it has to the person who purchases the food for with an intention to consume it, while safety involves all causes of action that are meant to safeguard the health of the person consuming the food. (Oloo, 2010). Further, Oloo in 2010 notes that for one to consider food to be safe there should be reasonably shown proof that there will be no injury or harm that will take place when it is consumed under the intended conditions of use.

#### **1.8.4 Health risk**

This is defined by the medical dictionary (1995) as a disease forerunner related to a higher than average unhealthy state of mind or the rate of death. Causes of disease may include differences in the population, the way some individuals behave, family and individual histories and some physiological changes.

#### **1.8.5 Actors**

These are people or groups that have an investment, share, or interest and/or any kind of dependence in a certain food system.

#### **1.8.6 Perceptions**

Perception refers to awareness, comprehension or an understanding of something. (Oxford Dictionary, 2004)

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

The main objective of this section is to explore relevant information from past researches with a view to identifying gaps which this study attempts to fill. The chapter presents past studies on the global, regional and national food borne diseases related to the food chain, concept of food systems, legislation on foods and standards, national standards and auditing organizations and ends with a conceptual framework on the relationships between health risks and the food system activities.

##### **2.1.1 Global, Regional and National context of food borne diseases**

Scott (2003) notes that there are a number of indicators pointing to the fact that incidences resulting from food consumption is increasing across the globe and is a major trigger of unhealthy state of mind and mortality world over. Further, it has been put without certainty though that up to one-third of the population in developed countries is suffering from a food borne sickness year in year out. For instance, in a country like United States of America, sicknesses which are as a result of the consumption of spoilt or adulterated food result to approximately 76 million cases of illness every year (Scott 2003).

According to the WHO (2012), there exist an increasing concern when it comes to how multiple antimicrobial resistant bacteria is transmitted through the food chain and that a number of serious outbreaks of diseases related to food have been reported in the African Region. As a result it is observed that food can at times be a noiseless transmitter for physical, microbial and chemical dangers.

According to WHO (2012) report, its regional office recorded a number of diseases outbreaks which resulted from consuming contaminated food. Some of the cases recorded were related to food poisoning and diarrheal diseases. Accordingly, Scott (2003) continues and asserts that it can be supposed to be the case though without any concrete



proof that the widespread presence of food borne sicknesses in poor agricultural countries striving to become more advanced socially and economically is even higher, however it would be an uphill task to get accurate information that would support this assumption. Further a study as Scott (2003) notes of campylobacteriosis in poor agricultural countries gave an insight into the commonness of *Campylobacter* species, which is the most commonly set aside bacterial pathogen from children who are under two years suffering from diarrhea. The rates of isolation for children under five years were roughly calculated to be between 40,000 per 100,000 and 60,000 per 100,000, compared with 300 per 100,000 in poor agricultural countries. The study discovered that the serious sources of disease in human were food and environmental contamination and an observation of retail poultry sold in Bangkok and Nairobi revealed *Campylobacter* species contamination rates of between 40% and 77%. Coker et al cited in Scott 2003 revealed that this illness is expected to remain one of the top ten isolated bacterial pathogens globally in 2020.

### **2.1.2 Concept of Food Systems**

In this study focus is put on the food system using an innovative two way approach such as by taking into consideration the interaction with energy and chemical systems found in the ecosystems which then brings the question of how the resources like land and biomass are allocated then a socio-economic approach and then a highlight of the diversity of the food systems. Colonna et al (2013).

Food systems is defined by Rastoin and Ghersi (2010) as an interdependent networks of stakeholders in a geographical area that participate either in a direct or indirect way in the coming up with the flows of goods and services aimed at making those living in a similar area geographically defined to be satisfied in terms of having enough food and of good quality. Goodman, (1997) however defines food system as: “All processes involved in feeding a population, and encompassing the input required and output generated at each step. A food system operates within, and is influenced by the social, political, economic and environmental context”

Food systems are very different and entail a number of different but connected parts, that include everything from farmers just growing enough food to feed themselves and their families to food companies operating beyond one country's borders and as Hueston and McLeod (2012) notes that each and every individual eats; therefore, everyone depends on food systems, whether it is one found within a locality or across the country's boundaries. Different types of systems as shall be discussed coexist and reflect varied ways of processing, production, distribution and consumption of foodstuff, Colonna et al (2013).

Hueston and McLeod (2012) points out the emergence of food systems came with the emergence of human social development as well as organization when agriculture, including the keeping of animals, made the conditions right for people to come up with permanent settlements. During this time people started growing additional amount of crops and raising additional number of animals than it was needed to give food to the people who looked after the animals. This brought a change in human behavior and cultural practices; as opposed to the earlier hunters and gatherers, those who practiced farming needed not to be in sustained state of movement to find sources of food that were not existing before. Tilling of land to grow grains spared time for drying and keeping of some of the harvest for to be consumed at a later date. Divergent grain cultures came up in each of the cradles of advanced human social development for instance in Mexico there was the maize, in China rice, and in the Middle East wheat and barley. From the time agricultural practices started, food systems have continuously developed gradually, each and every change leading to advantages and challenges that never existed before and even greater variety and complications, Hueston and McLeod (2012).

Increases in the coherence and the rate of production of food systems have led to the accomplishments in bringing down the commonness of lack of food and enhancing nutrition around the world. However, Ericksen (2008) notes that these accomplishments are not able to be felt because of the serious worries about those parts of food systems that present threats to economic, social and environmental goals and therefore eroding food security.

The globe is a continuously changing fusion of the varied types of systems all of which have an effect on the other. Food systems do not function in isolation but within a permanent process of interactions, recombination and hybridization, Colonna et al (2013). Accordingly, Goodman, 1997 continues and asserts that the path that food travels from the farm to the table functions within and is affected by the social, political, economic and environmental context.

A food system is therefore a conceptually rich entity that extends beyond the simple operations carried out in a food chain, broadened to cover all the consequences of technical choices in terms of substitutions and generating scenarios for long term and large scale effects Colonna et al (2013). Different types of food systems can thus be identified together with the variables upon which each is based and the sustainability of some alternative systems such as Geographical indication products, organic farming and fair trade, Colonna et al (2013).

### **Local Food Systems**

In this type of food system consumption occurs at the level of the production unit where the excess or unconsumed products are sold locally or in the context of non-market exchanges based on family or social links. Processing is also domestic or may include some types of cooperative organizations, Colona et al (2013).

These as Colonna et al (2013) notes, comprise several intermediaries (short chains, direct sales etc) and there is generally geographical proximity between producers and consumers. Quality here is developed through direct or indirect knowledge of the producer by consumers, so it doesn't require any official signs of quality. In addition, the local food systems are sometimes coupled with efforts to ensure health or gustatory quality, while proximity promotes quality attributes that are not easy to measure. This type of food system has historically been present throughout the world.

### **Regional Food Systems**

Involves basic food products such as cereals, tubers, pulses, fruits, vegetables and other food products that can be stored, travel moderate distances (100 to 1000 km) between the regions of production and consumption, the latter often being urban. Generally, the chain often involves collectors, wholesalers, small-scale or semi-industrial processing companies and retailers with transport by rail or lorry. Few contracts are made between players and relationships tend to function more based on personal and trust relationships. This type of system exists traditionally in both Northern and Southern countries though in the latter case the chains are markedly restricted by transport problems particularly in Africa and by the instability of production and consumption due to price fluctuations.

The relationship between players are also more personal, sometimes involving networks led by urban based wholesalers who maintain credit relations with their suppliers and play an informative role. The principle logic or consistency underlying these networks is the security of supplies and redistribution, the diversification of activities, small material investments (generally leading to a relatively low overall cost) and flexibility (Hugon, 1985; Moustier et al., 2002) cited in Colonna et al (2013).

### **Agro-industrial Food System**

The principle objective here is to produce food for mass markets while reducing costs and maximizing profits. This type of food system is pegged upon the development of technological/commercial economies of scale, and on processes for specialized production within producing areas. It has given rise to the growth of processed products and incorporated services, Colonna et al (2013).

The economic, geographical and cognitive distance between producers and consumers is considerable, with a relatively large number of intermediaries (collection centres, industry purchasing platforms, distribution). Standardization and regularity are the attributes that underlie product quality, enabling compliance with national and

international regulations in terms of health, social and environmental requirements among others.

This type of system has also been developed under pressure from consumer movements focusing on food systems, mainly with respect to controlling price levels and establishing global systems for information and guarantees (in terms of quality, traceability, health or nutrition) Dubuisson - Quellier, 2009a cited in Colonna et al.

### **2.1.3 Legislation on Food Safety and Standards**

Food control which according to FAO (2003) refers to the compulsory intended activity of compelling people observe regulations by national or local authorities to make sure the consumers are protected and also ensure that all foodstuffs at the time of production, handling, storage, processing, and distribution are not exposed to any form of danger or risk, healthful and suitable to be utilized; comply to safe and best quality needs; and are truthfully and marked in a manner that is correct as recommended by law cannot be ignored in the minimization of the health risks related to food system activities. In most countries, the duty of controlling food is divided among different organizations with copying of regulatory activity, broken close observation and an inexistence of coordination being a usual phenomenon. In addition, the duty to protect the health of the public may at times be in serious disagreement with mandates to make trading easy or make an industry or sector grow. (FAO 2003)

The department of Public Health (DPH) under the Ministry of Health (MoH) has the responsibility of coordinating the institutions involved in enforcing the laws in Kenya. This shows that DPH has to ensure that the purchasers of food are free from any hazard which may arise from consuming the same food and they do this through ensuring the food is safe and of good quality. (Mwangi et al 2009; Oloo 2010)

Oloo (2010) acknowledges that proper laws on food which are designed to protect the consumers are in existence in Kenya but notes that there is lack of a food policy that exactly describes how food can be safe as part of a wider National Food and Nutrition Policy. However, the Kenyan Government has been working to come up with a law to ensure that consumer expectations are taken into consideration right from the when planning then to production to the marketing and finally to consumption. Specialized stakeholders are in existence and their sole responsibility is to ensure safety and concerns about the quality are taken into consideration. As such, several regulations and standards have been put in place to bring a positive growth of the food sector.

When it comes to the inspection and grading of agricultural produces for export and in general for the proper regulation of the preparation and manufacturing of agricultural produce for export, Agricultural Produce (Export) Act Cap 319 takes that into consideration. In this act, the regulations comprises Agricultural Produce (Export) (Horticultural Produce Inspection) and the Agricultural Produce (Grading of fruits and vegetables for export). The regulations and quality levels for fresh produce horticulture are undertaken at the port of exit by Kenya Plant Health Inspectorate Services (KEPHIS). Each exporter is expected to have an export license issued by Horticultural Crops Development Authority (HCDA) renewable on an annual basis. There are also clearly defined quality levels for containers which are used for export.

The Stock and Produce Theft Act Cap 355 governs the beef sub-sector in Kenya in addition to the Meat Control Act Cap 356 and other regulations which are related for instance the Meat Control (Export Slaughterhouses) Regulations, The Meat control (Local Slaughterhouses) Regulations, The Meat Control (Poultry Meat Inspection) Regulations, and the Meat Control (Transport of Meat) Regulations.

