THE UNIVERSITY OF NAIROBI
SCHOOL OF THE BUILT ENVIRONMENT

LAND FRAGMENTATION AND ITS EFFECTS ON SUSTAINABLE FOOD AND LIVELIHOOD SECURITY IN KENYA:

THE CASE OF BANANA FARMING SYSTEM OF KISII COUNTY.

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DECLARATION.

I hereby declare that the work contained in this research project is my original work and has never been submitted for a degree in any other University.

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This research project has been submitted for examination with our approval as University Supervisors.

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DEDICATION

This research is dedicated to my late mum for her commitment to the pursuit of knowledge.

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I am highly indebted to my supervisors Dr. Samuel Obiero and Dr. Elizabeth Wamuchiru for their profound support and assistance at all stages of this work. They guided and directed me through the whole process tirelessly and their efforts culminated in this volume.

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ABSTRACT

The study investigated the phenomenon of land fragmentation and the effects on food and livelihood security in Kenya. The study was set in Bonyanchaire Sub-Location of Kisii County, which has banana farming as a significant contributor to the livelihoods of the population in this agro ecological zone. An analysis of the key drivers of land fragmentation was done and an assessment of its effects on the food and livelihood security in the area was done.

The aim of this study was to assess the phenomenon of land fragmentation and describe its effects of on sustainable households' food and livelihood security of rural agricultural parts of Kenya. The research was guided by four objectives namely: To assess the current household land sizes in the study area; to establish the factors which influence land sizes in the study area; to consider the relationship between land sizes and land use patterns in the study area; To analyse the factors that influence the use of land in the study area; and finally To make policy interventions that can lead to improved land resource management for sustainable livelihoods in the study area. The research was guided by relevant literature on land fragmentation, food security and household livelihood strategies.

The general approach to this study was exploratory, descriptive and inductive, based on mixed research techniques because the quantitative enquiries helped to explore the extent or magnitude of the situation or phenomenon under study while the qualitative enquiries helped to explore the diversities in a situation or phenomenon. The cross sectional survey method was employed using questionnaires and interview schedule.

The respondents were 102 residents of Bonyanchaire sublocation of Kisii County, stratified and randomly selected from the four villages of the sublocation. The data collected was subjected to statistical analyses using frequencies, percentages and chi square analysis.

The results of the study revealed that Bonyanchaire sublocation consists of households with diverse social and economic backgrounds. This meant that over time, the households in the sublocation had become heterogeneous in composition with diversity of livelihood sources as against the original residents who were mostly subsistence farmers. The results showed that 52% of the total male respondents engaged in professions other than farming while 55% of female respondents engaged had livelihood sources other than farming. 69% of total respondents claimed to be engaged in both subsistence farming and another livelihood activity. This indicates that there is a trend emerging where local population are diversifying their sources of livelihoods.

The result of the first test of the hypothesis revealed that the variable land fragmentation indeed influenced the household land sizes in the study area. The implication of this is that this variable can be used to predict issues concerning the household land sizes in the study area. Additionally, the result of the second test of the hypothesis revealed that the variable land size did not influence the household food and livelihood security in the study area. The implication of this is that this variable of land size cannot be used to predict issues concerning the household food and livelihood security in the study area. The variables for the study were: current land sizes, existing land use patterns, prevailing land holding structure, and land management policies in the study area.

It was further established that land fragmentation and reduced land sizes influenced household food and livelihood security differently. For example land sizes influenced the amount of yield the farms produced. The existing land use patterns influence the proportion of household land that could be put to farming of the main livelihood crop. It was observed that land in the study area was shared between space for homestead, some pasture area for livestock and space for farming of bananas, maize, beans and others. It was also observed that land use patterns was influenced by land subdivision because most sons to whom land had been subdivided established homestead leading to a duplication of the space occupied by homesteads. Availability of non-farm income sources such as business or employment was also found to influence the household land use patterns.

Measuring residents' reaction to land fragmentation which was conspicuous in the study area showed a high degree of social acceptance level at 63% approval among the respondents, in spite of the reduced yields from the farms. Another response to reduced yields from the land based enterprises by residents was a wide adoption of non-farm based sources of livelihood in the study area. Respondents who reported having non-farm income were distributed into the following categories: beekeeping (2.0%), business (44.1%), farming (22.5%), and teaching (4.9%).

The study concluded that, although land size and land subdivision influences crop yield from the farms, it does not lead to food and livelihood insecurity in the study area. The study further concludes that rapid population increase in the study area contributes to the increased incidence of land subdivisions which subsequently leads to reduced land sizes held by households. According to this study, adoption of alternative sources of income is one way of supplementing food and livelihood security in the study area.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Land is a natural resource on which majority of rural households' livelihoods are based. These livelihoods have their origins both in indigenous and modern knowledge and skills available within communities. Human beings over times accumulate relevant knowledge and skills that that help them to manipulate land resources to provide goods and services for their continued sustenance. These goods and services include food, energy, medicine, recreation and even spiritual land-based goods (WRI, 2003). Land, therefore becomes an important component of man's livelihood architecture, especially so for the rural populations.

1.1.1 An Overview on Land Fragmentation in Kenya.

The Government of Kenya through The Kenya Land Use Policy (2016) has identified land fragmentation among the major challenges Kenya's agricultural sector is grappling with. Land reforms in Kenya can be traced back to among other factors major Land reforms in the 1960s in the country that aimed at redressing colonial that consolidated large tracts of agriculturally productive land under the settlers and redistribute the same to the indigenous populations.

Bullard (2007) has identified rapid growth of population, land inheritance traditions, and the social status conferred to one as a result of land ownership as additional causes of land fragmentation. Land inheritance in which land is subdivided among heirs is a deeply entrenched cultural practice in most communities in Kenya.

Bentley (1987) identifies farm size, plot number, shape of land and distribution of plots spatially as the key parameters for indicating land fragmentation. Since the phenomenon of land fragmentation has been cited in the Kenya Land Use Policy (2016) as being of concern to the development of the agriculture sector, this study uses land size as a proxy of investigating land fragmentation in the study area.

1.1.2 The Status of Food Security in Kenya.

The Government of Kenya (2019), through The Kenya Food Security Outlook indicate that majority of households in Kenya directly rely on crop and livestock production for the supply of their daily food requirements. The Kenya Food Security Steering Committee's (2008) postulated

that food security is a condition in which all people have economic, social and physical access to nutritious, sufficient food that meets their dietary requirements and food preferences at all times for an active and healthy life.

The agricultural sector is considered the mainstay of Kenya's economy by Kenya Agricultural Research Institute (KARI). KARI opines that the agricultural sector contributes 24 percent directly to Kenya's GDP. The sector also indirectly contributes 27 percent to the country's GDP through linkages with manufacturing sector, distribution and other service-related sectors. Further, KARI observes that government earns revenues in excess of 45 percent from the sector which solely contributes over 75 percent of raw materials for industries and export earnings that are more than 50 percent are from the agricultural sector. The agricultural sector is the single largest employer in the country with over 60 percent of total employment. Further, in excess of 80 percent of Kenya's population and particularly those in the rural areas earn their living from agriculture related activities.

The most important area of focus in the agricultural sector is to achieve food security nationally. Official government statistics estimate that more than 10 million Kenyans are food insecure in a situation where most of these food insecure citizens are dependent on relief food. The regions that are food insecure in Kenya have been spatially mapped. According to The Famine Early Warning Systems Network (FEWS-NET, 2015), the regions that experience chronic food insecurity in Kenya include pastoral areas of Northern Kenya such as Garrissa, Wajir, Mandera, Isiolo, Samburu Marsabit, Turkana; the marginal agricultural areas of southern Kenya such as Tharaka Nithi, Mbeere, Kitui, Mwingi and Kitui; and coastal marginal areas which include Tana River, Kwale and Kilifi Counties.

Considering the important position that food security occupies in the Kenya national development, this study endeavors to unravel the association that might exist between food and livelihood security and the phenomenon of land subdivision which has been ongoing both as a cultural practice and supported by government policy.

1.2 PROBLEM STATEMENT

The United Nations (2015), while formulating their Sustainable Development Goals (SDGs) has identified in their second goal that ending hunger, achieving food security and improving nutrition

together with promoting sustainable agriculture as critical for sustainable development globally. The United Nations acknowledge the challenge posed by a growing global population, coupled with the fact that the planet is experiencing water and land scarcity, soil, land degradation as working counter to the achievement of this goal.

Agenda 2063 of The African Union is committed to implementing institutions and policies that aid sustainable development, improve food and nutrition security, increase production in agriculture, harness expansion of value addition and access to markets and sound natural resource and environmental management. This commitment was based on the knowledge that 60 percent of the global arable land is found in Africa and that 70 percent of population in Africa depend on agriculture as their core source of livelihood. Agenda 2063 of the African Union aims at improving productivity of small holders and build households ability to cope with shocks and accelerate rural infrastructure and value addition.

The government is mandated by the Constitution of Kenya 2010 to ensure every citizen is food secure through constitutional provisions particularly the provision that every citizen has right to food (Republic of Kenya, 2010). The implication of the right to food is that the government must not engage in activities that threaten or rather would result to increase in hunger levels, malnutrition and food insecurity. Kenya developed the National Food and Nutrition Security Policy (NFSP) in 2011 whose aim was to build synergies, add value and assist in the implementation of existing national and sectoral strategies and policies so as to address malnutrition and food insecurity issues effectively.

The Kenya Vision 2030 blueprint comprises of one of the most significant policy documents whose aim is to boost food security through several flagship projects in the country. Some of the various flagship projects include infrastructure development, creation of more opportunities for employment and establishment and development of irrigation schemes. The Vision 2030 on the agricultural sector focuses on innovative, commercially oriented modern farm and livestock agricultural sector (Republic of Kenya, 2007). Proper and keen implementation of the Vision 2030 will ultimately result to considerable mitigation of food insecurity in the country.

According to Kenya National Bureau of Statistics, Kisii County has one of the highest rates of population growth in the country, at 2.1% annually compared with the national rate of 2.5% annually (GoK, 2017). The culture of land inheritance where a father bequeaths a portion of land

to mostly his male children is held highly in the community. This has resulted in subdivision of land, which some sections of the community feel is becoming a challenge. The Law Society of Kenya, Nyanza South Branch has for example observed that land conflicts are the main sources of litigation in The Kisii Law Courts. Production of Banana which is the number two food crop after maize and number two cash crop after Tea has been observed by Africa Harvest (2014) to be declining.

There are a number of studies which have been conducted in an attempt to unravel the challenges posed by increased population on food security in the area. For instance, Omare (1979), is concerned with effects of population on land use changes in Kisii. Ogechi et al, (2016) has focused on the aspect of the implications that Land Use and Land Cover Changes have had on Food Production and by extension food security in Kisii County. Kumba et al (2015), is also concerned with the Influence of Agricultural Land Use on Household Food Security Situation in Kisii County.

Other scholars have focused on the role of bananas in the lives of the population in this agro ecological zone. Onguso et al, (2003), for example has focused on genetic characterization of bananas, while Kahangi et al (2004) is concerned with strategies for adoption of tissue culture banana technology and marketing of the produce. Kasyoka et al (2011) on the hand is interested in the link between banana farming and rural livelihoods in central and eastern regions of Kenya while Bosire (2013), is concerned with farmers' access to financial services to modernise their banana farming activities.

Consequently, considering the prominence of land as a natural resource and food security to the global SDGs, The Agenda 2063 of the African Union and The Kenya 2010 Constitution, this study undertook the important task of contributing to the body of knowledge which exists on land resource management and its association with food and livelihood security in the country. This study investigated the effects of land fragmentation which has been observed in the study area on the sustainable agro-based food and livelihood security of communities in agriculturally rich highlands of Kenya.

1.3 RESEARCH QUESTIONS

1. What are the current household land sizes in the study area?

2. What factors influence land sizes in the study area?

3. How do land sizes affect household food security in the study area?

4. Which factors influence the household land use patterns in the study area?

5. What is land holding and ownership (Land tenure) structure in the study area?

6. Which alternative policy measures could be adopted to improve land resource management to support livelihoods in the study area?

1.4 OBJECTIVES OF THE STUDY

1.4.1 General Objectives.

The broad objective of the study is to analyze and describe the effects of land fragmentation on sustainable households' food and livelihood security of rural agricultural parts of Kenya.

1.4.2 Specific Objectives

1. To assess the current household land sizes in the study area.

2. To establish the factors which influence land sizes in the study area.

3. To examine the relationship between land sizes and land use patterns in the study area.

4. To analyze the factors that influence the use of land in the study area.

5. To document how land rights are held and owned in the study area.

6. To make policy interventions that can lead to improved land resource management for sustainable livelihoods in the study area.

1.5 RESEARCH HYPOTHESIS

The following hypotheses were tested in pursuance of the objectives identified above:

H_o. That Land sizes have no statistically significantly effect on household food and livelihood security livelihood in the study area.