For there to be an influencing power over meat and all products that come from meat which is meant to be consumed by human and over slaughterhouses and places where such meat is processed and to provide for imports and export control over such meat and

meat products Cap 356 of the Meat Control Act exists to enable such to take place. Plans are underway to restore the Kenya Meat Commission (KMC) which earlier on exported beef to European Market. This plan is being executed by the Kenyan government through the Department of Veterinary Services (DVS). It will be taken care of by the Kenya Meat Commission Act, Cap 363 and will provide for a commission to buy farm animals and small stock, and to acquire, set up and operate abattoirs, meat works, cold storage concerns and refrigerating works for the purpose of slaughtering cattle and small stock, processing by-products, preparing hides and chilling, freezing, canning and storage beef, mutton, poultry and other meat foods for export or to be utilized in Kenya, and to bestow certain unique rights upon the said commission.

Oloo (2010) highlights the Public Health Act, Chapter 242, Meat Control Act, Chapter 316 and Food, Drugs and Substances Act, Chapter 254, as the basic Kenyan laws for food safety enforced by DPH. Most standards in Kenya are adopted from the international standards, such as Codex Alimentarius Commission (CAC) and International Organization for Standardization (ISO). FAO/WHO, 2005 documented a summary of the legal and policy framework of the agencies and the mechanisms for implementing the laws. The agencies include Kenya Agricultural and Livestock Research Organization (KALRO), Kenya Bureau of Standards (KEBS), Kenya Dairy Board (KDB), KEPHIS, Weights and Measures department (WMD), DPH, Government Chemist's Department, DVS, HCDA, among others. These agencies play a number of roles which include sensitization and implementation of hygiene codes and agricultural practices by stakeholders throughout the food chain. With all these laws however, Kenya still experiences major challenges of non-compliance with basic food safety and agricultural health practices in local markets. This is attributed to a low level of awareness of the said practices among small producers. (Mwangi et al 2009).

The non-formal sector in the food industry accounts for at least 80 percent of the supply to the domestic markets where hygiene controls are rudimentary thus exacerbating food borne diseases. (Oloo, 2010) Further he approximates that 70 percent of all cases of

diarrhea are attributable to consumption of polluted food and water. Foodstuffs which are already processed entail 75 percent and 25 percent of the diets in the urban and the rural areas of Kenya, respectively. The informal sector in the food industry entails small and medium size enterprises and food vendors, which supply at least 80 percent of the food products to local markets, including meat and milk, under rudimentary hygiene controls (Oloo, 2010). The removal of restrictions of large agricultural markets and the integration of food supply chains across the world have ensured there is confidence in the quality of food and safety a major concern approximately 75 to 80 percent of the Kenyan population is dependent on subsistence agriculture economy and 20 percent of all the agricultural food commodities are marketed (Oloo, 2010).

#### **2.1.4 National Standards and Auditing Organization**

In Kenya there are national standard and auditing organizations which it is imperative that we look at in details.

##### **Kenya Bureau of Standards (KEBS)**

One of the national standards and auditing organizations is KEBS which came into place through an Act of parliament, The Standard Act, and chapter 496 of the Laws of Kenya and came into operation in July 1974. It is mandated to prepare standards that relate to products, processes, materials, measurements among other duties and the promotion of such at all levels(national, regional and global); help in the production of goods of good quality; certification of industrial products; inspecting the quality of imports at ports of entry; enhancing measurement accuracies and dissemination of information relating to standards. KEBS also has a mandate to develop the Kenya standards; inspection of the quality of foodstuffs brought into the country and the ones which leave the country, certification, protection of the consumers, quality Assurance and testing services.



### **Kenya Plant Health Inspectorate Services (KEPHIS)**

This came into being through an act of Parliament with an aim of providing an efficient and effective regulatory service which is dependable to ensure that the agricultural inputs and produce are of good quality and this in turn enhances sustainable agriculture. To efficiently and adequately charge its mandate KEPHIS set up the Quality Control Services, Plant Breeders Rights Registration Services, and the Plant Protection Services units. Among the services offered by KEPHIS are advising the agricultural director on appropriate seeds and planting materials for export and import; coordinating of crop pests and matters to do with disease control; putting in place laboratories meant to monitor the quality and levels of toxic residues in plants as well as their soils and produce; carrying out inspection, testing, certification, quarantine control, variety testing and description of seeds and planting materials; undertaking grading and inspection of plants and plant produce at the ports of entry and exit.

### **Department of Veterinary Services (DVS)**

The DVS falls under the Ministry of Agriculture, Livestock and Fisheries. The department is charged with the responsibility of overseeing a number of responsibilities among them diagnosis, vaccination, artificial insemination, providing statutory disease control, controlling of ticks, vaccine production, clinical services and meat inspection.

### **Ministry of Health**

Under the ministry of health there is the DPH which is charged with the main mandate of coming up with provisions meant to maintain and secure the health of individuals. DPH has to ensure that all the foodstuffs are well protected so that in the event it is consumed it cannot be of any harm to the consumer. It also comes up with the guidelines that the buildings used to keep the foodstuffs are in proper hygienic conditions as well as having to keep to proper standard the public health for all the other food products such as meat and fish.

## **Laboratory Services**

As we look at the national standards and auditing organizations it is imperative that we put into focus the Laboratory of Government Chemist. This serves as the official laboratory for forensic analyses. It together with KEBS laboratory are employed in analyzing pesticide residues although the universities and Kenya Industrial Research and Development Institute (KIRDI) also offer laboratory services.

## **2.2 Theoretical Framework**

### **Environmental Epidemiology Theory**

Epidemiology is considered an applied science where the distribution which include the 'where' and 'when' and the determinants like the 'why' of conditions related to health or events in specified populations are studied then applied to the control of health challenges. It strives, through space and time, to specify and bring clarity to relationships between the state of human health and well-being and its underlying causes, with the goal of using that knowledge to promote, maintain, and improve human health (Soskolne and Racioppi 2006).

The National Research Council (NRC, 1991) defines environmental epidemiology as the study of the effect on human health of physical, biologic, and chemical factors in the external environment, broadly conceived. By looking at specific populations or communities exposed to different ambient environments, it aims to make clear the relationship between physical, biological or chemical factors and human health (Moeller, 2009).

For well over a hundred years, epidemiologic studies have played an important role in the investigation of how infectious diseases spread through the community. With the growing awareness of environmental pollution and its potential effects on health, the techniques of epidemiology have been expanded to investigate the effects of a variety of chemical and physical agents within the environment (Moeller, 2009).

Soskolne and Racioppi (2006) notes that the field heavily relies on the study of already existing patterns and events in the world, as opposed to active experimentation, in order to propose and test hypotheses about disease causation and propagation in human populations. This argument is supported by Moeller (2009) who assert that the field of environmental epidemiology is not experimental and involves a study of existing human population groups who have been inadvertently exposed to one or more chemical and/ or physical agents.

One of the first considerations in the design of an environmental epidemiologic study is the definition of its objectives and scope. As an extreme, one might consider looking at the health records of an entire population and linking that information with as many data on environmental factors as possible. Basic to such a study would be national death statistics and records on morbidity. To extend this type of study to include inquiries into the “health and habits” of individual members of the population on a national or local scale, however might be considered an intrusion on privacy and the financial costs would be prohibitive. Nonetheless, if success is to be achieved, some form of additional data gathering may be required (Moeller, 2009).

### **Significance of Environmental Epidemiology Theory to this Study**

Basically, epidemiology seeks to bring out the associations between risk factors and human disease like cholera, dysentery which are due to poor food handling with a view to bring out the casual linkage between the two. Risk factors are those agents known to propagate the chances of an illness occurring in humans. However, because of the biological variability inherent in individuals, in individual susceptibility, and in exposure-disease interactions, not every exposure of an individual to a risk factor will necessarily result in disease in that person. As a result of this, some degree of uncertainty and variability exists even among causal exposure and disease relationships. Epidemiology therefore uses statistics as an integral tool for evaluating the evidence for or against a particular exposure-disease relationship (Soskolne and Racioppi 2006).

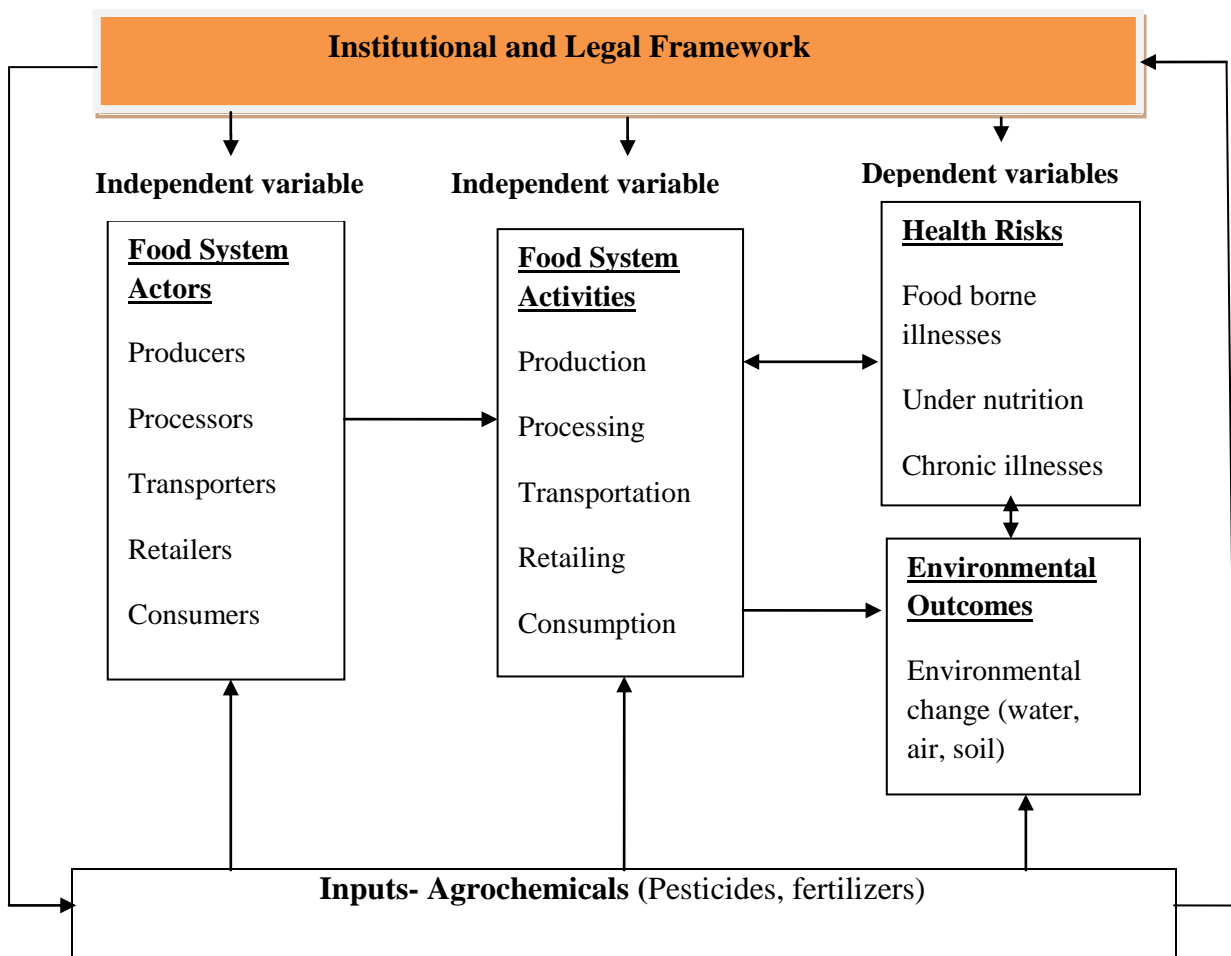
Whereas epidemiological research has both scientific and academic implications, its greatest utility may lie in its social significance. Epidemiology is an important method of providing factual and information which is evidence-based on any number of health concerns, and can thereby be used to prioritize the allocation of limited societal resources. Thus, findings obtained through epidemiological research can and should be used to improve public health, either through the provision of information directly to the public, through the creation of intervention or assistance programmes, or through influencing government policy (Soskolne and Racioppi 2006).

### **2.3 Conceptual Framework**

Food system activities and health related risks interact through the actors, environment, food and other outputs. Agricultural producers who are poor and their families are usually very vulnerable to malnutrition and disease. As agricultural systems interact with the environment, human health is affected while at the same time agriculture produces foods, fibers, and plants which are medicinal in nature and also has properties essential for human life, health, and culture. As shown in figure 2.1, the institutional and legal framework has a direct influence on the food system actors, activities in the food system, health risks and the inputs. This is basically because of the laws governing the health and agricultural sector. Food system actors affect the activities in the food system through various ways such as way of production, processing and even consumption. Food system activities on the other hand influences the health of human because they expose humans to various health risks but human health also has a great impact on the food system activities since with poor health there can be a reduction in each of the activity within the food system (production, processing, transportation, retailing and consumption)

Food system activities also influence the environmental outcomes for instance the use of chemicals may have severe effects on the environment. Health risks and the environmental outcomes interact in two ways with each affecting each other. The choice of inputs such as pesticides, fertilizers will influence the actors, activities within the food system and the environment and that makes it necessary to have a proper and functioning

institutional and legal framework. As such the independent variables in this conceptual framework are the food system actors (producers, processors, transporters, retailers and consumers) and the food system activities (production, processing, transportation, retailing and consumption) while the dependent variables are health risks (food borne illnesses, under nutrition, chronic illnesses) and the environmental outcomes (environmental change) Figure 2.1 shows a framework for linkages between, institutional and legal frameworks, food system actors, food system activities, health risks and the environmental outcomes as explained.



**Figure 2.1: Conceptual framework showing the interactions between food system activities, actors, environmental outcomes and health risks**  
*(Source: Researcher, 2017)*

## **2.4 Research Gaps**

A review of existing literature shows that a food system is a conceptually rich entity that extends beyond the simple operations carried out in a food chain, broadened to cover all the consequences of technical choices in terms of substitutions and generating scenarios for long term and large scale effects.

However there was a knowledge gap on the linkage between the food system activities and the risks of health of actors directly or indirectly involved. Additionally the health and agricultural policies are so much disjointed. Literature on how the agricultural and health sectors are linked was scarce and thus a need for further studies for a proper understanding on the linkage between the health and agriculture to bring out the importance of the linkage and how the perceptions of actors influence the food systems.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

Here the study background is outlined describing it in terms of the location, size, geographical characteristics, administrative and political units, physical environment and natural resources. In addition, it provides information on demographic profiles as well as land and land use. It also underpins the research methodology that was employed to give the direction of the study. Therefore, it entails the details of the design of the research, the population that was targeted, ways in which the data was obtained as well as the procedures, and how data collected was analyzed.

#### **3.2 Location, Size and Administrative Units**

Administratively, the study area was within Laikipia and Meru counties and only falls in Laikipia East and Buuri sub counties in the North West Mt. Kenya region. The figure 3.1 below shows the area where the study was conducted. The majority of the respondents at 67.7% were from Laikipia East and the minority of 32.3% from Buuri sub-county which indicate that respondents from Laikipia East were much more willing to participate in the interviews than their counterparts from Buuri.



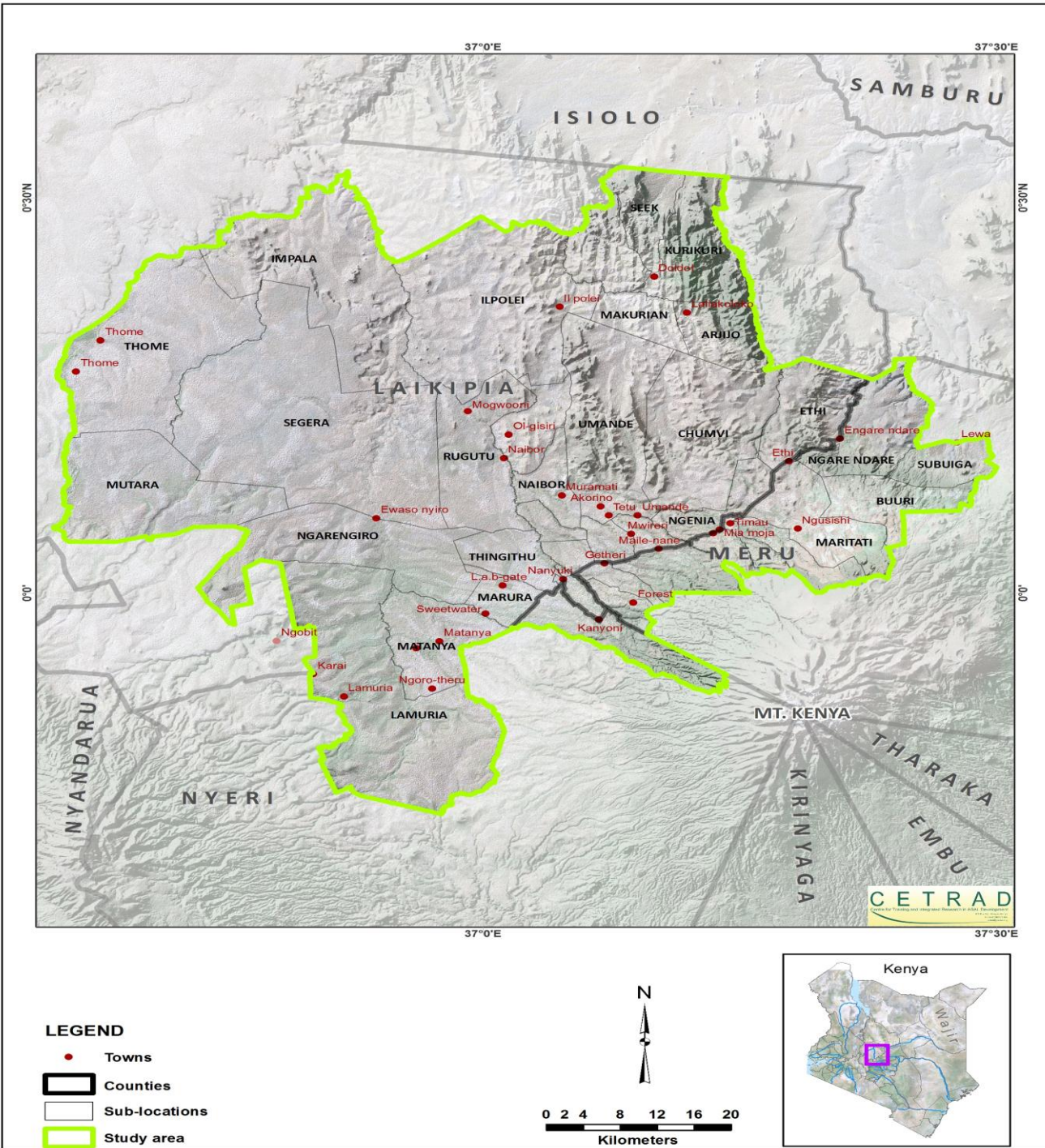


Figure 3.2: A Map of the study area.



### **3.3 Physical and Topographic Features**

The study area lies between latitude  $0^{\circ}18'S$  and  $0^{\circ}45'N$ ; and longitudes  $36^{\circ}70'E$  and  $37^{\circ}30'E$  as seen in figure 3.1 above. It is located within the Upper Ewaso Ngiro North basin which lies North to North East of Mt. Kenya and the Nyandarua (Aberdare) range. It also lies within the Laikipia plateau, an arid and semi-arid (ASAL) area. The climate of Timau sub catchment varies from humid towards Mt. Kenya in the south east to a mixture of sub and semi humid around Timau town with the remaining areas in the North West having semi humid to semi-arid type of climate. Around Nanyuki town the climate varies from humid to semi humid near Mt. Kenya and semi humid to semi-arid. Such climatic conditions with good soils promote intensive agricultural activities.

The main physical feature of the study area is Mt. Kenya (5199m). The area altitude varies from 5199 meters above sea level (masl) at Mt. Kenya to 2200 masl at Makugodo forest to 1800 masl towards the north at Sosian. Annual rainfall varies between 1200mm to 400mm. The area experiences different seasons in terms of the rainfall and these are the long rains which takes place between the months of March and May and the shorter periods of rains which occur in from the month of October through to November. The area experiences an average anual temperature ranges of between  $16^{\circ}C$  and  $26^{\circ}C$ . With this climatic condition the area is thus suitable for agricultural practices.

### **3.4 Demographic Structure and Composition**

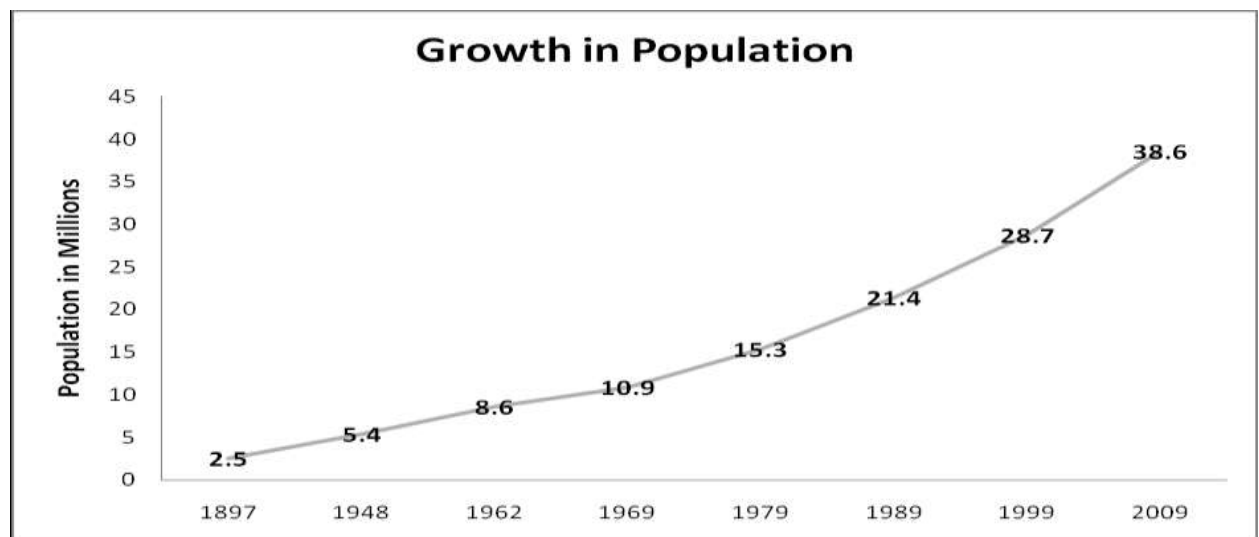
Nanyuki sub catchment has a total area of 73.9Km<sup>2</sup> with a combined population of 56,269 people living within seven sub locations (with an area of 721Km<sup>2</sup>) that are partly or completely within the sub catchment, while Timau has a total area of 269Km<sup>2</sup> with a combined population of 42,362 people living within eight sub locations (within an area of 1,018Km<sup>2</sup>) that are partly or completely within the sub catchment.