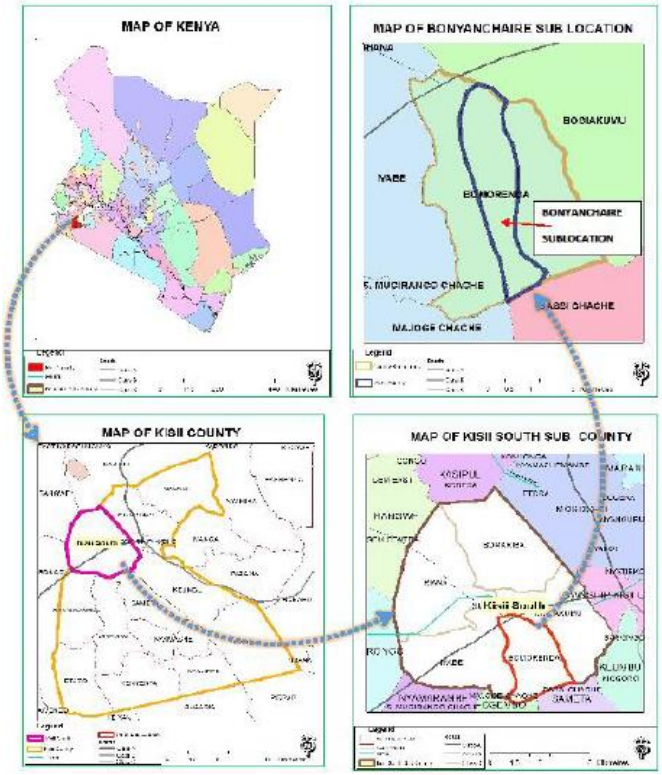
H_1. That Land sizes have statistically significantly effect on household food and livelihood security in the study area.

1.6 SCOPE OF THE STUDY

1.6.1 Geographical Scope of the Study

This study was carried out in Bonyanchaire Sub Location, Kisii South Sub County in Kisii County. This choice of geographical scope for the study was particularly informed by the fact that the sub location is the most densely populated sub location in Kisii South banana farming system and therefore possesses the characteristics being investigated in this study. Bonyanchaire sub-location is within the Bogiakumu ward and is bounded by Bomwanda, Bonyaoro and Bomwanda sub locations.

Figure 1: The study area.



Source: Author, 2019.

1.6.2 Theoretical Scope of the Study

This study confined itself to issues related to land fragmentation as it affects sustainable food and livelihood security of rural populations in Kenya. The study also looked into the factors which influence land sizes in the study area. This also extended into establishing whether a relationship exists between land sizes and food and livelihood security in the study

The study analysed changes in land size and land use patterns from a time-space dimension in the study area. These study was anchored in the Agricultural Land Use theory which has explained how societal factors or processes determine how land in different locations can be used. Von Thunen's Agricultural Land Use theory assumes a location which is self-sufficient and has no external influences. This study therefore tested whether the theory stands in a real life location with many external influences and which has many deficiencies for which it depends on other locations to supplement their lack.

The study also explored various land use policies that have been used in other countries to control subdivision of agricultural land and enhance agricultural production. Notably, the land consolidation policy was studied for its relevance and applicability in the study area.

1.7JUSTIFICATION AND SIGNIFICANCE OF THE STUDY

1.7.1 Justification of the Study

Kisii County occupies 1,317.9 km^2 (508.8 sq. mi), a relatively small land mass compared to its population of 1,152,282 people. This county's population was projected to grow at 2.1% in the 2009 census. This presents a challenge on managing the land resource, especially considering the population growth and cultural attitude to land. The Abagusii people believe in the traditional system where fathers divide and share out land among their sons as a form of inheritance. There is also a belief that having many sons means security of land and property against invasion by relatives.

For a long time, land has been an emotive issue in the Kisii region with families embroiled in conflicts over the issue of land. The Law Society of Kenya South Nyanza Chairman, Denis Nyatundo, is reported to have said that Kisii County faces a land crisis as the population balloons, leading to multiple disputes on sub division of land. This is evidenced by the large number of litigations in the Land and Environment Court in Kisii.

Kisii County therefore almost naturally becomes an area of interest in understanding the consequences of land subdivisions that have been rife on the sustainable livelihoods of populations living in the county that has hitherto been known for her undulating green hills and productive agricultural activities.

1.7.2 Significance of the Study

The significance of this study lies in the fact that land constitutes the most important economic, cultural and political issue in Kenya today. Desire to control Land resources formed a significant incentive for European settlers to relocate to Kenya during the period of colonialism. The Mau Mau insurgence and struggle for independence was inspired by the desire to regain control over land rights that had been alienated by the settlers. Since independence in 1963, in a country where the educated, the rich and poor alike consider land as the single most important form of personal wealth and are deeply entrenched with its distribution and use.

This research is pursued with the twin aims of contributing to theory development and to chip in to the current practice of land resource management in the context where fragmentation and sub-divisions are rampant. These contributions take two primary and interrelated forms.

Land resource management is an important concern for development of the Kenyan society. A current literature review demonstrates that the management of land resource issues in the country, just like the land resource itself, is fragmented. In this regard, the development of theories in this area has been wanting with a platform that unifies arguments yet to be established as a source of an incremental building up of knowledge. Consequently, this research proposal represents a pioneering academic investigation into the best practice of land resource management for sustainable livelihoods in rural Kenya.

At a practical level, the study anticipates to offer reliable findings that would guide rural livelihoods planners and land resource managers in developing the more appropriate and critical development control strategies for regulating rural land fragmentation. Identifying the critical impacts on livelihoods arising from rampant land fragmentation and subdivision of agricultural land is one of the main aims of the study.

This can be useful in helping rural livelihoods planners and land resource managers to identify the strategies they should employ in order to manage the extent of land fragmentation and subdivision in the face of declining agricultural productivity which seems to be compromising the ability of the land to support livelihoods in rural parts of Kenya.

1.8 DEFINITION OF OPERATIONAL TERMS.

The terminologies below provide meanings and explanations of technical words, as used in this study.

1.8.1 Household.

The term household, in this study, will be taken to refer a person living alone or a group of people who share living arrangements at the same address and take their meals from a common kitchen unless the exigencies of work prevent any of them from doing so.

1.8.2 Land Fragmentation

In this study, land fragmentation which is also known as pulverization, parcellization or scattering refers to a situation where a single farm comprises of multiple spatially detached parcels. Land fragmentation, in this study, shall refer to a situation where a farmer has many small pieces of land scattered in different places.

1.8.3 Land Subdivision

Simply put, land sub division is the portioning of a piece of land into small portions. In this study, the term Land Subdivision is used to the practice of dividing land into pieces that are easier to sell or otherwise develop.

1.8.4 Food Security.

This study will adopt the definition of "food security" given by World Food Summit, (1996). The summit defined food security as a state that exists when all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.

1.8.5 Livelihood

The study adopts the definition of a livelihood as the set of activities, (including secure food, water, medicine, clothing, fodder, shelter) and the capacity to obtain these necessities working as an individual or a group by use of endowments (both material and human) for the purposes of meeting individuals' requirements and those of his or her household sustainably with dignity. This meaning extends to include a means of securing the necessities of life such as food, water, shelter and clothing.

CHAPTER TWO:

LITERATURE REVIEW

2.1 Introduction.

Chapter two focuses on the review of available literature relevant to the subject of study being land fragmentation and sustainable rural livelihoods in a banana farming system of Kisii County. The review of literature was disintegrated down to the nitty gritty single elements of the central subject under study and combinations of such components to form the central theme as a way of developing the ideas of the researcher on the general concept of the project.

The emphasis of the literature review was specific to previous writings on themes such as land fragmentation, sustainable rural livelihoods, banana farming as a source of livelihoods and management of land assets for sustainable agro-based livelihoods. Additionally, the literature review aimed at offering detailed account of previous/existing studies on the subject mainly to determine the gaps in literature on the subject and so attempt to fill these gaps.

2.2 Overview on Land fragmentation.

This section of the study shall seek to create a clear understanding of what constitutes the phenomenon commonly referred to as land fragmentation and how it relates to household land sizes. There are several strains of meanings that have been proffered in an attempt to define land fragmentation. We shall explore a few of these definitions here below:

To start us off, McPherson (1982) explains that land fragmentation exists when multiple detached land parcels or farms or plots are owned or leased and farmed as a single unit of production. This should be understood to mean that leased farms or plots in a farm are separated spatially. On the other hand, Schultz (1953) considers land fragmentation as a "misallocation of the existing stock of agricultural land". According to him, a fragmented farm is "...a farm consisting of two or more plots of land so located one to another that it is not possible to operate the particular farm and other such farms as efficiently as would be the case if the plots were reorganized and recombined".

Dovring et al. (1960) provides another dimension of land fragmentation by arguing that the division of a contiguous land into huge numbers of distinct parcels is land fragmentation. Another definition by Papa Georgiou (1963), emphasizes that distance from main land holding is important

in analyzing land fragmentation. According to him land fragmentation is the situation where a land holding comprises of several plots that are scattered over a wide area.

Perhaps the definition by Agarwal (1972), which defines land fragmentation as "…a decrease in the average size of farm holdings; an increase in the scattering of each farmer's land; and a decrease in the size of the individual plots in a farm holding", is closest to the meaning this study pursues. However, Binns (1950), only views land fragmentation as a temporary stage in the land holdings evolution process. In this view, land fragmentation is "...a stage in the evolution of the agricultural holding in which a single farm consists of numerous discrete plots, often scattered over a wide area". Another approach to understand fragmentation is to see it as deriving from the word 'fragment'. Bentley, (1987) regards land fragmentation as a scenario where a single farm comprises of many parcels that are spatially separated while King and Burton, (1982) are of the opinion that fragmentation of land is a central spatial problem in the rural areas that is concerned with poorly organized farms at locations across space.

The foregoing has evidently revealed that land fragmentation has been understood to mean different things to different academics. However, there are three discrete interpretations that can be deduced. To begin with, land fragmentation indicates the subdivision of farm land into smaller sized units that are too minute for rational cultivation. Secondly, land fragmentation submits that the parcels are non-contiguous and inter-mixed with other plots that are operated by other farmers. Finally, distance is a core element of land fragmentation in that it implies the farms are further apart from one another.

The phenomenon does not occur uniformly in all parcels of land. Indeed, there are several broad distinctions that characterize the phenomenon of land fragmentation. According to Van Dijk, (2004), land fragmentation is of four different types mainly fragmentation on ownership of land, land use fragmentation, internal fragmentation which is fragmentation within a farm and separation of land use and ownership as the last form of fragmentation.

Land ownership fragmentation refers to the number of land owners who use a given parcel of land. Land use fragmentation concerns on the number of land users who are also tenants to the land. Internal fragmentation stresses on the parcel numbers that are exploited by each user and contemplates the shape, size and distance of the parcel as the key issues. Ownership and use

separation as a form of land fragmentation that is concerned with situations of discrepancies between use and ownership of land.

A multidisciplinary debate has been stimulated by contradictory considerations on whether land fragmentation is a problem or not. This aspect has been reviewed in detail by Bentley (1987). According to Bentley (1987), agricultural policy makers consider land fragmentation to be the source of ineffective agriculture which can only be remedied through legislative actions. Economists, according to Johnson, (1970), consider the phenomenon of land fragmentation as gradually becoming non-adaptive with improvements in technology and relevant cost changes despite their belief that the phenomenon can be adaptive under certain conditions. European geographers support the thinking that land fragmentation doesn't sit well with labor costs and machinery of the 20th century and thereby somehow agree with the economist's postulations.

Contrastingly, other planners are of the view that land fragmentation can be adaptive whilst a few others identify a series of merits and demerits of the phenomenon. Anthropologists consider land fragmentation positively since it offers farmers the ability to cultivate many different environmental zones and as such, they optimize schedule for cropping activities whilst minimizing on the risks. Further, most environmentalists are of the view that any interventions to the structure of land tenure that are intended to remove land fragmentation have the possibility of raising serious environmental effects in nature as well as social effects to owners of land.

These varied viewed that contrast each other are by far reasonable owing to the numerous studies that have posted contrary findings. For instance, Blaikie and Sadeque (2000) and Karouzis (1977) arguments consider land fragmentation as a serious constraint that prevents the productivity of a farm. Their views are totally in contrast to other authors such as Wong et al (1983) who consider land fragmentation as without having any negative effects on farm productivity.

Therefore, according to Van Dijk (2003) and Bentley (1987), land fragmentation phenomenon has both merits and demerits with adverse effects and consequent favor varied for different context of land uses. Therefore, the effects f land fragmentation should be evaluated separately for every community with considerations for local social, economic and environmental conditions prior undertaking of any relevant policies.

2.2.1Advantages and Disadvantages of Land Fragmentation

Land fragmentation isn't disadvantageous always only that it has fewer advantages compared to its many disadvantages.

The major advantages of land fragmentation are considered as follows. Firstly, land fragmentation is seen to be helpful in mitigating agricultural risk. This argument is based on the assumption that the risk of failure of crop production on an entire land is reduced by having several different parcels that are detached of each other. This risk is of little dimension and impact in Kenya and thus it can't be considered a primary advantage of land fragmentation in Kenya.

Land fragmentation also provides opportunity for farmers to diversify their crop production. This is possible for farmers who own several pieces land and tend to seek farms with different qualities. Owning several pieces of land enables the farmers to plant different crops on each farm depending on the qualities of that particular farm. This is good for a diversified crop production and may be considered as an advantage of land fragmentation.

Finally, land fragmentation allows the farmer to coordinate crop production on the various parcels of land. Land fragmentation is considered of great advantage to the farmer by providing the farmer the possibility of cultivating different crop types at different parcels at different times. This may lead to both increased output and higher income since farmers are able to work on different land parcels at different times of the season for growing of crops.

Land fragmentation is also thought to have a number of disadvantages. These are discussed in the following section.