Differences in potential of land, land use, infrastructure development and existence of social amenities are the key factors that people consider when settling in an area. There are six different patterns of land use in the study area which are to a large extent

characterized by the conditions of the climate and the ecological zones. These zones include ranching, agro pastoral, pastoralism, mixed farming, mixed farming in marginal areas and formal employment (GOK, 2013).

### 3.5 Population projection and growth trends

As time and years go by, Kenya's population has been increasingly going up as was found in the 2009 Kenya Population and housing Census where the total population stood at 38,610,097 million people which represented a 35 percent population growth from the one conducted in 1999 that is 10 years before. This is a rapid increase compared to the previous years. Kenya conducts its population census after every 10 years. In 1962 to 1969 the population increased from only 8.6 million persons 10.9 million, in 1979 it was 15.3 million, 21.4 million in 1989, 28.7 million in 1999 and 38.6 million persons in the year 2009 (Figure 3.2 below).



*Figure 3.2: Kenya's Population growth trend*

*(Source: Kenya Population and Housing Census, 2009)*

At present the population of Kenya is estimated to be around 41 million people and this indicates that the population growth rate is one million two hundred thousand persons per

year or there about. From this statistics it is easy to conclude that the population has grown twice over the last 25 years. This is not exclusive of North West Mt. Kenya region where the study was based.

### **3.5.1 Population trend of the study area**

The projected population of Meru county stood at 1,443,555 (713,801 male and 729,754 female), with the average density in the county being 282 persons per km<sup>2</sup> in 2012. The population density ranges from 134 persons per km<sup>2</sup> in Buuri Sub-County, (Agricultural Sector Development Support Programme, 2016).

The total population for Laikipia County according to the 2009 Kenya Population and Housing Census (KPHC) report was put at 399,227 people. Out of this, 198,625 were males and 200,602 were females. This population was projected to be 427,173 persons in 2012 and is expected to increase to 457,514 and 479,072 in 2015 and 2017, respectively. The population density of Laikipia East Sub-County ranges from 137 persons per km<sup>2</sup>.

### **3.6 Socio-Economic Activities**

The main economic activities in the study area are farming and livestock keeping. Farming is practiced by small holders and large scale farmers. The small scale farmers have on average two acres of land where they practice mixed farming. According to GOK report in 2013, the main crops grown include beans, wheat, maize, vegetables and potatoes. The large scale farmers have more than twenty acres of land practicing commercial agriculture. The existence of wheat and vegetable farming in Laikipia is also noted by LWF, 2012 which shows extensive commercial wheat and vegetable cultivation in Eastern Laikipia, near Nanyuki urban center (LWF, 2012).

Livestock keeping in the study area is mainly in three forms. a) Livestock kept by the small scale farmer as part of mixed farming b) Livestock kept under pastoralism and c) livestock kept under the ranching system. There are also large scale farmers who keep

livestock for beef and dairy. Pastoralists keep cattle, sheep and goats mainly as a means of livelihood while the ranchers keep cattle for commercial purposes.

About 10% of the land in Nanyuki sub catchment is under crops and settlements, 20% under grasslands, 38% under forest and 32% is under moorland. Timau sub catchment on the other hand has about 20% of its land under crops and settlements, 51% under grasslands, 11% under moorland and the remaining 18% of land is under forest.

### **3.7 Research Design**

The study is a descriptive, non-experimental survey. It examined the actors' perceptions of health risks and impacts related to food system activities in North West Mt. Kenya region. Doyle (2004) and Creswell (2005) opined that descriptive survey helps in making generalization and inferences from a sample to a whole population in terms of attitudes, characteristics or behaviors of the population under study.

In this study descriptive survey was used since when you take into consideration the intention behind conducting this study, the research questions, and the size of the population; it was the most appropriate design which lead the researcher to end up achieving the objectives of the study and to come up with appropriate conclusions from the study. The current study utilized the descriptive design because this case already exists (It is a natural phenomenon).

### **3.8 Population of the Study**

The study targeted the actors in the food system who included: the household, the farm workers, farm managers, and the retailers in North-West Mt. Kenya region.

### **3.9 Sample and Sampling Procedure**

The study employed the sampling procedure known as stratified random sampling. This technique of sampling, allows the targeted population to be first stratified and then, to be followed by random sampling. The stratification is usually conducted by dividing the

members of the target population into homogeneous groups. This is then followed by the random picking through the use of simple random sampling. The process is therefore of great preference because no element of the population is left out. It should be noted that strata is also collectively comprehensive, and thus the sampling error is condensed if the procedure is applied, (Mugenda, 2003). In this case, the actors' related to the food system activities in North West Mt. Kenya Region were those interviewed.

In the sampling procedure, the actors' related to the food system activities in North West Mt. Kenya Region were stratified in four sections. They included: the household who were interviewed as consumers; the farm managers; the farm workers; and the retailers. In the population, the household actors has a population of 380, farm manager 5, farm workers 361, and retailers 331.

Out of the 380 households the researcher applied probability with respect to size whereby the stratum that contained largest number of Households had the highest probability of being selected. From the 380 only 12 were selected bringing the number of households interviewed to 31, from the 361 farmworkers again selecting 12 brought the total number of farm workers interviewed to 30 and from the 331 retailers the number of those interviewed were 27.

Table 3.1 shows these figures. A list of those to be interviewed was taken from each actor. Mugenda (2003) advises that a sample representing 10 % of the population is adequate to ensure that the entire population is represented. The 10 % of the population for households was used and purposive sampling of top management, farm workers and retailers. A summary of this information can be found in the table 3.1 below.

**Table 3.1: Food system actors interviewed**

<b>Strata</b>	<b>Finite Population</b>		
	<b>Population</b>	<b>Correction Factor</b>	<b>Sample size (n)</b>
	<b>(fpc) (n<sub>0</sub>)</b>		
Household	35,000	384.16	380
Farm Mangers	5		5
Farm Workers	6000		361
Retailers	2400		331
<b>Total</b>	<b>43,405</b>		<b>1,077</b>

*(Source: Field data, 2017)*

### **3.10 Instrument used in the study**

To obtain data from the respondents, the researcher used a questionnaire as the major tool which was administered by the researcher. This instrument is what was basically used to obtain data on the actors' related to the food system activities in North West Mt. Kenya region and was applied on all the actors including the farm managers. The research tool was categorized in two different parts which was section A and B respectively. Section A dealt with the personal or the demographic data of the actors. These included County, Sub-County, farm sizes in acres, age, gender, household size, and household headship among other variables. Section B assessed the health risks concerns of household actors, how the perceptions impact the food systems of the household actors, how activities impact human health by household actors, retailers as actors, and farm workers as actors. It is important to note that the questionnaires for each actors were all separate and different and a copy of each has been annexed.

### **3.11 Validity and Reliability**

Validity can be defined as the level in which a test measures what it is intended to measure. My supervisors approved the questionnaire following detailed scrutiny they did and after a pretest had been done by the researcher. In the process, all corrections, omissions, grammatical errors, and any form of ambiguity were removed. Consequently,

the items were found to be clear, precise, and concise. On the other hand, Cohen, Manion, and Morrison (2003) stipulated that reliability is a statistical characteristic of a score and is independent of content. Eshun and Effrim (2009) outlined seven methods of testing for reliability including the test–retest method. In ensuring that the questionnaires were reliable, a method which involved testing and retesting was used to determine the reliability coefficient. The questions were administered to about 10 actors in the food system in North West Mt. Kenya region. A week later, the same questionnaire was administered to the same actors again.

### **3.12 Data Collection Procedure**

The researchers presented an introductory letter from the Department of Geography and Environmental Studies of the University of Nairobi to those actors related in the food system for permission to carry out the study and appointments made to discuss the study and obtain permission from the actors to take part voluntarily. The researchers then explained why the study was being conducted in general terms with a promise to keep all the information given in a confidential manner, guaranteeing anonymity and placing emphasis on the need for candid responses that will not be used to victimize them in anyway. An emphasis was put that the information was only going to be used for academic purposes only.

### **3.13 Procedure used in analysing the data**

After collecting the data all the tools were collected and the first thing to be done was to undertake editing of the data, after that they were numbered serially, and thereafter coding was done. In analyzing the data, Statistical Package for Social Sciences (SPSS) version 23 software supported the analysis. Percentages, frequencies, and descriptive statistics were used to check if there were major differences in the frequencies observed and the frequencies expected.

**Table 3.2: Data needs matrix/Analytical Framework**

<b>Objectives</b>	<b>Sources of data</b>	<b>Data collection methods</b>	<b>Data Analysis</b>	<b>Data presentation</b>	<b>Expected Outcomes</b>
To determine the actors' health risk concerns that influences the food system.	<p><b><u>Secondary data</u></b></p> <p>Journals Books Reports</p> <p><b><u>Primary data</u></b></p> <p>Farm workers Households Retailers</p>	<p>-Literature review</p> <p>-Questionnaire administration</p> <p>- Interviews</p>	<p>Content analysis</p> <p>Qualitative and quantitative analysis using SPSS</p>	<p>Tables</p> <p>Photos</p> <p>Maps</p>	To understand the health issues of great concern that influences the food system activities in Laikipia East and Buuri Sub counties.
To find out how the perceptions of the actors influence the food system.	<p><b><u>Secondary data</u></b></p> <p>Internet sources Books Journals</p> <p><b><u>Primary data</u></b></p> <p>Key informants Public Health Environmental officer</p>	<p>-Review of Literature</p> <p>-Questionnaire administration</p> <p>-Interviews -Checklist</p>	<p>Content analysis</p> <p>Qualitative and quantitative analysis using SPSS</p>	<p>Tables</p> <p>Photos</p> <p>Maps</p>	<p>An understanding of the food systems actors perceptions</p> <p>An understanding of how these perceptions influence the food systems</p>



<p>To find out how the activities in the food system affect human health.</p>	<p><b><u>Secondary data</u></b>  Internet sources  Books  Journals</p> <p><b><u>Primary data</u></b>  Public Health/  Environmental officer  Farm workers  Households  Retailers</p>	<p>-Questionnaire administration</p> <p>-Interviews</p> <p>-Photography</p>	<p>Content analysis</p> <p>Qualitative and quantitative analysis using SPSS, MS-Access, MS- Excel</p>	<p>Tables</p> <p>Photos</p> <p>Maps</p>	<p>To understand how human health is affected by the food system activities</p> <p>Effects of food system activities on human health.</p>
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*(Source: Researcher 2017)*

### **3.14 Ethical Issues and Data Limitations**

Gillespie (1995) defined research ethics as guidelines or codes that assist in reconciling value conflicts. He goes further and notes that even though ethical codes give direction, it is very imperative that the decisions in research must be arrived at by taking into consideration the specific options that are in existence and that alternatives settled on in each case weigh the potential contribution of the research against the potential risks to the participants. Weighing these alternatives is essentially subjective and involves degree matters rather than kind and also involves a comparison and the experiences required in the research and the ones anticipated in day to day life.