Some Scholars, such as MacPherson (1982), generally view land fragmentation as a limiting factor of land production. This may be attributed to the problems associated with mechanization, irrigation, transport, fertilization and agronomic practices. Land fragmentation related problems are classified as (1) land fragmentation checks modernization of agricultural activities such as irrigation, mechanization and agronomic practices among others; **(**2) land fragmentation hinders land improvements and increases the risk of abandoning some land parcels; and **(**3) land fragmentation establishes production and economic problems owing to increased work, time and organization needed by distant parcels.

The distance between farmstead and parcels, multiple lines of boundaries, lack of access, irregular shape of parcel and small size of parcels are the major problems associated to land fragmentation (Bentley, (1987) and Karouzis, (1977)). Particularly, Niroula. & Thapa, (2005) observe that the travel time and costs of labor and machine movements from one parcel to the other increases as a result of land fragmentation when land parcels are dispersed spatially. Van Dijk, (2003) has postulated that the resulting disadvantage of land fragmentation is decreased intensification of parcels that are at greatest distance further away from the homestead. Thompson (1963) in his study on Greek farms, and Karouzis (1971) studying Cypriot landholdings, have illustrated that intra-farm cropping patterns are significantly related to distance.

Burton, (1988) has additionally observed that complicated network of boundaries among parcels arising from land fragmentation. The network of boundaries among parcels comprises of stone walls, hedges, ditches among others. He posits that this results to wastage of land, especially in small parcels, since portions of the holdings are left uncultivated particularly at the parcel margins. Further, conflicts with neighboring land owners and costs of fencing increase as a result of this problem of land fragmentation. Additionally, Yates, (1960) argues another dominant problem of land fragmentation as the irregular shapes and small sizes of parcels. It is difficulty if not impossible to employ modern technology and machinery to tiny land parcels resulting from land fragmentation and therefore these tiny parcels may demand more quantities of manual labor especially in the corners and the edges along the boundaries Karouzis, (1980). To be specific, Karouzis, (1980) notes that irregular shaped parcels deter proper land cultivation specially for some crops like vines, olives etc which require series form of cultivation. It is harder to implement measures for soil conservation due to higher costs of construction and requirements for more roads and fencing which is most commonly adjusted according to the shape of the parcel hence low geometrical standards.

2.3 Land Consolidation as a Policy Option to Challenges of Land Fragmentation.

There are several policy options that can be adopted in an attempt to solve the enduring problem of diminishing land sizes as a result of land fragmentation for whatever reason. Land consolidation is one such policy that has been attempted widely around the world. The concept of land consolidation, according to Burton (2015), is an ancient one with records traced to the fourth century B.C. when the logical division of land in rural areas into square units was proposed by the

Chinese sage Mercuis who suggested that small villages in the rural areas be made of nine such units. The logic of this operation became a well-established system which dispersed in different forms to other East Asia regions since they drew on the culture matrix of the Chinese.

The concept of Land consolidation, has been defined by Pasakarnis & Maliene (2010), as "…the reallocation of parcels with the aim of the landowners obtaining larger parcels at one or more places in exchange of their former smaller and fragmented land plots". They argue that land consolidation ought to be viewed as an activity which entails more than just a simple rearrangement of parcels of land to eliminate land fragmentation effects with aim of attaining higher agricultural productivity and decreased costs. Land consolidation should therefore be driven by the understanding that the structure for agricultural improvement is seen as being similar to maintaining the social viability in the rural areas that whatever is good for the farmers is good for the rural areas and for the state too.

Land consolidation can be a very effective tool for development in the rural areas according to FAO. Land consolidation plays a vital role in agricultural development which is an integral part component of rural development. Land consolidation has the ability to enable farmers have farms with fewer parcels that are better shaped and larger as well as aid in the expansion of land holding sizes and therefore facilitates creation of competitive production of agriculture. Further, FAO argues that land consolidation is an essential tool in projects and strategies to enhance quality of rural life through improved management of natural resources and conservation of the environment, creation of employment opportunities, provision of infrastructure and services and amelioration of conditions in the villages. Land consolidation is even considered to be an instrument that can be used to improve the structure of land tenure in support of development in the rural areas by addressing the issues of land fragmentation.

Consolidation of land has the ability to aid farmers amalgamate their fragmented parcels. A good example is a scenario where a farmer owns five parcels all divided in one hectare of land would stand to benefit from consolidation of land which would eventually result to having a one-hectare single parcel of land. Despite that the size of the parcel remains the same, one hectare after consolidation, the farmer has a larger well shaped parcel that would possibly permit the farmer introduce better farming practices and techniques. By and large, such micro-farms aren't suitable for more competitive agricultural practices. Land consolidation can therefore provide farmers with

opportunities to increase their farm sizes for instance say by acquiring land from the state land reserves and banks or even through having access to other people's land through purchases/sales and/or improved lease arrangements. The results of land consolidation projects should be amalgamation of parcels that are fragmented as well as include other measures that are appropriate to establish an improved structure of land tenure that supports rural development. The focus of land consolidation projects should therefore be on providing solutions that are needed and practical to solve problems that farmers face together with other residents in the rural areas.

Rusu, (2002) has proposed that consolidation of land has the potential to result to improved agricultural productivity. This is achieved by permitting farmers obtain farms that have fewer parcels which are better shaped and larger in size and as well expand the size of the land holding makes them more competitive. Furthermore, improved structure of land tenure has the ability to facilitate adoption of modern agricultural technologies like mechanization of agriculture and so result to more successful, efficient and thriving agricultural sector. Increases in gross income of farmers and reduced time and/or hours spent in the field are some of the key benefits of land consolidation accrued to farmers in Western European countries.

Sayilan, (2014) on the other hand has argued that consolidation of land allows for promotion of improved management of soil and natural resources including soil fertility. Rationalized structure of land tenure can facilitate protection of soil and support better planning for land use and management. As a result of economic development, increasing the quantities of land under agriculture are annexed for non- agricultural purposes such as industrial and housing purposes, transportation channels and other functions. According to Sayilan, (2014) consolidation of land can help in solving potential conflicts that would arise as a result of land use changes. Land consolidation is an essential tool to establish alternative land for compensating agricultural land owners who pave way for socioeconomic development projects or land designated for other purposes. Improved planning for resources such as water more than often calls for readjustments on the boundaries of parcels. The land structure can therefore have significant influence on the bio-ecological and geo-ecological resources. The shape and size of parcels, parcel gradient and type of land use can operate to either prevent or cause soil and landscapes degradation. Increased micro-parcel size of land has the potential to aid farmers adopt less intensive farming methods and so decrease adverse effects of agricultural activities to the environment.

According to Mehmet et al (2003), consolidation of land can play a very essential role in improvement of sustainable rural development. Land consolidation when applied as an instrument of rural development can improve cost effectiveness and efficiency of public and private investments in communication and transportation networks, irrigation and utilities systems. Consolidation of land can promote social stability by facilitating community's renewal. Studies by Vitikainen (2004) in Western Europe indicate an that the number of new job opportunities have increased among most communities that have experienced consolidation of land and it results to improved rural livelihoods. He suggests that integrated planning of local land and effective coordination of interests in land cab be useful mechanism for mitigating any potential conflicts that may arise between environmental protection and the promotion of agricultural sector economic growth. Therefore, land consolidation can be reliably used to provide a procedure for the implementation of integrated planning of local land.

Initiatives on consolidation of land play the role of improving the systems on land administration since they provide opportunities for updating and clarifying records on ownership of land. Improved quality of data on land resources particularly size and use of land is critical in that it facilitates management of land related conflicts and the development of land markets.

Louwsma et al, (2014) contends that there are several approaches to land consolidation. Comprehensive land consolidation is one of these approaches. It refers to an approach of land consolidation that involves re-allocation of land parcels incorporated with other broad range measures whose main objective is to promote development in the rural areas. Some of the activities included in comprehensive land consolidation include support to community oriented agro-processing programs, village renewal, rehabilitation and construction of drainage and irrigation systems, rural roads construction, measures for the control of soil erosion, creation and maintenance of social infrastructure facilities such as sports playgrounds and other public facilities and improvements and protection of the environment complete with designation of natural reserves. Projects for comprehensive land consolidation introduce notable changes in the project site with all project owners required to participate in the project area. Land owners in many countries are mostly drawn into a comprehensive land consolidation project contrary to their will. Participation is a key requirement of the project and even if people are opposed to comprehensive

land consolidation, they may be required to participate in the project only if they won't lose as a result of the process.

Simplified land consolidation is another approach identified by Demetriou, (2014). This approach of land consolidation adopts parcels exchange or re-allocation together with provision, from land banks, of additional land for the optimization of conditions in the agricultural sector. Projects adopting the simplified land consolidation approach most often incorporate infrastructure rehabilitation and at times minor facilities provision. Simplified land consolidation approaches rarely include major public works constructions but rather may provide a framework for their construction at a later stage. Simplified land consolidation procedures tend to be similar to those of the comprehensive approach of land consolidation albeit with relaxation of some of the requirements.

Voluntary group consolidation is the third approach to land consolidation. This approach does not involve compulsion at any stage of the consolidation process but rather advocates for mutual agreement of all participants of the land consolidation process. All participants in voluntary land consolidation process must fully agree with project proposals for the consolidation of land. Due to this, projects for voluntary land consolidation tend to be small hence the approach is suitable majorly for addressing small and localized problems.

Finally, Individual consolidation, can also be considered as an approach to land consolidation. This approach may comprise of sporadic and an informal way of consolidating land holdings. Individual consolidation approach rarely involves the state directly. Due to this, provision of public utilities is highly unlikely in individual consolidation activities. The state can however play a very vital role of encouraging and promoting individual consolidation approaches that improve agricultural production. The promotion of individual land consolidation practices can be achieved through adoption of instruments like leasing, joint land use agreements as well as retirement schemes.

2.4 FOOD SECURITY

2.4.1 The Concept of food security.

Many attempts to define food security in research and policy use construe it to be a flexible concept. Whenever the concept of food security is introduced in a research study title or in the

study objectives it calls for an in-depth and critical look to determine its implied or explicit definition (Maxwell, 1996).

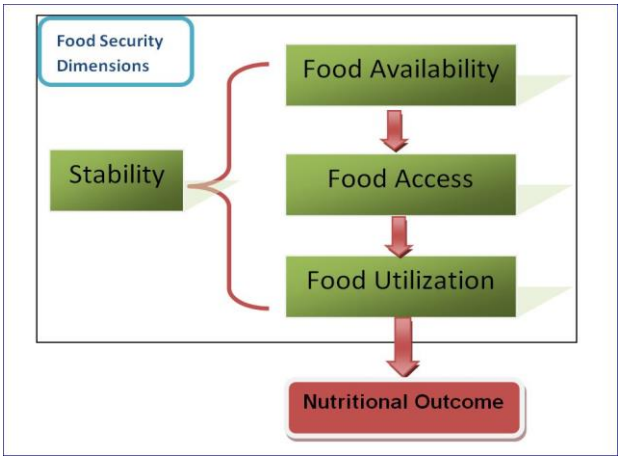
Households are considered food secure according to WFP (2018) when food is available, adequately accessible at all times, is safe, sufficient and nutritious to the households for them to maintain a healthy and active life. Food availability concept in the definition refers to the idea that food supplies must be available on a consistent basis and in sufficient quantities. Stock and production in a given area are the main considerations on this context together with the capacity to bring food from elsewhere mainly through aid or trade.

Food according to The WFP, 2008 entails that households must be in a position to obtain regularly adequate food quantities through buying, barter trade, home production, borrowing, gifts or food aid. A positive nutritional impact of food on people is a key element of consideration for food that is being consumed according to food security analysts. This involves storage, cooking, and hygiene practices, water and sanitation, individual's health, and feeding and sharing practices within a household.

Food stability is another dimension and key concept of food security. This concept or element is hugely concerned with addressing the stability of the above discussed three other components of food security. People can only be considered as food secure if they feel so. People don't feel food secure unless the accessibility, availability and proper condition of food utilization are stable. Fluctuations and instability of prices of staple food products in the market, political instability, inadequate risk that bars people's capacity in case of adverse conditions such as unexpected weather changes, natural disasters etc. and unemployment are major factors that affect the stability element of food security.

The Committee of United Nations on World Food Security has on the other hand defined food security as the situation where all people at all times have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and preferences for an active and healthy life.

Figure 2: Dimensions of Food Security



Source: Adopted from Bajagai (undated).

Multiple varied definitions of food security have been developed over the course of time. This study will however, pick out a few that will help in amplifying the meaning that the study will adopt. Some of these definitions are listed below:

One such definition by the FAO (2002) states that, "food security exists when all people, at all times, have access to, and can afford enough nutritious and culturally appropriate food of their preference". The World Food Summit (1996), on the other hand takes the view that, "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."

According to World Health Organization (WHO),"Food security means that: (i)all people at all times have both physical and economic access to enough food for an active, healthy life; (ii) the ways in which food is produced and distributed are respectful of the natural processes of the earth and thus sustainable; (iii) both the consumption and production of food are governed by social values that are just and equitable as well as moral and ethical; (iv) the ability to acquire food is ensured; (v) the food itself is nutritionally adequate and personally and culturally acceptable; and (vi) the food is obtained in a manner that upholds human dignity."

The Community Food Security, an organ of the Public Health Association of British Columbia (PHABC) has been defined food security as follows: "Community food security exists when all citizens obtain a safe, personally acceptable, nutritious diet through a sustainable food system that maximizes healthy choices, community self-reliance and equal access for everyone."

From these definitions, it is increasingly evident that food security is a multi-faceted, flexible concept. As such, communities have to be very deliberate in their efforts if they hope to grasp its reality. The important thing to note, however, is that regardless of whichever way we prefer to define food security, the most ultimate and important essential human need is to have enough food to eat regularly without limitations of supply for one to lead an active and healthy life.

2.4.2 Household Food Security

According to Bajagai (undated), a household can be said to be food secure when it has access to the food needed for a healthy life for all its members (adequate in terms of quality, quantity, and safety and culturally acceptable) and when it is not under undue risk of losing such access. It is easier to understand household food security by examining the characteristics of a household with very low food security.

These include: (a) Household members (mainly adult) are worried that their food would run out before they got money to buy more. (b) Food they bought just didn't last and they didn't have money to get more. (c) They couldn't afford to eat balanced meals and have to rely on inexpensive non-nutritious food. (d) An adult had to cut the size of meals or skipped meals because there was not enough money for food. (e) They had to eat less than they felt they should because there was not enough money to buy food. (f) They had been hungry but did not eat because they could not afford enough food; and (g) they had to acquire food through socially unacceptable means such as charitable assistance, buying food on credit etc.

2.4.3Household Food Insecurity.

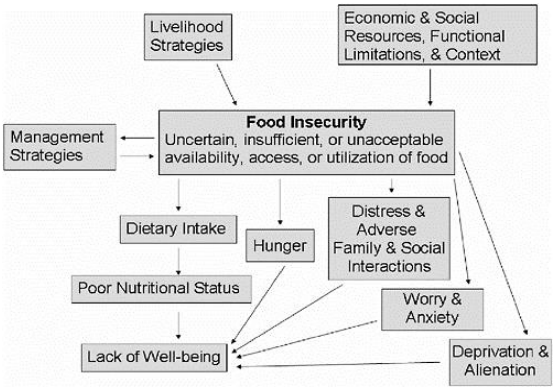
Closely related to the phenomenon of food security is the phenomenon of food insecurity. A discussion on food security would not be complete without developing an understanding on its nemesis.

Food insecurity, according to Radimer et al. (1992), refers to “the social and economic problem of lack of food due to resource or other constraints, not voluntary fasting or dieting, or because of illness, or for other reasons”. From the definition, it can be deduced that households can be said to be experiencing food insecurity if access and availability of food in the future in uncertain, the quantities and food type needed for a healthy lifestyle is insufficient and/or if they have to employ socially unacceptable ways for them to obtain food. Despite the fact that absence of economic

resources is the major prevalent hindrance to food security, Lee and Frongillo (2001a and 2001b), opines that when food is accessible and available but due to physical and/or other constraints, like restricted physical functionality by those with disabilities or the elderly, it cannot be used can result to experiencing food insecurity.

The causes and consequences of are summarized in the figure below.

Figure 3: Determinants and Consequences of Food Insecurity



Source adapted from Habicht et al., 2004.

Of interest to this study, Livelihood strategies are identified here as being a determinant or a factor contributing to food insecurity. Land is a natural asset that man exploits to generate Economic resources such as cash crops and social resources such as a homestead. This therefore implies that land and livelihood strategies are critical factors determining the incidence of food insecurity.

2.5 LIVELIHOOD SECURITY

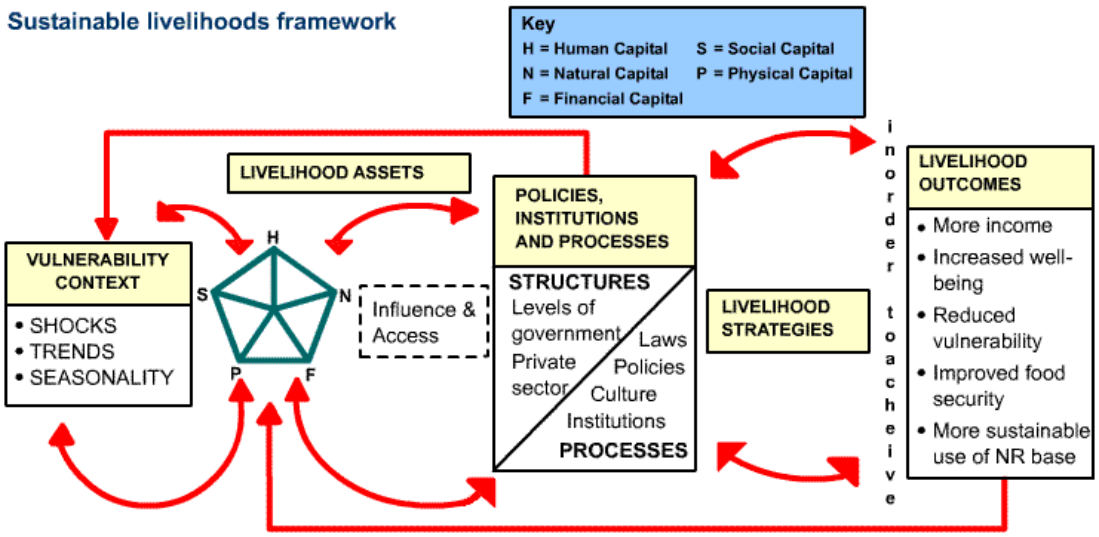
2.5.1 The Concept of Livelihood Security.

Livelihood is defined by Chambers and Conroy (1991) as the assets – both social and material resources –, capabilities, and activities that are needed for earning a way of living. Chambers & Conway, (1991) further argue that a sustainable livelihood is one that has ability to survive with stress, recover from both shocks and stress and maintain and harness both assets and capabilities presently and in the future while at the same time not undermining the natural resource base.

Livelihoods, according to Chambers & Conway, (1991) should be viewed as systems comprising of the assets upon which people draw a source of living and the strategies adopted by people to

make a living from the assets. Other components of the livelihood systems are the context for developing a livelihood together with the factors that determine the vulnerability of a livelihood as more or less to shocks, seasons and trends within their communities. This definition of sustainable livelihood is demonstrated in Figure 3.

Figure 3: The Sustainable Livelihoods Framework



Source: Adapted from: Carney et al., 1999,

2.5.2 Elements of Sustainable Livelihoods

The elements of the sustainable livelihoods summarised in the figure above are expanded in the following discussion. This is chiefly for the purpose of broadening the understanding of the context of livelihoods especially as it applies to rural farming communities.

Firstly, is the element of livelihood assets, about which (Buckland, 2005) states that they comprise of tangible resources including cash savings and food stores together with land, trees, tools, livestock among other resources. Further, he argues that assets for livelihood may as well be intangible assets including things like for instance work, claims one can make for food, assistance as well as access to information, materials, education, opportunities for employment and health services.

Categorizing livelihood capitals or assets used by people to earn a living provides another way of understanding them. Livelihood assets can be classified into five categories of natural, human, political, financial, social and physical capitals.

Table 1: Summary of Livelihood Assets.

Livelihood Assets	
Natural Assets	This include natural resources of soil, land, water bodies, fisheries and forests.
Human Assets	This comprises of human resources endowed with knowledge, skills, ability to work and health
Political Assets	This refers to the politics that drive a country's development and influence the peace, stability of a society. The institutional and governance framework that makes it possible to live, work and make a living comfortably and peaceably.
Financial Assets	These include credit facilities, savings and income from businesses (trade), employment and remittances.
Social Assets	The social resources that comprise of memberships to formalized groups and relationships of trust that facilitate cooperation and economic opportunities as well as membership to informal networks.
Physical Assets	These are the basic infrastructure facilities such as road networks, schools, health facilities, water and sanitation, ICT and producer goods such including livestock, tools and equipment.

Source: http://www.eldis.org/go/topics/dossiers/livelihoods-connect/what-are-livelihoodsapproaches/livelihoods-assets

2.5.3 Household Livelihood Framework

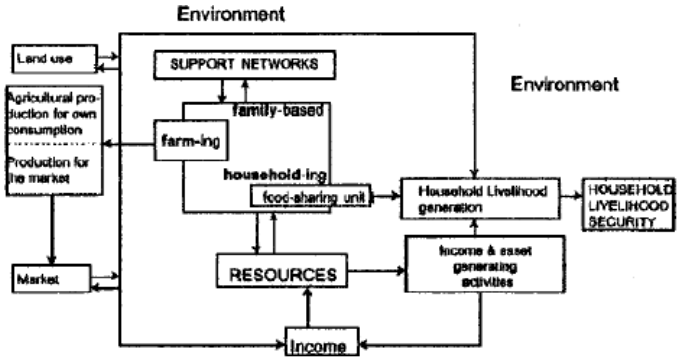
The concept of livelihood can tend to be abstract and to make it concrete and workable it is important for it to be tied to a person or a group. In support of this position, Clay and Schwartzweller, (1991:1), have held that "households are one of the basic units of human social organisation. Though variable in form, depending upon cultural norms, environmental conditions, and particular circumstances, households represent to a large extent the *arena of everyday life* for a vast majority of the world's people".

Consequently, Niehof and Price (2001) have argued that it is within this arena of everyday life, this 'basic unit of human social organisation', that activities are undertaken to provide for the basic needs of people. This is to mean that Livelihood is generated within the household. Rudie (1995:228) has gone a step further and defined a household as a co – residential unit that takes care of the management of resources as well as the basic primary needs of the members of the family since a household is typically family based in some way. The overlap between a household and livelihood is more apparent through this definition particularly in its latter part. The management

of resources by households is aimed at meeting the needs of the household members mainly the basic or rather primary needs (Ibid). Generation of livelihoods through use of assets and resources is one of the core household activities.

It is therefore sensible to study portfolios of livelihoods at the household level informed by Rudie's definition of a household and the fact that it's the responsibility of the household to provide the primary needs of its members. It should also follow naturally that strategies for livelihoods ought to be analyzed at the household level. This should take into account that variations exist within household and they influence household portfolios like age, gender and even the diversity that may exist between households based on resources and assets differentials. The following diagram in Figure 4 analyses the links between livelihood and household.

Figure 4: Link between Household and Livelihood security.



Source: Adopted from Niehof and Price, 2001

Food is possibly people's most critical and important primary need. Based on this, it is therefore expected that an overlap between food security and livelihood security must exist. In this view, livelihood security should therefore be considered as the most encompassing concept. Households that have sustainable or rather secure livelihoods are by default food secure while the opposite is not necessarily correct since being food secure is not guarantee for being livelihood secure.

Households often find that it is necessary to provide food security at the expense of meeting other primary needs of proper shelter or clothing despite the fact that such households' food security status may be more imagined than real. Households that are categorized as being extremely vulnerable with regard to livelihood security will, more often than not, also not be food secure. Further, another category of households with vulnerable livelihoods exists. This category has the possibility of being food secure in most cases albeit in difficult times or when faced by burning

challenges their strategies for coping might boil down to ignoring other needs purposely to focus on providing food.

Niehof (1998) has exposed the pitfalls in assessing household food security, especially when it is considered as a component of livelihood security. The challenges are applied in the assessment of livelihood security for households as well. Niehof suggests that it is only very sound empirical research that can explicitly elaborate on the actual strategies and procedures that can be adopted by households in their efforts to attain both food and livelihood security.

Chances of obtaining a complete picture of assets and resources available to a household are improved through mapping which also aids in investigating resources and assets allocation and use. It is important to underscore the indivisibility of household resources and assets at this point. The household farm, family and household are to be considered as a combined system. For instance, a subsistence farmer hardly separates the resources and assets required for household maintenance from those needed for farming purposes. The system of farming, household system and the complete livelihood system will ultimately be affected by allocation and use of assets and resources simultaneously.

2.6 BANANA - BASED FARMING SYSTEMS

2.6.1 Definition

A farming system refers to the unique and practically stable organization of farming enterprises managed by a household in tandem with well-defined practices in response to the biological, socioeconomic and physical environments and in accordance with the resources, preferences and goals of the household (Shaner et al., 1981). Another definition of a farming system is by Lal and Miller (1990) who consider it as a strategy for managing resources purposely to attain sustained production and economic goals presumably to meet varied household farm requirements whilst maintaining a high-level quality of the environment and presenting the resource base. On the other hand, Fresco and Westphal (1998) define a farming system as a unit for making decisions that is composed of livestock, farm household and cropping system that transforms capital, labor and land into beneficial products that can be sold or consumed.

A farming system can thus be considered an intricate inter related matrix of plants, soil, implements, animals, labor, capital, power and other inputs controlled partly by farming families

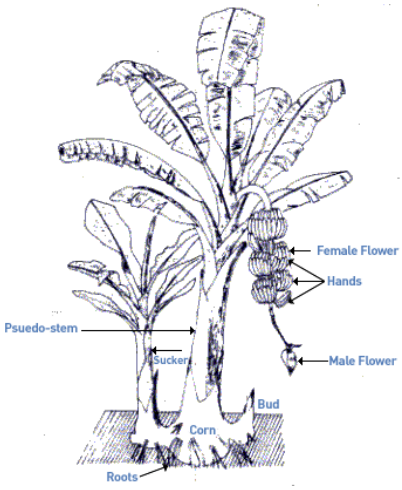
and to a varying degree influenced by economic, political, socio-cultural and institutional forces that function at multiple levels. On their part, Kalisa and Nshimyumukiza (2007) view a farming system as simply the combination of all farm activities of production of which the type and number of activities may be diversified. A farming system type can vary from a simple system involving a few activities say one or two to a more intricate system where several farming enterprises can be carried out simultaneously in a farm.