Creswell (2007) acknowledges that researchers however practical and detailed their approach maybe, often faces varied limitations in the field when gathering data. This study is not exceptional and in its course some limitations were encountered. One of the challenges was the unwillingness of some of the stakeholders such as the farm managers to provide vital information on the grounds of confidentiality. To overcome this challenge, the researcher explained that the information will be used only for academic purposes.

In a number of instances there was an encounter with people under the age of 18, while some participants could also not understand English and the written information in the questionnaires. To overcome this, the researcher only conducted interviews among adults and while the illiterate group gave information via their local language which then was translated by the research assistant. Another major challenge that the study experienced was limited finances and time to cover the targeted population.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSION**

#### **4.1 Introduction**

In this chapter the study results and findings that was acquired from field responses is given. The analyzed data is broken down into household, retailers and farm workers as guided by the differences in the stakeholders involved in the study and the findings presented as per the objectives of the study.

##### **4.1.1 Sub-Counties**

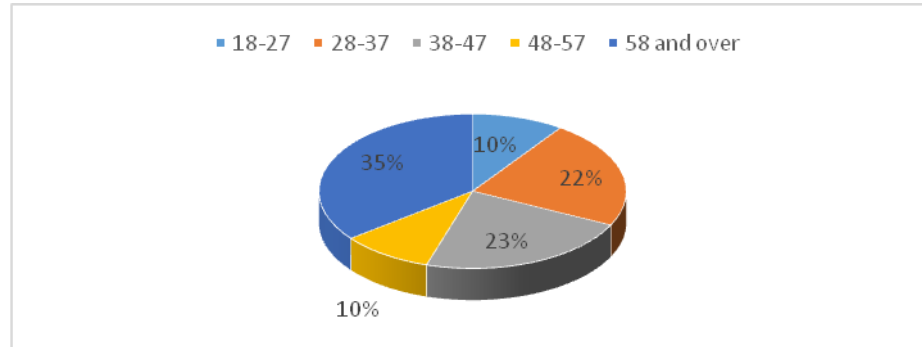
The majority of the respondents at 67.7% were from Laikipia East Sub-county, while on the other hand, the minority of 32.3% were from Buuri Sub-county. This indicates that respondents from Laikipia East Sub-county were willing to participate to the study as compared to Buuri Sub-county.

##### **4.1.2 Farm Sizes in acres**

The majority of the respondents at a frequency of 8, are possessing a farm size of 1 acre while the minority of them at a frequency of 1, were all possessing farm size of 0.75, 1.25, 4.5, and 5 acres. This is supported by Hakizimana, Cyriaque, et al (2017) who note that there is an increasing pressure and a demand on land in Meru County and that other processes of land fragmentation and consolidation have affected ways of farming models and their patterns of accumulation in different ways. They continue and assert that amongst smallholders, some of whom allocate a portion of their land to contract farming, there is increasing land fragmentation which is caused by the inheritance system, as land is divided across generations. This indicates that there is a high disproportion in farm size possessions. The majority has small farm size therefore disenabling them to fully practice the farming practices that they would want, but on the other hand, it is easier for them to manage such kind of farm size, therefore guaranteeing friendly environment with regards to management.

### 4.1.3 Age

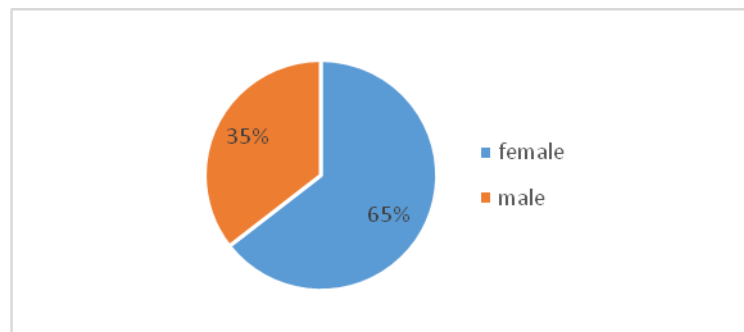
35% of the respondents are 58 years and above while on the other hand 10% represents 18-27 years and 48-57 years respectively. This indicates the major actors within the food system are within the ages of 58 years and above. This might be contributed by the fact that youths are not interested in the agricultural activities.



*Figure 4.1: Age (Source: Fieldwork, 2017)*

### 4.1.4 Gender

The majority of the respondents at 65% were female. The minority of 35% were male. This indicates that actors within the food system and its activities are majorly women. From the study therefore it can be concluded that it is the perception of women that majorly affect the food system as compared to those of men.



*Figure 4.2: Gender. (Source: Fieldwork, 2017)*

#### **4.1.5 Household Size and Headship**

The majority of the respondents 52% are in a household size of 3-4 people, the minority are in the household size of above 5 people, representing 3%. This indicates that actors within the food system in this region have lean household size of 3-4 in an average. This greatly affects the food system and perception because there is no big household size for the provision of labor force. Further most of the respondents were female indicating that there is a very big number of men moving to towns to look for other sources of livelihood. This not only result in reduced labor from the men if not a total loss of male labor but also affects the ability of a household to make some decision regarding investments in the farm.

This is also supported by Place et al 2006, who assert that when husbands are away, there is considerable variation in the extent to which women are able to make decisions over land management. In terms of labor, men generally provide important roles in land preparation, cutting of trees, and caring for live-stock. These roles can be assumed by women however their time is squeezed by other demands. When you have two adults in a households, it is easier to simultaneously practice good husbandry on their own land while also earning other incomes from activities not related to farming but with only one adult, there are more serious trade-offs in selecting one or the other option. 84% of the households interviewed were male headed, while 16% of the households were female headed.

#### **4.1.6 Duration lived in the area**

Majority of the respondents at 61% indicated that they have lived in the area for over 10 years; the minority have lived in the area for between 1-5 years and less than a year, both at 3% each. This signifies that on average, the respondents have lived in the area for over 10 years. It signifies that they are fully aware of the environmental conditions of the area and are more conversant with food regimes in the areas.

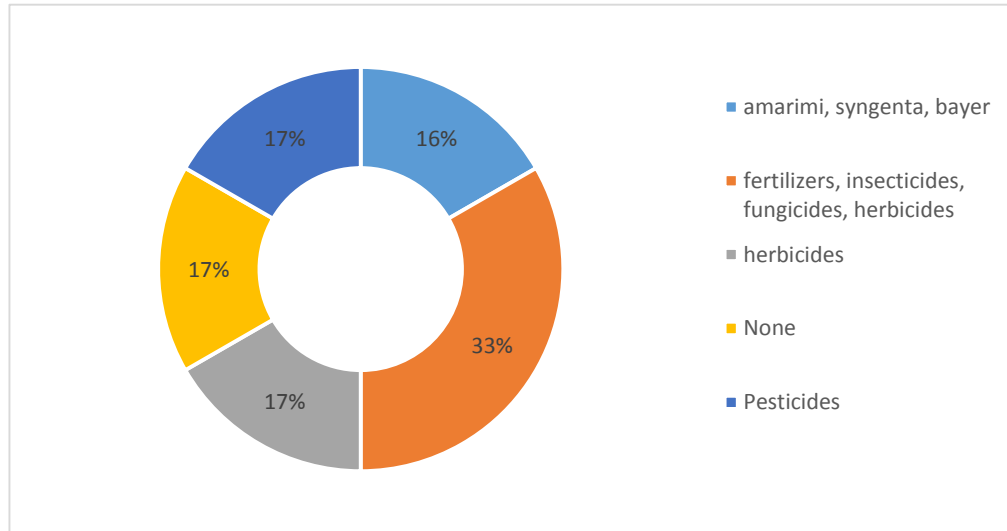
When it comes to the type of crop farmed in the study area the major crops included cereals, potatoes, vegetables, onions, tomatoes while some farms also grow lucern and hay.

#### **4.1.7 Source of income**

Overall a majority of the households according to this study had farming as their primary source of income. This stood at 81% compared to the 19% who supplemented their income by other means. From this it indicates that farming is the main source of livelihood, however, Hakizimana, et al (2017) in their study which focused in Buuri observed that for some households are forced to carry out both production in form of small scale agriculture on their own land and be involved in wage employment to be able to achieve adequate livelihood outcomes.

#### **4.1.8 Types of agrochemicals used**

14.3% of the farm workers had used the following types of agrochemicals: Fertilizers, insecticides, fungicides, herbicides, while some farm workers at 14.3% did not know the type of chemicals that they used in the farm. This indicates that the actors in the value chain were at a major risk because the farm works did not know the type of the agrochemicals that they were using in the farm. A minority of 2.9% indicated that they used: Pesticides; Biophate, geophate; DAP 17:17,MAP, cold related chemicals; Fertilizer; disinfectants; Fertilizers, herbicides; and insecticides. This shows that on an average, farm workers use agrochemicals in the farm. While applying the chemicals there are workers specialized in chemical application and they use protective gear. It is however important to note that some of these workers do not take the use of protective gear seriously since they do not put them on as they should be put on, some are loosely fitted while some are old and this has a great implication on the health of the applicant.



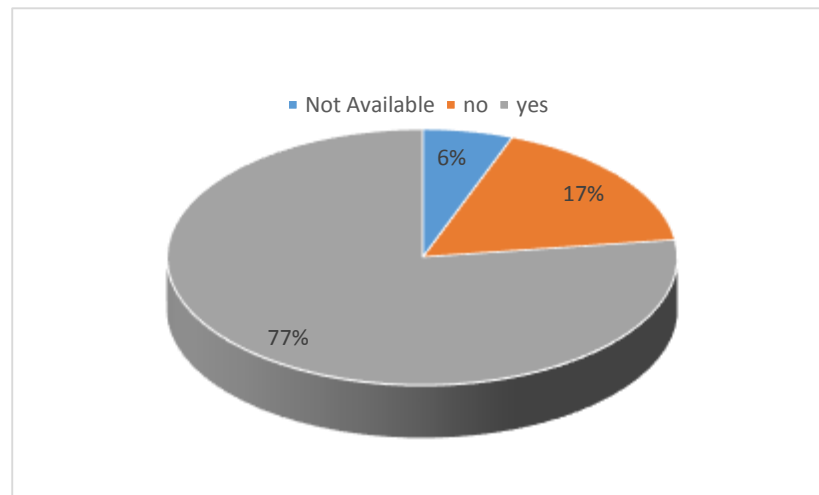
**Figure 4.4: Types of agrochemicals used**  
 (Source: Fieldwork, 2017)

#### 4.1.9 Number of years handling agrochemical

14.3% of the farm workers had handled agrochemicals for 3 years. This signifies that the farm workers have much experience in handling the agrochemicals on the farm and therefore reducing the health effects the chemicals would have on them and the environment. This in turn also ensures the safety of food produced. A minority of the farm workers at 2.9% responded that they had handled agrochemicals for less than 2 years. This implies that on an average, the farm workers have wealth of experience to handling the agrichemicals in the farm and thus rendering the whole system safety.

On Training on agrochemical use, 57% of the respondents have training on agrochemical use, while a minority of them do not have. This indicates that on an average, the farm workers have training on agrochemicals use in the farms. When it comes to the Use of protective gear, 77% of the farm workers interviewed used personal protective gears while applying agrochemicals on the farm. This indicates that farm workers are aware that they are supposed to wear protective agrochemicals gears so as not to harm themselves. A minority of 6% indicated that the protective gears were not available. On the other hand, 6% of farmers do not wear protective gears. Exposure to the pesticides usually occur as a result of the chemical spills but if the sprayer or mixer is well dressed

in the personal protective gears then this is tremendously reduced thus low risk. The figure below shows the use of protective gear by the applicant.