2.6.2 Overview of the Banana Crop.

Banana (Musa spp) is among the most important tropical fruits (FAOSTAT, 2001). Banana when ripe is eaten raw and is sugary. The unripe banana fruit, commonly referred to as plantain, is cooked. It provides a starchy meal rich in nutritional values just like potatoes. The total production of banana is estimated at 68.6 million tons of fresh fruit globally.

A banana plant is generally between two to nine meters tall. The banana plant is made up of leaves on a pseudo stem that comprises of leaf stalks. From the pseudo stem emerges the flowering stalk. The shooting stalk produces a bunch of flowers that hang on it. Banana fruits are then formed on "hands". The "hands" have approximately 12 "fingers". Approximately up to 150 "fingers" can be found on each bunch. The pseudo stem is cut down after harvesting. New pseudo stems also known as suckers are formed from the sprouting buds borne by the underground stem (rhizome or corn) which bears several of the buds. The new stems are then removed safe for one or two which are left to provide the ratoons crop.

Fig 5: The banana plant.



Source: Champion, (1963)

Ordinarily, bananas are vegetatively multiplied. Several sucker types can be used in banana multiplication process. The banana plant development process can be divided into three distinct periods. These are the vegetative, flowering and yield formation periods. The vegetative period is basically the time between planting and shooting. It usually takes between seven to nine months and up to 18 months at higher altitudes with lower temperatures or in the subtropics. The flowering and yield formation time is mainly the period between shooting and harvesting. This period lasts approximately 90 days. It takes about 6 months to harvest the next ratoon crops in the tropical lowlands. The ratoon numbers vary. A commercial banana plantation has an average life of between 3 and 20 years. Adoption of mechanical cultivation sees the economic average life of commercial banana plantation decrease to often between 4 and 6 years. Some banana varieties can be replanted after every harvest.

2.6.3 Environmental requirements for a Banana Farming System.

The growing zones for bananas vary from coastal lands to lower highlands zones. The growing of bananas calls for ecological conditions consisting of soils, temperatures, rainfall and altitudes.

a) Soils

A wide range of soils permit the growth of bananas. Adequate fertility and good drainage are major soil components that must be available for bananas to thrive. Bananas require good soil aeration though they are able to withstand short period of flooding. Well drained light to medium loam soil is the best soil type for banana production. Wherever possible, fertile deep soils that are rich in humus should always be preferred for production of bananas. A soil pH range between 5.5 and 6.5 is recommended for best growth of bananas.

Adequate fertility, good drainage and moisture are essential soil components for bananas. A good soil for banana farming should not be too acidic or too alkaline, should have adequate level of phosphorus and potash, and it must be rich in organic material that has high content of nitrogen.

b) Temperature

Bananas require a warm humid climate for optimal growth. They require an average temperature of between 20^{o}C and 30^{o}C. The normal banana plant growth is retarded at temperatures below 20^{o}C. The Valery and Lacatan varieties are a bit resistant to cold weather and tolerates it better

than any other banana varieties. Higher altitudes mean the areas are cooler and they slow down the development of the banana plant with the possibility of the inflorescence failing to emerge.

c) Rainfall

Bananas grow very well at an optimal average annual temperature of between 1000 and 2500mm. An average rainfall of 1400mm or more which is evenly distributed and does not have long dry spells provide an optimal yield environment for bananas.

d) Altitudes

Banana production usually requires the recommended altitudes of below 1800 m above sea level.

2.6.4 Spatial requirements for Banana Farming System.

According to Scott et al (2006), a banana-based farming system, together with growing the banana fruit may also include packaging, processing and even shipping the banana products directly from farms to markets. Further, contingent to the extent of the banana-based farming functions, the size of the farm may vary from a small family farm activity to a corporate entity comprising large expanses of land, many employees and multiple physical plants (Ibid).

On the issue of farm sizes for banana farming, Israel (2017), has found that land tenure practices are a major bane to banana farming because of fragmented lands in many rural areas where banana farming is practiced for subsistence. On the issue of small farms, Israel (2017) recommends a spacing of 3m between plantain rows and 2m within the row, i.e. 3m × 2m. Further, a spacing of 2.5 m x 2.5 m is provided as an alternative spacing. Israel (2017) estimates that a total 1667 banana plants can be accommodated in a hectare of land adopting the 3 by 2m spacing. Less plants numbering 1600 are accommodated on a similar farm size when using the 2.5m × 2.5m spacing.

Israel (2017) postulates that bananas rows should be in straight lines on flat fields so as to the banana plants maximum quantities of sunlight. Rows on sloping lands should follow the contour lines mainly for the purposes of containing or decreasing soil erosion. The desired banana plant pieces are typically planted at a depth of 30 to 60cm, about 11.8 to 23.6 inches, in the soil.

2.6.5 Economic Considerations in Banana based farming system.

According to Alemu (2017), banana is an important income-generating crop in most rural households living in the highland areas of East Africa. Mbaka et al (2008) have separately

established that approximately 20 million people in East and Central Africa hinge on banana for food supplies and income generation. Bagamba et al (2008), also states that the production of bananas provides appropriate alternatives to subsistence farming and generation of income especially in the mid and high elevated areas of East Africa.

Bananas can be relied upon for ensuring food security. According to Alemu (2017), banana is the world's fourth most significant crop in the food market adjacent to wheat, rice and maize. As a result, banana becomes a prime fruit crop leading in terms of value and volume in the world food market.

Lewis (2000) has established that banana farming provide employment for a large segment of rural populations. The jobs available in the banana farming system include opportunities in areas of banana research, banana processing plant operations, sales and marketing of banana products and transportation of banana products to markets. Consequently, numerous people in both rural and urban areas, have found employment in the banana industry.

Umadevi et al (2012), states that a banana is valued for its nutritional value. A banana is rich in both carbohydrates and vitamins specially vitamin B. Furthermore, it is a very good source of phosphorus, potassium, magnesium and calcium which are essential requirements of the human body. The banana fruit is easily digestible and cholesterol and fats free. Crushed banana produces a banana powder that is used as the very first food for a baby. When used regularly, a banana helps in the minimization of heart diseases and thus its highly recommended for arthritis, high blood pressure, kidney disorders, ulcers and gastroenteritis patients.

Very part of a banana plant has medicinal properties according to Kumar (2012). He, for instances states that banana flowers have been found useful in treatment of ulcers, dysentery and bronchitis. On the other hand, cooked banana flowers are considered a very good food for patients of diabetes. They are among the very best sources of potassium which is a very indispensable mineral critical for maintaining the heart function and normal blood pressure.

The fact that the banana fruit contains mild laxative properties and is constantly used to remedy constipation among children provides the clearest indication of its medicinal benefits as per FDA. The banana fruit is believed to play a very essential role in the treatment and curing of dysentery

and diarrhea. The fruit is used in the healing of intestinal lesions. The banana fruit is also part of the diets that are recommended for use by children suffering from malnutrition.

It is believed that the core of the banana stem is extremely useful in treating diabetes and stomach upsets. Further, an extract from the core of the banana stem is well thought out to be suitable for the purpose of reducing weight, dissolving the stones in the urinary bladders and the kidney. A mixture of coconut oil and spices with the banana inflorescence is beneficial for flushing of urinary blocks. The banana fruit is thought to minimize problems of worms in children.

The banana fruit can as well be processed to generate products such as jelly, chips, jam, banana puree, juice, banana crisps and even wine. The tender banana stem is used as a vegetable. The stem bearing the inflorescence is extracted by way of removing the leaf sheaths of the pseudo stem that has been harvested and hence used as a vegetable. Cooking bananas or the plantains are rich in starch and consists of chemical components similar to those of a potato.

The fibre in banana mainly from the stems is used weaving and basketry to make products like pots, wall hangers and bags. Banana waste can be used to prepare good quality paper and rope. The leaves of bananas are depended on as hygienic and healthy plates for eating.

2.6 THEORETICAL FRAMEWORK

2.6.1 Von Thunen's Agricultural Land Use Theory.

The first theory to ever attempt to explain the location of activities on an agricultural land was The Theory of Agricultural Land Use by Johann Heinrich von Thunen (1783-1850) and it was posted from the first half of 19^{th} century. Von Thunen formulated the model of crops distribution in agricultural territorial space after keen observation of various agricultural activities distribution in space and adherence to the usual assumptions of perfect competition (Ivanička, 1987).

Von Thunen avers that farming activities that attain the greatest profits would outbid all other products while competing for their location on agricultural land especially if environmental variables were held constant. He posits that the competition position of a livestock or crop activity, i.e. how high a bidding should go to secure a desirable state, depends on the anticipated level of return from producing such a crop of livestock at the particular location. This is important when considering the factors that influence how farmers allocate uses on their farms.

A crop that is anticipated to have a high food and livelihood return and hence a higher ability to repay its rent automatically outbids any other product that would generate less profits and hence rent-bid ceiling is that is relatively modest.

This principle of rent paying ability of an agricultural activity is important in this study as that would be an indicator of the activity's ability to support food and livelihood security in the community. The focus of this research project was therefore keen to investigate the level of benefits farmers accrued from various activities carried out on the farm, as a way of understanding their motivations for utilizing the land in the manner they did.

2.6.2 The Law of Diminishing Returns.

The law of diminishing returns is defined as a situation where the incremental or marginal output of a system of production decreases as the quantity of a single factor of production is increased incrementally while all other factors of production remain constant. From the literature that was reviewed in this study land fragmentation was found to be advantageous in helping mitigate risk and in helping a farmer to diversify their crop production. Subdivision of land and allocating it to a specific individual also enhances sense of ownership and responsibility thereby acting as an incentive for the individual to optimize production from the farm. Simply put, land fragmentation may be viewed as one way of eliminating the negative outcomes of production communal systems or the tragedy of commons.

As such it may be argued that with more subdivision of land and allocation to individuals, their sense of ownership will be improved and therefore they will be motivated to utilize their specific plots to maximize production. According to the law of diminishing returns this assumption will hold true up to a certain critical level, after which any further land subdivision for individual tenure will result to lower incremental yield per-unit returns.

From the law of diminishing returns we learn that there is a limit to which we can subdivide land to incentivize farmers to produce optimally and mitigate against risks associated with consolidated farming systems.

2.6.3. The Principle of Economies / Diseconomies of Size and Scale.

The principle of economies or diseconomies of scale is a sub set of the wider production theory which is a major attempt to elaborate on the principles through which systems or entities of

production decide on the quantity of each commodity it sells mainly its products or outputs it will produce, as well as how much of each factors of production such as land, raw materials, labour, fixed capital etc. it will employ.

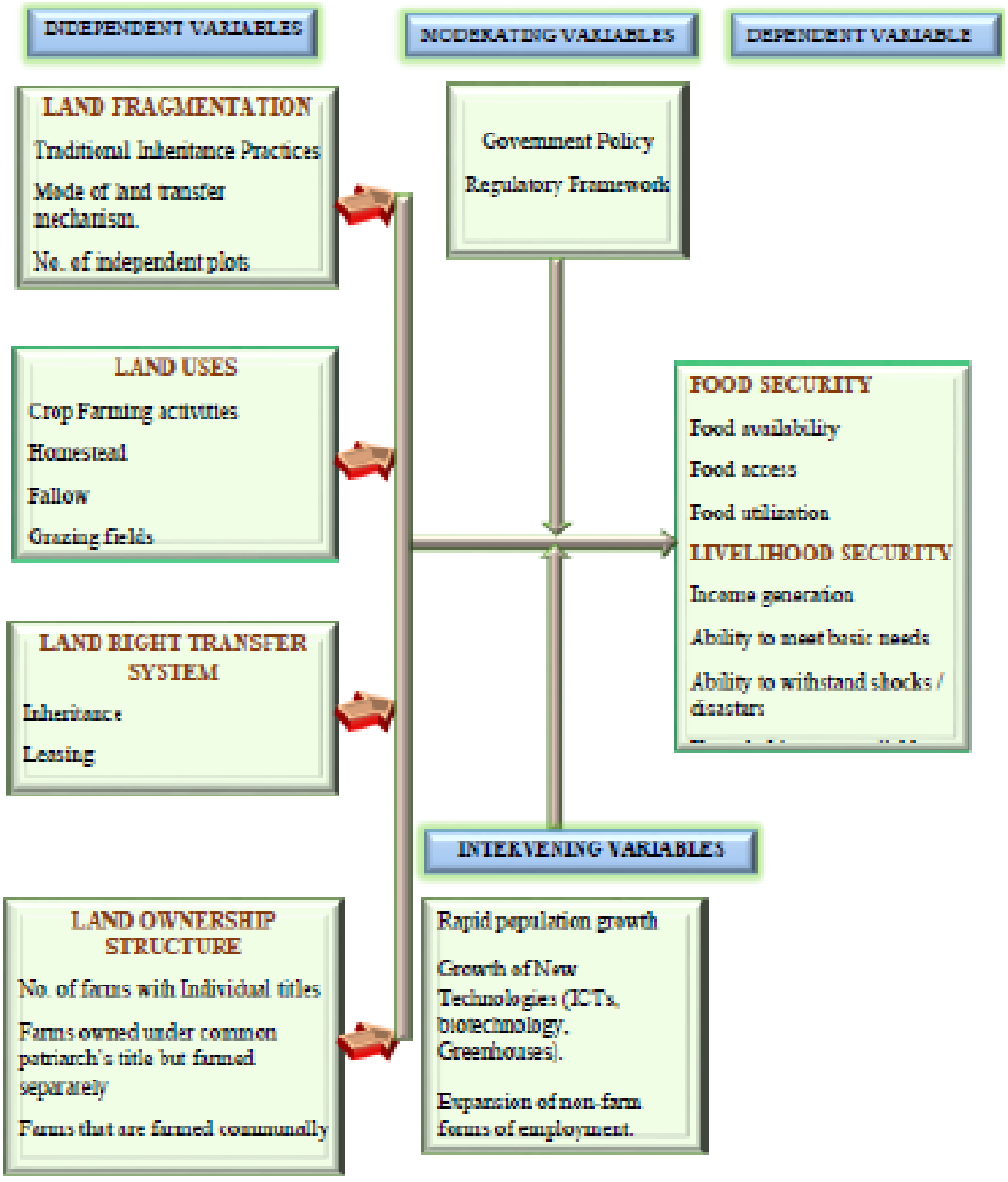
An example of economies / diseconomies of scale in a farming system may refer to a situation where yield is increased by increasing the size of land on which farming operations are carried out. The economies / diseconomies of scale is measured when all the factors of production are changed proportionately.

The focus of this study is on the impacts of land fragmentation on levels of food and livelihood security. The concept of economies / diseconomies of scale helps us to understand the relationship between reduced land sizes and the total crop yield from a farm. The size of land at some point attains a level where agricultural production is compromised and the size of land therefore becomes uneconomical for production.

2.7 CONCEPTUAL FRAMEWORK

The set of broad principles and ideas adopted from the relevant fields of inquiry and relied upon for structuring a subsequent presentation or study is a conceptual framework. A conceptual framework when it is clearly articulated has the potential to be useful for supporting a research. As a result, it thus aids a researcher to deduce meaning of succeeding findings. As a research tool, a conceptual framework is aimed at assisting a researcher advance an understanding and awareness of subject being scrutinized and be able to communicate the results comfortably. A conceptual framework, just like any other investigations in the social world, is in itself an element among the agenda of the study for negotiation. It therefore should be tested and scrutinized by the study as well as reformed and reviewed as part of the investigation.

Figure 6: Conceptual Framework.



Source: Author.

CHAPTER THREE:

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This study is based on data obtained from fieldwork including standard questionnaires, focused group discussions and interviews, measurement, photo and map interpretations and literature review. The data that was collected was analyzed using simple statistical techniques, and presented inform of maps, tables, charts, graphs and the text.

3.2 RESEARCH DESIGN

A research design is, according to Yin, (2002), the blueprint of any research. A research design refers to the description of the procedures and methods for adoption while in the process of obtaining the required information for purposes of solving the identified research problem. The core role of the research design is to ensure that the obtained evidence responds correctly the initial research question with as limited ambiguity as possible and if possible, without any ambiguities at all. A research design, "deals with a logical problem and not a logistical problem" (Yin, 1989: 29).

This study adopted an exploratory and descriptive approach as its research design. Consequently, both quantitative and qualitative data was used to help generate unique insight into land fragmentation which is a complex societal phenomenon. This is because the qualitative enquiries helped to explore the diverse manifestations of land fragmentation while the extent or magnitude of land fragmentation was determined through the quantitative means. The purposes of the combined approach were considered to reduce restrictions that could otherwise instigate from the research techniques either individually and or contribute towards increasing and testing positively the data's validity and reliability.

The study followed a field survey design in its resolve to respond appropriately to the research questions, goals and objectives. Generally, field surveys are non-experimental research designs. They don't have control for or ability to manipulate treatments or independent variables. Survey designs measures the study variables and tests their impacts by use of statistical methods. The field survey in this study captured snapshots of how land fragmentation takes place in the study area together with the local cultural beliefs that disseminate the practices of land subdivisions or food security situation. It followed the sampling of subjects randomly from the field settings to be able to respond to the study objectives. Further, the survey relied on a structured interview schedule

and a survey questionnaire to collect the relevant data from the identified sample elements. The external validity arising from data being collected from the field settings is a major strength of the survey design. Further, the ability of field surveys to study a phenomenon from multiple theories and multiple perspectives as well as their ability to capture and control for multiple variables are the other strengths of the survey design.

This research followed the cross-sectional survey method of research due to the fact that it has advantages in that one can generate sufficient data on the extent to land fragmentation is practiced in the study area at a reasonably very low costs and within a very short timeframe. Also, it can easily produce relevant data on the food and livelihood security in the study area which can be generalized to a wider population and it also makes it possible for the researcher to reach an appropriate conclusion on issues concerning land fragmentation and the state of food and livelihood security of a population. The cross-sectional survey method also afforded the researcher the overall control over ascertainment and or measurement process of the study variables. This meant that the researcher had unmeasured control over the accuracy of the estimates in strata or subgroups.

3.3 TARGET POPULATION

The target population was taken to be all the households in Bonyanchaire sub-location. The accessible population included peasant farmers, teachers, administrators, traders, land survey officers, Kisii County government officials, church leaders, and key informants.

In both the main plot and sub-plots, questionnaires were administered to either the landowner, head of the family (father/mother) or a grown up person (18 years and above) living within the house and has a blood relationship with the family farming on the land, children under 18 years were not interviewed.

In each village, the study focused on households living in subdivided land and those living in the main land and also considered those operating farming activities on leased land to support their livelihoods.

3.4 SAMPLING PLAN

3.4.1 Sampling Preliminaries.

The process of acquiring information about an entire population by investigating only a portion of it is sampling (Kothari, 1985). Those methods that are employed to determine an element that is to be included in the sample from the entire population are sampling procedures.

The complete list of all units that are in the study population together with the determination of the structure of enquiries is the sampling frame (Olaseni, 2004). The sampling frame in this study refers to the list of all registered plots in Bonyanchaire sub-location.

The total number of all items that are identified for extraction of the required information on behalf of the entire population is the sample size. To determine the sample size and achieve a representative response, the statistical theory of estimation was deployed with considerations of a certain degree of confidence as expected to be adopted based on the nature of this research.

3.4.2 Sampling Procedure.

The process of identifying a few members from an entire bigger population or group for use as the foundation for predicting or estimating the extent of occurrence of an unknown outcome, piece of information or situation concerning the entire group or population is sampling (Ranjit kumar 2014). Therefore, a sample is a representative sub group of the entire population a researcher has interest in.

A combination of four sampling methods were considered appropriate for this research in order to collect a more formidable representative data for analysis. These four sampling methods are firstly purposive sampling method which involved choosing the Sub-location that would specifically address the objectives of this study from amongst four (4) sub-locations within Bomorenda location; the stratified sampling method which entailed the listing out of all the six different villages as strata for studying the land fragmentation phenomenon; the systematic sampling method was used to select the specific plots for collecting data from each strata and finally sampling randomly according to each of the form of land fragmentation.

Stratified sampling was used to select the village within the sub-location and Systematic sampling method which was used to select the specific plot of land or household for collecting data. Bonyanchaire sub-location is geographically divided into six (6) villages. The study denoted these

villages as subgroups or strata. This method will applied since the land in Bonyanchaire has been surveyed and allocated registration number along numerical order in each village.

In each stratum, the study identified the first twenty plots of land according to the numerical labeling. The study used twenty pieces of paper, similar colour and sizes to write each number on a paper to represent the first twenty plots of land. The papers were mixed and put into a paper bag which were then thoroughly shaken. Then, the study randomly drew one piece from the bag containing twenty pieces. This number was taken to represent the first household or land to administer the questionnaire. The study then picked every twentieth household thereafter. This was be repeated to all the four villages / strata. This allowed each household within Bonyanchaire sub-location to have equal opportunity of being nominated.

3.4.3 Sample size.

In this study the sample size was determined using a statistical formula (Yamane, 1967) as shown:

$$N = \frac{z^2pq}{d^2}$$

p = the proportion in the target population estimated to have characteristics being measured.

q = l-p

d = the set statistical significance level

The study assumed the characteristics of interest as 90% for Bonyanchaire sub-location to get valid data as recommended by Fischer et al.

Thus, Z statistic will be 1.96

Desired accuracy - 0.05 level

$N = (1.96)^2(0.9 \times 0.1) / (0.05)^2$

= 138 (Approx. = 140)

= 140 households.

3.5 DATA COLLECTION INSTRUMENTS

A good research design must be able to aid in the ability to obtain reliable and valid data that can be depended upon to establish facts and refute or even validate any pre-existing anticipation or hypothesis if at all there was any. Based on this understanding, this research pursued data based on two categories mainly: -

i. Primary data
ii. Secondary data

Primary methods of data collection were adopted to source the primary data where the following data collection instruments were relied on.

3.5.1 In-depth interviews

This instrument was used on households particularly their heads, officials of the village headmen and officials of the national and county agencies managing land and residents' livelihoods in Bonyanchaire sub-location. The interview sessions were guided by a detailed interview schedule targeted at capturing issues on land fragmentation and food security that could not be exhaustively examined through the questionnaire. These interviews were scheduled to take place between 4.00 pm and 6.00pm on week days and Saturdays between 8.00am and 10.00am. This strategic timing helped to ensure that the expected respondents would have enough time to spare and furnish the researcher with sufficient information that would aid in the extraction of the desired data.

3.5.2 Structured Questionnaire.

The structured questionnaire comprised of structured questions that formed the basis upon which data was extracted from the respondents basically on household sizes, age brackets, education levels, career, and socio-economic class among others of the residents. The questions included on the structured questionnaire were very interactive and thus encouraged maximum attention and cooperation of the respondents. The questions were self-explanatory as well and were simple and clear aiding collection of accurate data and right responses from the sample size. The structured questionnaires were administered to the heads of the households of the sample population or their representatives with main focus being to extract the relevant data to respond to the study questions and objectives.

The questionnaire was administered in two ways:

i. Self-administered.

This method was considered vital because its combination with other instruments of data collection is most appropriate for a research of this sort as the advantages derivable from appropriate multiple approach includes high response rate, opportunity for clarification request if any and a detailed investigation of the physical structures on ground.

ii. Collective Administration:

This was be done through the assistance of headmen of the four villages in Bonyanchaire sub-location. A target audience was achieved during their monthly village meetings, where they address villagers on various government initiatives. This helped to ensure a quick and high response rate.

The secondary data used will be sourced from secondary sources including the following:

3.5.3 Documentary/Historical Materials (From Archives).

A visit was made to the Planning, Lands, Trade and Agriculture Departments of Kisii County to obtain secondary data such as land survey map, details of the registered land and, major sources of livelihood/ income, and master plan for livelihoods improvement. The data so extracted was used to identify the individual household by their numberings and their locations on the survey map which served as a guide to the sampling method adopted for the study. Statistical data and information were collected from public and private institutions at county and national levels.

3.6 Research validity and reliability.

The accepted and rigorously accepted methods of research were employed to execute the research needs. Validation of findings to ensure they were based on a critical investigation was done. The purpose of validating the process of research and or research arguments is aimed at showing that the research was sound and well founded. Validation demands that procedures for data analysis are as objective as possible and that the theories used to inform the study are universally applicable. In this context therefore, objectivity corresponded to the statistical concepts of validity and reliability.

3.6.1 Pilot Testing.

The preliminary testing of research instruments on a small sample of the study population is pilot testing. The essence of pilot testing is to aid in troubleshooting the study instruments of any format or any other potential shortcomings. Further, pilot testing is additionally important in that "the impressive economy of the questionnaire is partially offset by the researcher's inability to clarify the meaning of terms" (Sommer and Sommer, 1991, p. 138).

On October 4, 2018, a pilot study was conducted on the questionnaire used in this study. This was so as to assist in reducing any confusion and ambiguities of the questions. For any problems that were detected during pre-testing process, changes were made to the questionnaire as necessary (Sommer and Sommer, 1991). The questionnaire was then reviewed by the researcher and subsequently finalized.

3.6.2 Validity of the instruments.

The accuracy and meaningfulness of the inferences made in a research that are founded on results of the research is validity (Mugenda and Mugenda, 1999). The extent to which research analysis results actually represent the phenomenon under study is validity. The reasonability and correctness of data to actually represent the object of study.

Specialists, senior academics and experts on the study topic were consulted for the purposes of determining the suitability of the contents of the instruments so as to achieve face and content validity, content-related evidence, of the study instruments. The reason for this was to establish the extent with which the instrument was able to cover mainly the breadth of the content area and ultimately find out if the instrument format was appropriately designed to aid in extracting the needed information.

3.6.3 Reliability of the instruments.

Reliability refers to the measure of the extent to which an instrument of research harvests consistent data or results after frequent trials (Mugenda and Mugenda, 1999). Reliability concerns itself with consistency of the results obtained using the study instruments and the consistency of the research instruments to yield similar results or rather gives consistent outputs that are either the same or close to each other upon replication of the instruments under the same conditions and assumptions (Asika, 1991).

For replicating a study, it is most important to use consistent and systematic line of questions especially in areas that aren't even anticipated. The study instruments adopted for this research comprised of consistent and systematic line of questions to enhance reliability of the instruments. The questions included in the research instruments were related to the study subject and organized into themes in the study.

The research project also adopted statistical levels of measurement commonly known as rating scales. Basically, rating scales refer to values that can be taken buy an indicator but do not say anything regarding the indicator. The Likert items allowed for more granularities and hence more finely tuned responses were obtained from the respondents.

The Test – Retest technique was used to enhance reliability in this study. The same data collection instrument was administered to the same group of objects twice. A time lapse was allowed between the first and second tests. A reliability coefficient of 0.80-1.0 indicated that there is a high degree of reliability of the data used in this research project. A positive result of the test retest supported the efforts made by the researcher and the design of the study to control for factors outside the control of the respondents.