**Figure 4.5: Use of protective gear by the applicant.**

*(Source: Fieldwork, 2017)*

#### **4.1.10 Empty containers disposing methods**

25.7% of the farm workers destroy and burn empty bottles disposing methods. A minority of the farm workers at 2.9% empty bottles disposing methods through: company disposer; contracted agent; destroy and discard; Discard in the farm; Dispose and burn; incineration; keep for reuse; destroy and burn; keep in the store; return to company; and stored and suppliers come for them later.

On the expired agrochemicals disposing method 25.7% of the farm workers don't know expired agrochemicals disposing method, closely followed by farm workers dispose to the pit the expired agrochemicals disposing method. A minority of 2.9% of the farm workers use these expired agrochemicals disposing methods: As directed by supervisors; Burn; contracted agent; destroy and carried by suppliers; discard in the farm; incineration by the distributors; never experienced; put together to be collected for disposal; and stored and suppliers come for them later.



When asked whether they wash hands after disposing agrochemicals 90.7% of farm workers always wash their hand after disposing agrochemicals. This indicates that farm workers understand the importance of washing their hands so that they cannot contaminate food to them and along the production system. Some farm workers at 3.6% do not handle agrochemicals, 2.9% never wash their hands after disposing agrochemicals, and lastly, 2.9% sometimes wash their hands after disposing agrochemicals.

In response to the question as to whether they eat while handling agrochemicals a majority of farm workers at 85.7% never eat while handling agrochemicals indicating that they take into consideration high level of hygiene while only 5.7% of them handle agrochemicals while eating. When it comes to observing the Pre Harvest Interval (PHI) number of days a Majority of farm workers at 82.9% always observe PHI number of days. This indicates that they have been trained or have knowledge to observe PHI number of days. A minority of 2.9 do not know while at the same time, another 2.9% sometimes observe PHI number of days.

#### **4.2 Actors' health risk concerns that influences the food system.**

The first objective of the study was to determine the actors' health risk concerns that influence the food system.

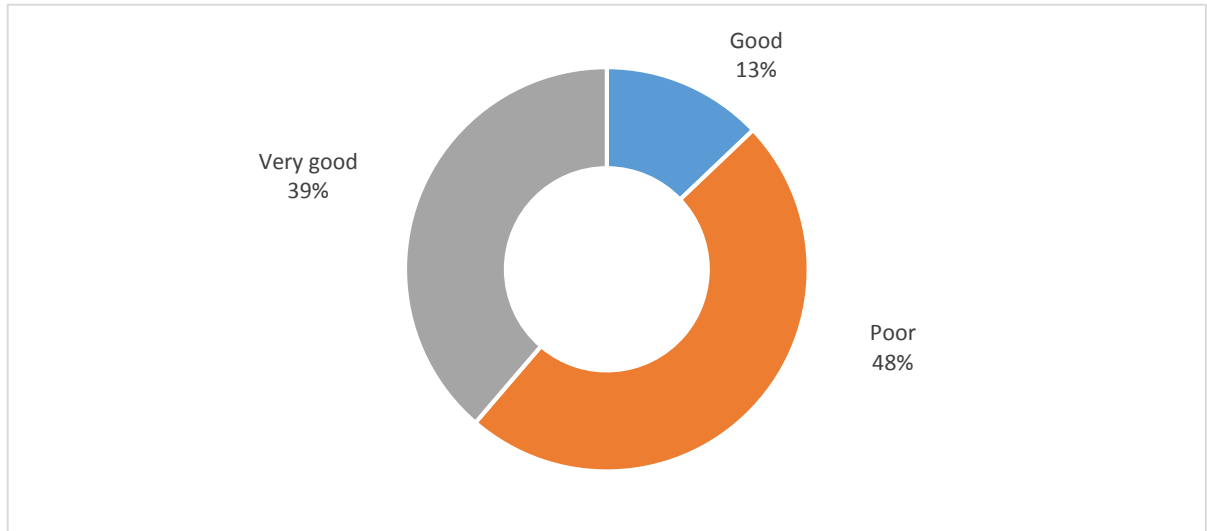
Here it is good to note that the respondents were asked the relationship between diseases and activities in the farm and 55% indicated that there was relationship between diseases and activities in the farm, the minority of 10% did not agree that there is relationship between diseases and activities in the farm. This indicates that on average, there is significant relationship between diseases and farm activities.

When asked if anyone in the family ever suffered from any illness related to food consumption, 97% of the respondents pointed out that no one in the family had ever suffered from any illness related to food consumption whereas 3% indicated the vice

versa. This shows that the food produced is fit for human consumption. When asked how often households suffered from illness related to food consumption, the majority representing 67.7% did point out that they do not at all suffer from illness related to food consumption. A minority of 9.7% did point out that they less often suffer illness related to food consumption. This indicates that the perception of the actors in this region is that food is fit for their consumption and food system related activities are also safe.

#### **4.3 How the actors' Perceptions Affect the Food Systems**

The second objective of the study was to find out how the actors' perceptions impact the food system and here the study revealed that on rating of food handling from farm to consumption, the figure 4.13 below shows that the majority, representing 48% have a perception that food handling from farm to consumption is poor. A minority of 13% of the respondents indicated that food handling from farm to consumption is good. This indicates that on average, food handling from farm to consumption is poor. This thus increases the risk of food system. This contradicts the observation earlier made where 97% of the respondents pointed out that no one in the family had ever suffered from any illness related to food consumption and a minority of 3% indicated otherwise showing that the food produced is fit for human consumption.



**Figure 4.3: Effect of actors perception on the Food Systems**  
 (Source: Fieldwork, 2017)

The study also sought to get the measures at household level to reduce contamination and in response to this question, majority of the respondents, at 6.5% are ensuring food is totally dry before storing, putting chemicals for preservation as measures at household level to reduce contamination. The minority at 3.2% specified that these were the measures at the household level to reduce contamination: Winnow the food, clean them and cook, storing them when dry; Washing food before preparation, ensure food is properly cooked; Washing food before preparation; Using clean utensils when cooking, storing food well by covering; Use of agrochemicals to keep off pests, cleaning food stuffs before consumption; Storing potatoes in cool places, using the fridge to store perishables; Storing harvested food in a dry place; washing hands; Proper storage in a dry place, preservation using chemicals so that weevils do not attack the crops;, for cereals application of chemicals to control weevils; Minimize winnowing after harvesting, esp. beans to avoid attack by weevils, use pesticides, to reduce attack by pests during storage; Keeping food stuffs clean, cooking as required; some use organic manure instead of fertilizers; Harvest when ready, store in the house after applying chemical to preserve; Ensuring food prepared is not kept for long; Ensuring food is totally dry before storing, burning infected food crops in the farm to avoid spread of infection; Ensuring food

(cereals, maize) is totally dry to avoid growth of aflatoxin; Ensure food is cleaned using boiled water; Cleaning of food before consumption; Cleaning food before preparation, storing food in a clean place where it is totally dry; Avoid use of pesticides, practice use of manure; Avoid use of agrochemicals. This indicates that on an average, there are measures at household level to reduce contamination due to perceptions of health risks by the actors that influence the food system.

#### 4.4 How the Food System Activities Impact Human Health

The third objective of the study was to find out how the food system activities impact human health.

Here the respondents were asked their opinion regarding safety of food production in the area and a majority representing 74.2% was of the opinion that the food produced in the area that was safe for human consumption. The minority of 10% were neutral on the opinion regarding safety of food production in the area. This signifies that the production activities have an impact in the food system by proving safe food production in the area.

When asked if there were diseases that people contracted from working in the farm 87% did not agree that there were diseases that people contracted from working in the farm. A minority of 13% agreed that there were diseases that people contracted from working in the farm. This shows that farmers have good habit of putting on personal protective gear while in the farm.

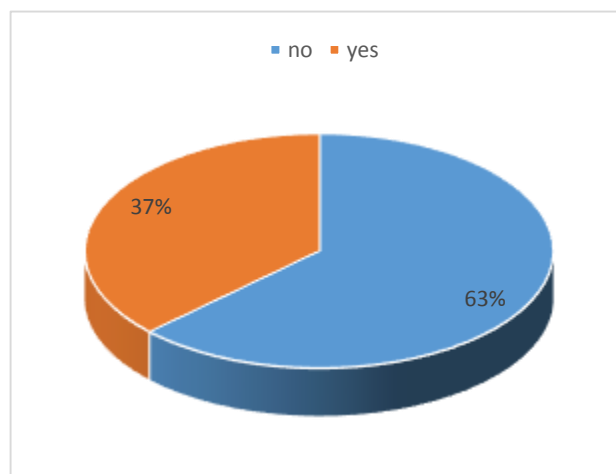
**Table 4.1 Rating risk of agrochemicals to human health**

<b>Rating risk of agrochemicals to human health</b>	<b>Frequency</b>	<b>Percent</b>
Moderately harmful	8	22.9
Not harmful at all	3	8.6
Slightly harmful	7	20.0
Very harmful	17	48.6
<b>Total</b>	<b>35</b>	<b>100.0</b>

*(Source: Fieldwork, 2017)*

The above table conceals that majority of farm workers at 48.6% rate risk of agrochemicals to human health as very harmful while 5.7% rate risk of agrochemicals to human health as none meaning that there is no risk at all.

In response to the question if they ever suffered ill health from use of agrochemicals 63% of farm workers indicated that they have never suffered ill health from use of agrochemicals. This could be because the respondents have enough knowledge and training on how to protect themselves and put on protective gears whenever handling agro chemicals. A minority of 37% indicted that they have suffered ill health from use of agrochemicals. Damalas and Eleftherohorinos (2011) points that those who prepare the mixtures in the field, those who spray pesticides, plus the population that lives near the sprayed areas, pesticide storage facilities, open fields, a greater risk is expected to arise from high exposure to a moderately toxic pesticide than from little exposure to a highly toxic pesticide. The chart below shows how the response to the question as to whether they ever suffered ill health from use of agrochemicals.

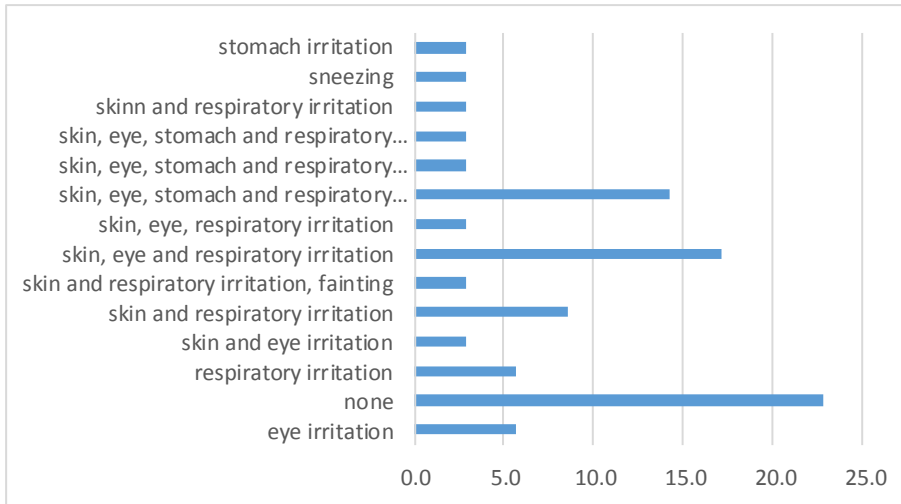


***Figure 4.6 The response to the question as to whether they ever suffered ill health from use of agrochemicals.***

***(Source: Fieldwork, 2017)***

When it came to how work and the current health status was related majority of farm workers at 88.6% indicated that the two were not in any way related and this indicates

there are other contributors to the relationship between work and health status. Some of them representing 3% indicated that there was a relationship between work and health status while 1% did not know.