To enhance reliability further, the researcher did not predetermine the respondents' opinion or responses or ask guided questions; and the questionnaire was crafted so that the questions are clear and precise and they were not ambiguous nor could they be interpreted in many different ways.

3.7 DATA ANALYSIS METHODS

Statistical tools were used in two different ways to analyze the data that was collected by this research. Descriptive analysis was the first way adopted for analyzing the data. The descriptive analysis was systematically undertaken by representing the obtained data as frequencies and percentages for each study theme inform of tables. Inferential statistics that involved mainly the testing of the research questions that is theory testing was done statistically.

The raw data that was collected during field survey was prepared first for analysis. It was converted into a machine-readable format basically a numeric format in a spreadsheet. This was so as to aid its analysis through computer-based program known as SPSS. The preparation of data for this kind of analysis followed the given procedure.

Data coding was the first step. The coding process was guided by a codebook which was created first before coding could start. A codebook refers to the detailed document that consists of comprehensive description of every study variable being investigated by the research. Further, it consists of the measures or items for each variable, the scale of response for each item, the format for each item and the procedure for coding each value into a numeric format. In this study, we had a measurement item on a five-point Likert scale with anchors ranging from "strongly disagree" to

"strongly agree", we coded items as 1 for strongly disagree, 3 for neutral, and 5 for strongly agree, with intermediate anchors in between.

Data that had been coded was then input in a spreadsheet before it was directly entered in the SPSS. The benefit of entering the data on the spreadsheet or a database first before coding in the SPSS program was to aid in reorganizing as required, ability to share the data across programs, and the fact that spreadsheets and or databases allowed for extraction of subsets of the data for analysis. Occasional spot checks on a set of observations or items during and after data entry aided in frequency checks of entered data's accuracy. Furthermore, while entering data, the coder watched out for obvious evidence of bad data, such as the respondent selecting the "strongly agree" response to all items irrespective of content, including reverse-coded items. When found, such data was entered but was excluded from subsequent analysis.

Missing data is an inevitable part of any empirical data set. Respondents may not have answered certain questions if they found them ambiguously worded or too sensitive. During data entry, SPSS automatically treated blank entries as missing and simply dropped the entire observation containing even a single missing value. Research data that was so prepared was then be presented in tables and pie charts representing the frequency and percentages of individual values for that variable. The researcher also tested the statistical significance of the means obtained from data for the separate variables used in the study.

3.9 ETHICAL CONSIDERATIONS.

The researcher assured the respondents on the confidentiality of information given by them. Respondents were informed of the purpose of the study. Information was collected from respondents with their consent and voluntarily. Further, Permission was also sought from the relevant authorities to allow collection of information from respondents.

3.10 OPERATIONALISATION OF VARIABLES

Operationalisation is a process of defining the measurement of a phenomenon that is not directly measurable, though its existence is indicated by other phenomena. It is the process of defining a fizzy concept so as to make the theoretical concept clearly distinguishable or measurable, and to understand it in terms of empirical observations. In this study, indicators of the main variables under the study were identified in order to render the variables measurable.

Table 2: Operational definition of variables.

Objective	**Variable**	**Indicator**	**Measurement scale**
Assessment of current household land sizes due to persistent land fragmentation in the study area.	Land Sub divisions.	Number of subdivisions on farm. Number of different people farming on a farm.	Nominal
To examine the relationship between land sizes and food security in the study area.	Land sizes.	Crop Yield per acre of land. Frequency of food shortages experienced in household.	Nominal
To analyse the factors that influence the use of household land in the study area.	Land Uses.	Types of crops grown on a farm Frequency of times food from crop is eaten in the household Income earned from crops harvested from farm when sold	Nominal
To document inter-generational transmission of land rights in the study area.	Land rights Transfers.	Original ownership of farm Relationship between original owner of farm and other users.	Nominal

CHAPTER FOUR:

EMPRICAL RESULTS AND DISCUSSIONS

4.1 Introduction

The purpose of this study was to investigate the implications of land fragmentation on the sustainable food and livelihood security of farmer households in Kenya with Bonyanchaire Sub location in Kisii county serving as the case study. This Chapter presents an analysis of the data collected from questionnaires and interview schedules administered in Bonyanchaire sublocation of Kisii County, Kenya.

The Chapter also deals with presentation of results, which begins with description of the participants' bio-data. The research questions formulated for this study guided the arrangement of the presentation of the results. Each research question focuses on the variables such as current land sizes in the study area, factors affecting land sizes, availability of food for households throughout the year, land use patterns, land tenure, and possible alternative policies as independent variables and sustainable food and livelihood security as the dependent or criterion variable. An analysis of the main findings on each aspect of enquiry follows and in addition and where relevant, selected findings from the personal data collected are used to inform and contrast the findings.

4.2 Response Rate.

The response rate is the proportion of the sample that participated in the research intended in all research procedures. The study targeted the household heads, community leaders and planning professionals who are very conversant with the subject of study. A total of 140 questionnaires were administered to the respondents from the target population in collecting data with regard to the effects of land fragmentation on sustainable food and livelihood security in the banana based farming system of Bonyanchaire sublocation of Kisii County, Kenya.

From the study 104 out of 140 target respondents filled in and returned the questionnaires contributing to 74%. This is a positive response rate. The reason for this could probably be that the farming households, community leaders and enlightened respondents were concentrated in the study area and because of their literacy level they understood the importance of interview and administration of questionnaires and responded promptly.

The questionnaires that were not returned were due to reasons like; the respondents not being available to fill them in at the time and with persistent follow-ups there were no positive responses from them. The response rate demonstrates a willingness of the majority of the respondents to participate in the study.

4.3 Demographic Characteristics of Respondents.

The study mainly targeted heads of households, their spouses or community leaders drawn from Bonyanchaire Sublocation, Kisii County, Kenya. As such the results on demographic characteristics of the respondents were investigated in the first section of the questionnaire. They are presented in the following sub-sections as age of respondents, level of education and occupation of the respondents.

4.3.1 Age of Respondents.

Respondents' age ranged between 22 and 75 years with a mean age of 45.29 years and standard deviation of 13.05 years. This is a moderately varied distribution showing that the population contains a large number of members in both the young and older age categories. This is particularly important because youths make up the majority of the population while the elderly have the historical knowledge handed down the generations on traditional land management practices. They age of respondents was categorized as below:

Table **3**: Age of Respondents.

Age Bracket	Frequency	Percentage
18-27	24	23
28-37	19	19
38-47	15	15
48-57	17	17
58-67	12	12
68 and Above	14	14
Total	102	100

Source: Survey Data, 2019.

4.3.2 Marriage status of respondents.

The target respondents are distributed in various age brackets hence their marital status are likely to be different. As such the research study sought to establish the marital status of these

respondents since marital status or family responsibilities are factors that can influence one households' perception of threshold for food or livelihood security.

Table **3**: Sample distribution by marital status

Marital status	number of respondents (n)	percentage
Married	76	74.5
Single	8	7.8
Widowed	16	15.7
Divorced	1	1
Separated	1	1
Total	102	100

Source: Survey Data, 2019.

Research assistants were required to collect data from respondents who had to be household heads as the study was household based. Slightly over half of the respondents (56.4%) were male while female respondents accounted for 43.6% of the total sample size. All the households surveyed were nuclear in type, that is, they were not of the extended family or clan-based type.

4.3.3 Gender Distribution among respondents.

Gender of household members was considered an important aspect because traditionally land inheritance has been from fathers to their male children. An analysis of number of males per household would therefor give an indication of the rate of land subdivision arising from the tradition of inheritance which is common in the study area.

The households were surveyed on the number of children they had (sons and daughters). The lowest number of sons found in the study was 1 with the highest being 7. The mean number of sons in a typical household was 2.34. The lowest number of daughters was 1 and highest 6. Mean number of daughters in the study was found to be 2.18.

This means that the number of sons per family in the study area was marginally higher than that of daughters and this might have an implication on land size given that the cultural practice in the community under study is to divide land among sons, rather than to daughters. It is only in limited cases (for example when there is no male in the family) where daughters inherit land from their parents.

Further, the distribution of males in the study area shows that about half of households have at least two sons with the mean number of males in the household being 1.83. This information is shown in the next table:

Table **4**: Sample distribution by marital status

Number of Males in Household	percentage (%)
0	8.3
1	41.7
2	25.0
3	8.3
4	16.7
Total	100

Source: Survey Data, 2019.

For the number of females, there were 46.7% households with 1 female, 40.0% with 2, and 6.7% with 3 females. The households which did not have a female person was 6.7%. The mean number of females in households in the study area was 1.47 again showing that males were marginally more than females in this region.

4.3.4 Education Levels of respondents.

The education level for respondents sampled in the study area is shown in the table below:

Table 6: Education level of family members

Respondent	Education Level			
	No School	Primary	Secondary	Tertiary
Male Respondent	30.4	45.1	19.6	4.9
Female Respondent	13.7	62.7	17.6	5.9

Source: Survey Data, 2019.

The table shows that a third of the male respondents (30.4%) do not have any school education compared to only slightly more than 10.0% of the female respondents. Further, more female respondents have a primary level education compared to male respondents. The significantly

lower level of male respondents compared to female respondents in this study translates to the type of occupations that male respondents specifically will command, which will naturally cluster around subsistence farming or other unskilled labourer.

As expected from the education levels, more than a third of the male respondents do not have any occupation (36.3%), 42.2% describe themselves as farmers with the rest in small business (11.8%) or other occupations. The percentages for female respondents are similar: 39.2% have no occupation with an equal percentage describing themselves as farmers. The rest are in small business (14.7%) or other occupations.

The sons or daughters in the households surveyed were aged between 1 and 57 years. A sample of the cohort for first son or daughter with respect to education level shows that 31.4% had no education (or had not joined school), 30.4% had a primary school level education, and another 30.4% had a secondary school level education. Only 7.8% had tertiary education.

The occupations for sons and daughters in these households were naturally defined by their ages. Those with no education tended to have no occupation (69.6%), those in school going age listed themselves as students (23.5%), while only 4.9% described themselves as farmers. The general finding is that the lower the education level the more likely it was that the respondent did not have a recorded occupation.

4.4 Determination of Land sizes in the study area.

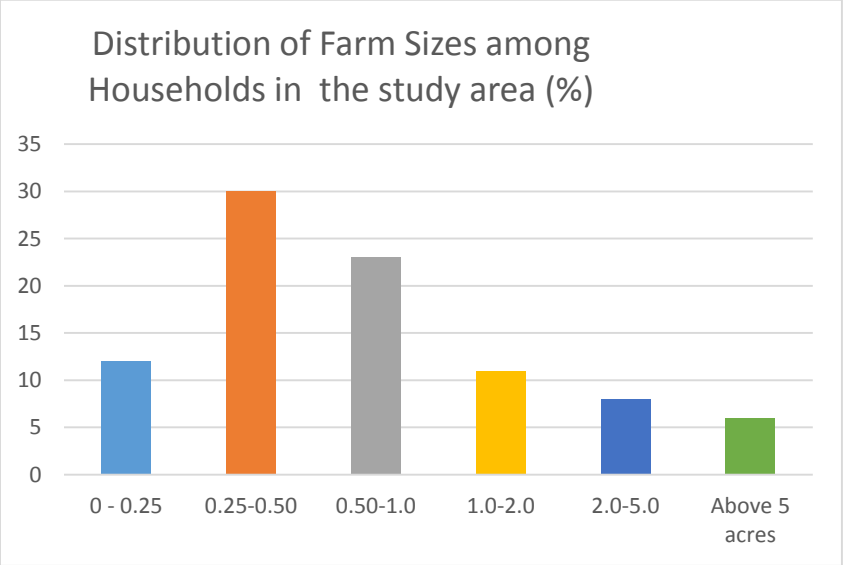
The study set out to determine the average household land sizes in the study area. Information on the land sizes obtained from respondents in the study area is summarised in the table below:

Table 6: No. of households with farm size category.

Farm Size Category (acres)	No. of Households	Percentage	Cumulative Percentage
0 - ≤ 0.25	14	14	14
0.25 - ≤ 0.5	36	35	49
0.5 -≤ 1.0	27	26	75
1.0 -≤ 2.0	11	11	86
2.0 -≤ 5.0	8	8	94
≥ 5.0	6	6	100
TOTAL	102	100	

Source: Survey Data, 2019.

Chart: Distribution of Farm Size Categories among households in the study area.



Source: Survey Data, 2019.

Respondents reported that their parents' land size before subdivision ranged from less than a quarter an acre to a high of twelve (12) acres. The farm sizes were categorised and represented in the chart above. It shows that most households in the study area own between a quarter of an acre (30%) to one acre (25%). The average household land size holding in the study area was determined to be 0.67 acres.

4.4 The factors which influence household land sizes in the study area.

The second objective of the study was to find out which factors influence land sizes in the study area. This information was summarised in the table below:

Table 6: Factors influencing land sizes.