**Figure 4.7 Human health symptoms ever experienced from use of agrochemicals**

*(Source: Fieldwork, 2017)*

In this section the study established challenges that are faced in food production and some of those identified include: absence of rain and water for irrigation during the dry season, potatoes are affected; availability of agrochemicals is minimized and expensive, pests and diseases, soil fertility is low so a lot of organic and inorganic fertilizer is needed to increase fertility; climate change that has caused inadequate rain and increase in frost; earthworms / millipedes that reduce crop productivity, frost that burns food as it grows in the farm; earthworms have negatively affected food production, fungi which adversely affect the potatoes; earthworms/ millipedes affect potato production, stalk borer infestation, animals like rabbits reduce food production, frost bite due to cold burn food; cutworms that affect cabbage and stalk borers for maize, financial constraints; exploitation by middlemen who buy from farmers at a throw away price, high cost of labor, lack of water because of frequent droughts; maize is at times infected by insects; earthworms that reduce yield, pest and disease infestation if spraying is not done, birds

destroy crops when they are shouting affecting production; maize is affected by stalk borer, seeds that are available may be infected with diseases; markets of food produced are not favorable to farmers, lack of dam used to store water for irrigation during the dry seasons; nearness to large scale farms that use agrochemicals results to decline in food produced in farms, size of land is diminishing, lack of extension workers to advise farmers on best practices, use of agrochemicals that are sprayed on crops; and use of fertilizers has negatively affected soil.



*Plate 4.1: One of the large scale vegetable farms. (Source: Field Data, 2017)*



*Plate 4.2: Agrochemicals mixed and ready to be used in the farm. (Source: Field Data, 2017)*





*Plate 4.3: Some of the farm workers in one of the vegetable farms during harvesting. They do not put on protective gear basically because they do not deal with chemicals but perceive this activity to be very safe. (Source: Field Data 2017)*



*Plate 4.4: A modified tap put at the entrance/exit of one of the farms where the farm workers are expected to thoroughly wash their hands before leaving the farm. (Source, Field Data 2017)*



*Plate 4.5: During the interviews in one of the farms talking to one of the farm workers who is in charge of mixing the chemicals. The chemical mixer is on protective gear though not full. (Source: Field Data 2017)*

## **CHAPTER FIVE**

### **SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

The chapter is subdivided into three distinct parts, the first part presents the study's summary of findings relating it to the study objectives. The second part presents conclusion on the study findings and the third section outlines the recommendations.

#### **5.2 Summary of key findings**

As was earlier noted this study had a number of objectives which it aimed at filling. This section therefore gives a summary of what the study found out in a very brief way as per the objectives. The first objective of the study was to determine the actors' health risk concerns that influences the food system. The study found out that the health risk concerns influence the food system and therefore there is significant relationship between actor's health risk concerns and the food system activities.

When it comes to objective number two of this study which aimed at finding out how perceptions of health risks by the actors influence the food system. The study found out that there is relationship between actor's perceptions of health risks and the impacts of food system, thus the study found out that actors' perceptions of health risks have an influence on the food system activities.

This is based on the rating of food handling from farm to consumption where the majority of the stakeholders at stated that food handling from farm to consumption was poor. It is also based on the measures at household level to reduce contamination, where the majority of stakeholders at are ensuring food is totally dry before storing, putting chemicals for preservation as measures at household level to reduce contamination. Some of them listed that they winnow the food, clean them and cook, storing them when dry; Washing food before preparation, ensure food is properly cooked. It is also based on the perception whether work as a farmer affected the stakeholder's health status. The study

found out that the stakeholders strongly disagreed that work as a farmer affected their health status.

The third objective was to find out how the activities in the food system affect human health. The study revealed that actors did not agree that there are diseases that people contract from working in the farm.

### **5.3 Conclusion**

The study established that the actors' health risk concerns that influences the food system was such as; relationship between diseases and activities in the farm, did hinder the influence of the food system. This is because the actors indicated that there is relationship between diseases and activities in the farm. The study established that a big number of the stakeholders' family had never suffered from any illness related to food consumption. It thus means that the food produced is safe for human consumption. The study too proved that the majority of the stakeholders pointed out that they did not at all suffer from illness related to food consumption. The actors most of the time seeks for health attention at the health centers as compared to other health facilities such as the government hospitals.

The study established that the perceptions of health risks by the actors have an influence in the food system in a number of ways such as the rating of food handling from farm to consumption by the stakeholders was poor. The study established that there were enough measures at household level to reduce food contaminations. Actors at the household level indicated that they were ensuring food is totally dry before storing, putting chemicals for preservation among other measures. There were other general observations from the actors as well some of which include current low production due to inadequate rainfall; some crops such as potatoes and cabbages doing better as compared to others like maize; over reliance on rain fed agriculture; dependent on the season; food is not enough to last the whole year, potatoes are affected by earthworms thus reducing their productivity. The study too undoubtedly disapproved that working as a farmer affected the actors' health status.

The study established how the activities in the food system affect human health as: the stakeholder's (actors) opinions regarding food production safety in general was that the food produced in the area and finally consumed was safe. The study also established that the actors in the system did not agree that there were diseases that people contracted as a result of working in the farm. The study demonstrated that actors should mostly avoid using chemicals that may harm them among many other measures to ensure that they do not contract diseases from the farm: adopt use of organic fertilizer instead of inorganic fertilizers.

#### **5.4 Recommendations**

In order to ensure proper performance of actors' perceptions of health risks and impacts related to food system activities in North West Mt. Kenya region, the study recommends the following:

1. The actors (Household, Farm Workers, Farm Managers, and Retailers) health should be taken into consideration if the food system is to be improved. This is because when the stakeholders are healthy, they will be physically and emotionally fit to engage their energy in all the food system production, therefore a bumper harvest and to the extension meeting the consumers' needs.
2. The Health Centers should be evenly distributed and adequately furnished with both medicines and health personnel to efficiently and effectively handle cases of food related diseases. This will additionally manage the other non-related food health cases in the region.
3. There should be well-defined mechanisms by all actors to help in improving the ratings of food handling from farm to consumption. This will reduce food wastages among all actors therefore minimizing the already experienced massive food loss and wastages.
4. There should be increased level of awareness by the consumers at the household levels on how food contamination should be further reduced to guarantee food safety.

5. The agrochemicals and the protective gears should be subsidized by the Government so as to ensure they can be accessed by all the actors within the food system.

### **5.5 Suggestions for Further study**

Worth noting is the fact that this particular study was only limited to actors' perceptions of health risks and impacts related to food system activities in North West Mt. Kenya region. The researcher has the following suggestions to be considered as areas for further research:

1. Need to have similar studies being conducted in other counties where commercial agriculture is being practiced.
2. There is need to do a study on how the two sectors, agriculture and health can be integrated so that the policies are harmonized.

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**APPENDICES**

**APPENDIX I: FARM WORKERS QUESTIONNAIRE**

**BACKGROUND INFORMATION**

Name of Farm (Optional).....

Date of the interview.....

Sub County.....County.....

Crops growing in the farm.....

What is your specific role (s) in the farm? .....

.....

Types of agrochemicals usually used- (fertilizers, insecticides, fungicides, herbicides).....

.....

Number of years handling agrochemicals.....

**AGROCHEMICAL HANDLING AND SAFE USE**

**Have you ever undergone any training on agrochemical use?**

- a) Yes
- b) No

**If yes, kindly tick any topic(s) below you were trained on with regard to agrochemicals**

- a) Fertilizer use
- b) Pest and disease control
- c) Impacts of agrochemicals on human health and their safe use
- d) Impacts of agrochemicals on the environment and safe use
- e) Other.....

**How would you rate your knowledge on appropriate use of agrochemicals?**

- a) very little
- b) little
- c) enough
- d) more than enough

**Who is the primary mixer of agrochemicals used on the farm?**

.....

**Does the applicator always wear protective clothing when handling the chemicals/spraying?**

- a) Yes
- b) No

**If NO to the above, please state the reason(s) why.**

.....  
.....

**How are the empty agrochemical containers/bottles disposed?**

- Dispose into the disposal pit
- dispose in the latrine
- discard them in the farm
- Keep for re-use
- Destroy and burn or bury
- Other

(specify).....

**How do you dispose any spoilt/expired agrochemicals?**

- Dispose into the disposal pit
- discard them in the farm
- dispose in latrine
- discard in nearby bushes/roadsides
- Other

(specify).....

**Do you wash your hands with soap every time you handle agrochemicals?**

- a) Never
- b) Sometimes
- c) Always

**Do you eat or drink while inside the store or when handling chemicals?**

- Never
- Sometimes

- Always

**After spraying pesticides do you observe the pre- harvest interval (PHI) number of days if;**

- Never
- Sometimes
- Always

**How would you rate risk effects of agrochemicals on the human health?**

- Not harmful at all
- slightly harmful
- moderately harmful
- very harmful

**Have you suffered ill health problems you associate with agrochemical use from your work?**

- a) Yes   b) No

**Is there a relationship between the work you do in the farm and the status of your health?**

- a) Yes   b) No

**Which below are the human ill health symptoms you have experienced and associated with use of agrochemicals?**

- a) Skin irritation (e.g. rash, itching, burning or prickling),
- b) Eye irritation (impaired vision, redness),
- c) Stomach irritation (nausea, vomiting, diarrhea, excessive salivation, abdominal pain),
- d) Respiratory irritation (chest pain, cough, running nose, wheezing, difficulties in breathing, throat irritation
- e) Other(s).....
- f) None

**Any additional information.....**

**APPENDIX II: HOUSEHOLD QUESTIONNAIRE**

**BACKGROUND INFORMATION**

Name of respondent (optional).....

Sub County.....County.....

Date of the interview.....

Farm Size in acres.....

**Age**

18-27  28-37  38-47  48-57  58 and over

**Gender**

Male  Female

**Household Size?**

1-2  3-4  5-6  Other

**Type of household headship**

Male headed  Female headed  Child headed

**How long have you lived in this area?**

Less than a year  1-5 years  6-10 years  Over 10 years

**What type of crops do your farm?**

Cereals  Fruits  Vegetables  Others

**Is farming your primary source of income?**

Yes  No

**Specify any other source of income if any**

.....

**What specific activities do you play in the farm?**

.....

**Have you employed anyone to help you work in the farm?**

Yes  No

**If yes, what is their specific role (s) in the farm?**

.....

**Do you have family members working in the farm?**

Yes  No

**What activities are more likely to cause sickness/illness in your farm?**

.....

**Do you or any member working on your farm suffer from any disease as a result of your/their work there?**

Yes  No

If yes, specify

.....

**HEALTH RISKS CONCERNS**

**Is there a relationship between the diseases and the activities in the farms?**

Yes  No

---



**Have you or any of your family member ever suffered from any illness related to food consumption?**

Yes  No

If yes, specify the disease.....

**How often do members of your household fall sick as a result of food consumption?**

Often  Less often   Rarely  Not at all

**What are the diseases that you would consider as the greatest threat which are common in this area?**

.....

**Where do you get health services/ treatment for such diseases?**

Health center/ Government hospital  I buy drugs over the counter

Private hospital  others (Specify)

**Do you think the disease(s) affect the production of food?**

Yes  No

If yes, Explain.....

### **HOW THE PERCEPTIONS IMPACT THE FOOD SYSTEMS**

**How can you rate the handling of food from the farm until it is consumed in your household?**

Very Good  Good  Poor  Very Poor

**What are the measures you have put in place at household level to reduce the risk of food being contaminated?**

---

.....  
.....  
**What general comments do you have on food production in this area?**

.....  
**Do you agree that your work as a farmer has affected your health status?**

Strongly Agree        Agree       Neutral       Disagree       Strongly Disagree

**HOW ACTIVITIES IMPACT HUMAN HEALTH**

**What is your opinion regarding the safety of food produced in this area?**

Very safe     Safe     Neutral     Not safe at all     Don't Know

**Are there any diseases that people contract as a result of working in the farm?**

Yes  No

If yes, specify.....

**What do you think should be done to ensure that people do not contract diseases from the farm?**

.....  
**Do you think the process of producing food has any effect on human health?**

Yes  No

If yes explain?  
.....

**Would you say the activities are safe?**

Yes  No

If **NO** which of them is not safe?

.....

**List some of the challenges faced in food production.**

.....

**APPENDIX III: RETAILERS QUESTIONNAIRE**

**BACKGROUND INFORMATION**

Name of respondent (Optional)..... Sub County.....County.....

Date of the interview.....

**What type of food crops do you sell?**

- Cereals
- Fruits
- Vegetables
- Others (Specify)

**Is food retail your primary source of income?**

Yes  No

Any other source of income (Specify) .....

**Have you employed anyone in your business?**

Yes  No

**If Yes, what specific duties/roles do they perform in the business?**

.....

**HEALTH RISKS PERCEIVED**

**What is the disease (s) related to food consumption that you know?**

.....

**Have you, your employee (s) or someone you know ever suffered from any illness related to food consumption?**

---

Yes  No

If YES, specify the type of illness.....

**How often/ long ago did this occur?**

.....

**Where do you seek medical attention when you are sick?**

Health center/ Government hospital  I buy drugs over the counter

Private hospital  others (Specify)

**What are the diseases that the locals mostly suffer from?**

.....

.....

**Which of the diseases mentioned above relate to food consumption?**

.....

**Is there a relationship between these diseases and activities in the farm (s)?**

Yes  No

**ACTORS PERCEPTIONS**

**Do you think the disease (s) that people suffer from affect the production of food?**

Yes  No

If yes, state how

.....

**How do you store food that you sell?**

---

.....  
**How do you preserve the food you sell?**

.....  
**How do you package?**

.....  
**How do you transport the food from the source to your retail shop?**

.....  
**What are the health risks related to:**

Storage of food?  
.....

Preservation of food?  
.....

Packaging of food?.....

Transportation of food? .....

**How can you rate the handling of food from the farm until it is consumed?**

Very Good  Good  Poor  Very Poor  Don't know

**What are some of the practical measures you have put in place to reduce the risk of food being contaminated?**

1. ....

2. ....

**IMPACTS OF THE ACTORS PERCEPTIONS ON THE FOOD SYSTEM**

**In your own opinion what do you think should be done to ensure that risks resulting from food production, retail and consumption are minimized?**

.....

**Do you play any role in production of food in this area?**

Yes  No

Explain.....

**Do you have any influence on the prices of food you sell?**

Yes  No

If yes, explain

.....

**How do you ensure that the produce you retail are of the right quality for human consumption?**

.....

**Do you think the process of producing food has any effect on human health?**

a) Yes                       b) No

If yes, state how?

.....

**What are the health authority requirements to operate a food retail shop?**

.....

**Any additional comments.....**

.....

**APPENDIX V: FARM MANAGERS QUESTIONNAIRE**

**BACKGROUND INFORMATION**

Name of Farm (Optional).....

Sub County.....

County.....

Date of the interview.....

Position in the Organization.....

Farm size in acres.....

Crops growing in the farm.....

What are the common problems affecting crops (soil fertility levels, diseases, insects, weeds) .....

Types and names of agrochemicals usually used- fertilizers, insecticides, fungicides, herbicides.

Number of years of farming experience with use of agrochemicals.....

**ACTORS PERCEPTIONS/HEALTH RISKS PERCEIVED**

**Are you aware of any person working on this farm who has suffered any food related disease?**

a) Yes

b) No



**Is there a relationship between the diseases and food activities in the farms?**

c) Yes

d) No

**How can you rate the handling of food from the farm until it is consumed?**

a) Very Good

b) Good

c) Poor

d) Very Poor

**What are some of the practical measures put in place to reduce the risk of food produce being contaminated?**

1.....

2.....

3.....

**In your own opinion would you say there is a relationship between the health risks to humans and the activities in the farm?**

**AGROCHEMICAL USE KNOWLEDGE AND MANAGEMENT PRACTICES**

What is the reason(s) why you use agrochemicals (Fertilizers and Pesticides) in your farm?

a) To increase yields

b) To control pests and diseases

c) To improve appearance (spotlessness) for marketability and better price.

- d) Advised to do so by extension agents
- e) Other (specify) .....

How do you determine the type of agrochemicals to apply in your farm?

- a) Use own experience
- b) Asks what other farmers have used
- c) As advised by extension officer
- d) Experiments on different types then choose
- e) As advised by inputs stockist
- f) On what can afford
- g) Other (specify) .....

Before using an agrochemical do you check if it is currently approved for the intended specific target/insect, disease or weed?

Yes  No

Do you read the instructions on the label before using a particular agrochemical?

Yes  No

If yes, do you understand the instructions specified for chemical/pesticide usage?

Yes      No

Do you subsequently follow the instructions as prescribed?

Yes  No

How do you measure the required agrochemical amount for a particular purpose?

.....  
How would you rate risk effects of agrochemicals on the environment?

Not harmful at all

Slightly harmful

Moderately harmful

Very harmful

Are you aware of potentially beneficial organisms in the farm which could be harmed through use of agrochemicals?

Yes  No

If yes kindly name them.....

Do you take precaution to ensure the organisms are not harmed when applying Agrochemicals/pesticides?

Yes  No

What are the measures you undertake to avoid harming the beneficial organism?

.....  
If the agrochemicals are approved and sold at licensed agrovets/stockist, then it means they are safe for use in the environment?

Agree  Don't know  Disagree

Have you ever undergone any training on the use of agrochemicals?

Yes  NO

If yes, kindly tick any topic(s) below you were trained on with regard to agrochemicals

- f) Fertilizer use
- g) Pest and disease control
- h) Impacts of agrochemicals on human health and their safe use
- i) Impacts of agrochemicals on the environment and safe use
- j) Other.....

How would you rate your knowledge on appropriate use of agrochemicals?

- e) Negligible
- f) very little
- g) little
- h) enough
- i) more than enough

**AGROCHEMICAL HANDLING AND SAFE USE**

Who is the primary mixer of agrochemicals used on your farm?

If the person handling chemicals never puts on protective gear when doing the work, kindly state why.

How do you dispose agrochemical containers/bottles that are empty?

- throw into a disposal pit
- throw in the latrine
- discard them in the farm

- Keep for re-use
- Destroy and burn or bury
- Other Specify

How do you deal with spoilt/expired agrochemicals?

- Dispose into the disposal pit
- discard them in the farm
- dispose in latrine
- discard in nearby bushes/roadsides
- Other (specify).....

Do you/workers eat or drink while inside the store or when handling chemicals?

- Never
- Sometimes
- Always

After spraying pesticides does the farm observe the pre- harvest interval (PHI) number of days if;

- Never
- Sometimes
- Always

How would you rate risk effects of agrochemicals on the human health?

- Not harmful at all

- slightly harmful
- moderately harmful
- very harmful

Have you suffered ill health problems you associate with agrochemical use?

Yes  No

Which below are the human ill health symptoms you have experienced and associated with use of agrochemicals?

- i) Skin irritation (e.g. rash, itching, burning or prickling),
- ii) Eye irritation (impaired vision, redness),
- iii) Stomach irritation (nausea, vomiting, diarrhea, excessive salivation, abdominal pain),
- iv) Respiratory irritation (chest pain, cough, running nose, wheezing, difficulties in breathing, throat irritation)
- (v) Other(s).....

**In your opinion would you say the activities that workers engage in here have any short term effect on their health?**

- a) Yes
- b) No

**In your opinion would you say the activities that workers engage in here have any long term effect on their health?**


- c) Yes
- d) No

Any additional information.....

## APPENDIX IV: RESEARCH PERMIT

**THIS IS TO CERTIFY THAT:** **MR. ANTONY FREDRICK OGOLLA** of **UNIVERSITY OF NAIROBI, 36333-200 NAIROBI,** has been permitted to conduct **research in Laikipia County** on the topic: **ACTORS' PERCEPTIONS OF HEALTH RISKS AND IMPACTS RELATED TO FOOD SYSTEM ACTIVITIES IN NORTH WEST MT. KENYA REGION** for the period ending: **12th September, 2018**

**Permit No : NACOSTI/P/17/92455/19086**  
**Date Of Issue : 12th September, 2017**  
**Fee Received :Ksh 1000**




**Patent**  
**Director General**  
**National Commission for Science, Technology & Innovation**

**CONDITIONS**

1. The License is valid for the proposed research research site specified period.
2. Both the Licence and any rights thereunder are non-transferable.
3. Upon request of the Commission, the Licensee shall submit a progress report.
4. The Licensee shall report to the County Director of Education and County Governor in the area of research before commencement of the research.
5. Excavation, filming and collection of specimens are subject to further permissions from relevant Government agencies.
6. This Licence does not give authority to transfer research materials.
7. The Licensee shall submit two (2) hard copies and upload a soft copy of their final report.
8. The Commission reserves the right to modify the conditions of this Licence including its cancellation without prior notice.

**REPUBLIC OF KENYA**



**National Commission for Science, Technology and Innovation**

**RESEARCH CLEARANCE PERMIT**

**Serial No.A 15690**

**CONDITIONS: see back page**



## APPENDIX V: RESEARCH AUTHORIZATION



### NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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Uhuru Highway  
P.O. Box 30623-00100  
NAIROBI-KENYA

Ref. No. **NACOSTI/P/17/92455/19086**

Date: **12<sup>th</sup> September, 2017**

Antony Fredrick Ogolla  
University of Nairobi  
P.O. Box 30197-00100  
**NAIROBI.**

#### **RE: RESEARCH AUTHORIZATION**

Following your application for authority to carry out research on "*Actors' perceptions of health risks and impacts related to food system activities in North West Mt. Kenya Region,*" I am pleased to inform you that you have been authorized to undertake research in **Laikipia County** for the period ending **12<sup>th</sup> September, 2018.**

You are advised to report to **the County Commissioner, the County Director of Education & the County Director of Health Services, Laikipia County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

A handwritten signature in blue ink, appearing to read "Godfrey P. Kalerwa".

**GODFREY P. KALERWA MSc., MBA, MKIM  
FOR: DIRECTOR-GENERAL/CEO**

Copy to:

The County Commissioner  
Laikipia County.

The County Director of Education  
Laikipia County.