Factor	No. of Households	Percentage	Cumulative Percentage
Land Inheritance	66	64	65
Household size	25	25	89
Off farm incomes	9	9	98
Government Policy	2	2	100
TOTAL	102	100	

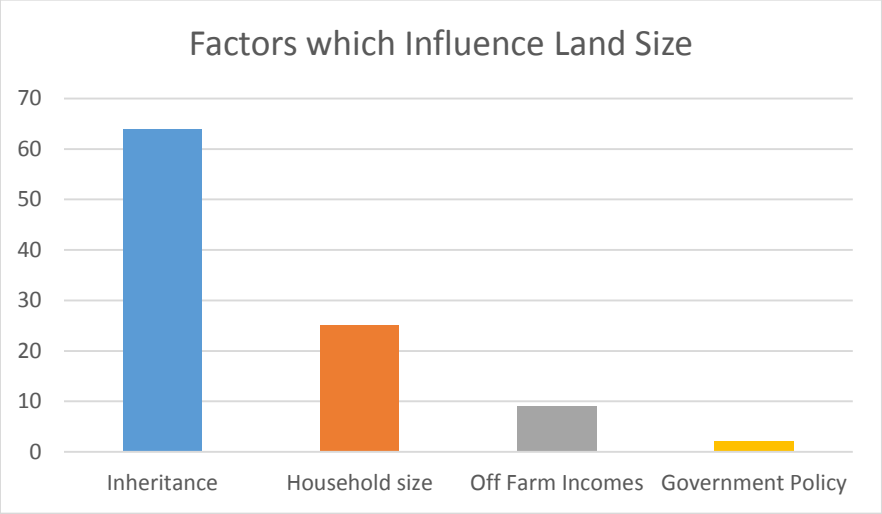
Source: Survey Data, 2019.

The respondents reported that Land inheritance is the single most influential factor (66% responses) influencing the size of household land sizes. This is related to the cultural practice of bequeathing sons as a form of inheritance to sons. 25% of respondents reported that the size of the household influenced land sizes. This can be explained with the high rate of population growth recorded in the study area.

9% of the respondents reported that off farm incomes influenced the size of household land sizes. This could be explained by the fact that some of the respondents with off farm incomes had spent their savings to purchase or lease a piece of land, thereby adding to land inherited. The study also observed that respondents with off farm incomes were under less pressure to subdivide land for sale to offset household needs for fees and medical expenses. Only 2% of respondents felt that government policy influenced land sizes in the study area. Government policy can either regulate or facilitate or hinder and control land subdivision in the study area.

This information is presented in a chart below.

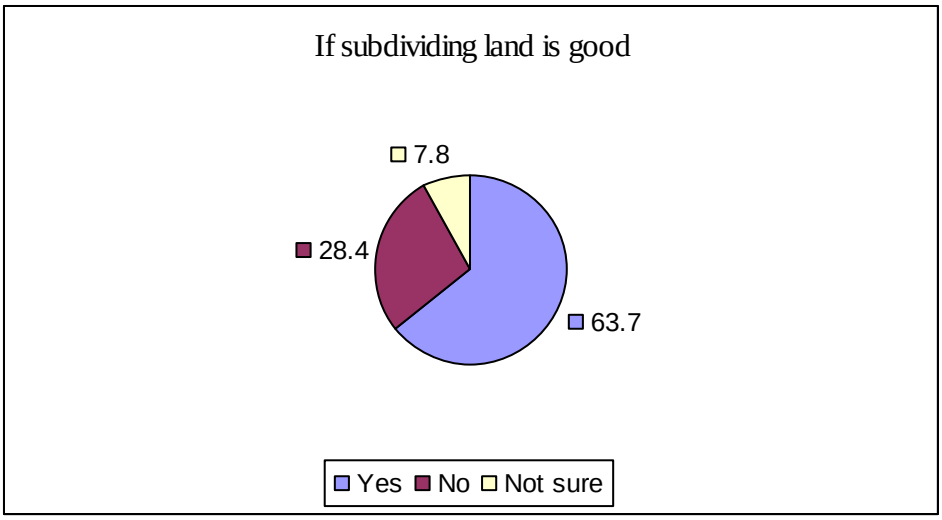
Chart 1: Factors which influence Land size.



Source: Survey Data, 2019.

The study also sought to investigate the attitudes that the respondents had towards land subdivision which leads to reduced land sizes. The attitudes towards subdividing land are captured in the chart below:

Chart 2: Respondents' attitudes towards subdividing land



Source: Survey Data, 2019.

From the chart, majority of respondents (63.7%) report that subdividing land is good while about one third (28.4%) think that it is not good. The reason for supporting land subdivision was given as enabling family members (heirs) satisfy the human need of owning land. For those who said subdivision was not good, promotion of an alternative policy was considered necessary to limit or curtail this process. It was also felt that subdivision of land led to low yields in crops and livestock. In the case land was subdivided, respondents preferred to obtain land averaging 4.41 acres (if it were available) feeling that this would very adequately meet their needs.

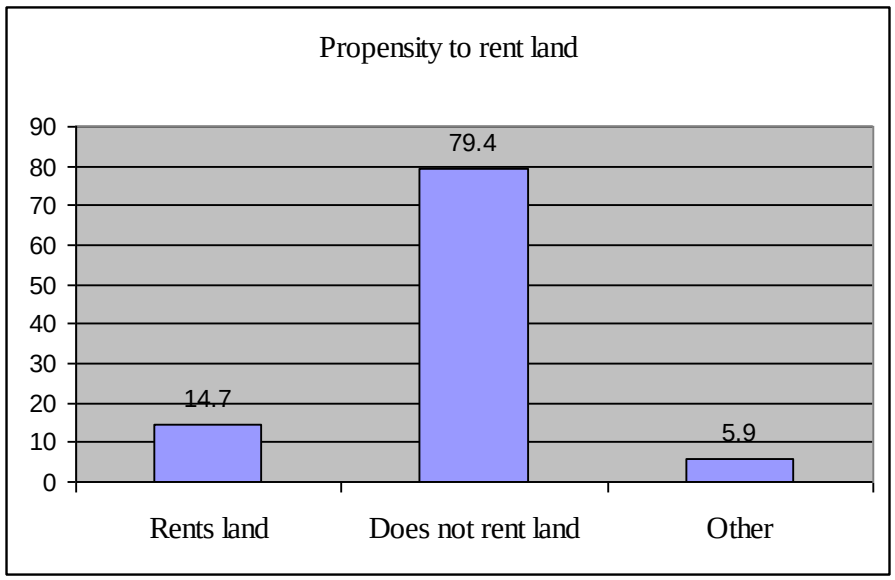
4.4. The land holding or ownership structure in the study area.

62.7% of respondents surveyed reported that they owned land while 34.3% did not own land. The number of pieces of land owned ranged from just one (owned by 76.8% of respondents) to two (12.5% of respondents) or more than two (8.9% of respondents). Total land owned averaged 1.65 acres with the smallest piece being under 1.0 acres and the largest at 6.0 acres.

In terms of spatial distribution, 69.2% of pieces were located within 10 kilometres of the respondents' home while the rest (30.8%) were over 10 kilometres away. The size of land owned under this arrangement averaged 0.84 acres with the smallest being just under one acre and the largest at eight (8) acres. The major mode of acquiring land was through inheritance (86.3%). Buying accounted for only 2.0% of land owned while 11.8% of land was acquired through other means.

The main use of land currently owned was for domestic purposes (94.1%) while commercial and other uses accounted for the remainder (5.9%). Only 34.3% of land parcels had titles or documents of ownership with the remainder (65.7%) not having any documents (or not indicated). Further, majority of respondents do not rent land as shown in the next chart.

Chart 1: Respondents' propensity to rent land



Source: Survey Data, 2019.

Thus, from the chart majority of respondents do not rent land. Only a small percentage (14.7%) gets to rent land for its use. This data might have relevance when considered from the perspective of the nature to which land is put and the food security situation.

Majority of rented land (84.6%) lies within a spatial spread of 4 kilometers with only 15.4% being over 4 kilometers away. The mean size of rented land was 0.98 acres spread between a low of 0.5 acres and a high of 5.0 acres. The main use of rented land was domestic purposes (10.8%), farming (3.9%), or other uses (84.3%).

In terms of the duration of renting, the shortest time for which land was rented was one month while the highest was ten months. The mean duration of renting was 4.07 months. The cost of renting also varied between a low of Kenya shillings 1,000 and a high of Kenya shillings of 10,000. The mean cost of renting was Kenya shillings 3893.33.

4.5. The effect of land sizes on household food security in the study area.

Respondents also report that subdivision has led to low yield. The study tested the impact on food security of total land owned and the size of land under main crop. This study tested a hypothesis on whether land size has a significant relationship with food and livelihood security in the study area. This hypothesis was stated mathematically as follows:

Null hypothesis, H_0: Land sizes do not significantly influence household livelihood and food security in the study area.

Alternative hypothesis, H_1: Land sizes do significantly influence household livelihood and food security in the study area.

(Significance level at 95%)

The results of this test are shown in the next table:

Table 8: Hypothesis testing for relationship between Household land size and food sufficiency.

Test statistic	*Value*	*Degrees of freedom*	*Asymp. Sig. (2-sided)*
Pearson Chi-Square	14.997	19	0.723

Source: Survey Data, 2019.

From the test statistic and the p-value at 14.997 being larger than 0.05 means that the results are not significant. Accordingly, it is not possible to reject the null hypothesis. In other words, the statement that Land sizes do not significantly influence household livelihood and food security in the study area. This may mean that despite the reduced land sizes, the study area is food and livelihood secure.

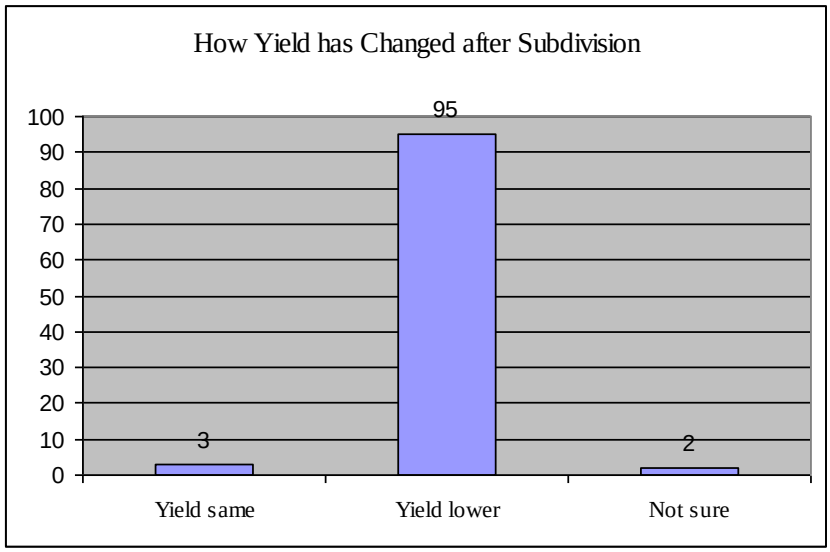
This could probably be explained by the diversification of livelihood sources beyond farming. There could also be food supplements coming from other regions in Kenya such as Kitale and the North Rift.

Slightly over half of respondents (50.5%) reported that modern farming techniques are easy to apply while 43.6% disagreed. The percentage reporting not sure is 5.9%. Further, 73.3% of respondents agreed that land fragmentation has led to new farming techniques, while an equal percentage (13.3%) disagreed or was not sure. Respondents also reported that cattle numbers have declined due to small land sizes (72.3%) while 19.8% disagreed. Only 7.9% reported that they

were not sure if the decline was due to small land sizes. The mean change in cattle numbers was found to be 3.88 heads of cattle.

The study shows that there have been changes in food production yields as a result of subdivision of land. The changes are shown in the next chart:

Chart 4:: How food yield has been impacted by land subdivision



Source: Survey Data, 2019.

Respondents also indicate that declines in food yield have changed by about a quarter (8.9%), half (44.4%), or by three-quarters (46.7%). Thus, it can be seen that there has been a major change in food yield due to land subdivision. The reason given for this change is that smaller land sizes do not yield the same as when large.

The degree of food security is shown by the number of months in a year in which the family has no shortage of food. The study found that 11.0% of families were food secure for 3 months, 9.9% were food secure for 4 months, and 40.7% were secure for 6 months, while 23.1% were food secure for the entire year (12 months). The mean duration of food security was 6.84 months for the families in the study area.

Most families also reported that food was sufficient during the year (87.3%) with only 12.7% reporting that their food supplies were not sufficient. The mean duration in which food was sufficient was 8.21 months. For the families who did not enjoy food sufficiency, 3.9% lacked food 3 months in the year, with another 3.9% lacking food for 9 months in the year.

Of the families experiencing food insufficiency, 85.3% reported suffering moderate scarcity while only 1.0% reported severe scarcity. The percentage of families who have skipped meals in the last three months is shown in the next table

Table 9: Family has skipped a meal in the last 3 months due to scarcity

Family has skipped meal	***Percentage (%)***
Yes	14.7
No	71.6
Other	13.7

Source: Author.

Thus, only 14.7% of families have had to skip a meal due to scarcity with a majority (71.6%) still managing to find food even in this situation.

The main food was the traditional Uji or tea for breakfast, Ugali or Bananas for lunch and Ugali for supper. This represents the cultural attachment to maize-based foods popular in the area of study. As far as protein intake was concerned, milk was consumed mostly weekly, beans also mostly weekly while chicken/fish/goat meat were consumed mostly monthly. Thus, the traditional meals consumed were mostly starch-based and reflected both the income and production profiles of the residents of the area.

4.7 The factors which influence the household land use patterns in the study area.

The study sought to establish the factors which influenced land use patterns in the sub location. Data obtained from the respondents was summarised in the table below:

Table 6: Factors influencing land use patterns on household land.

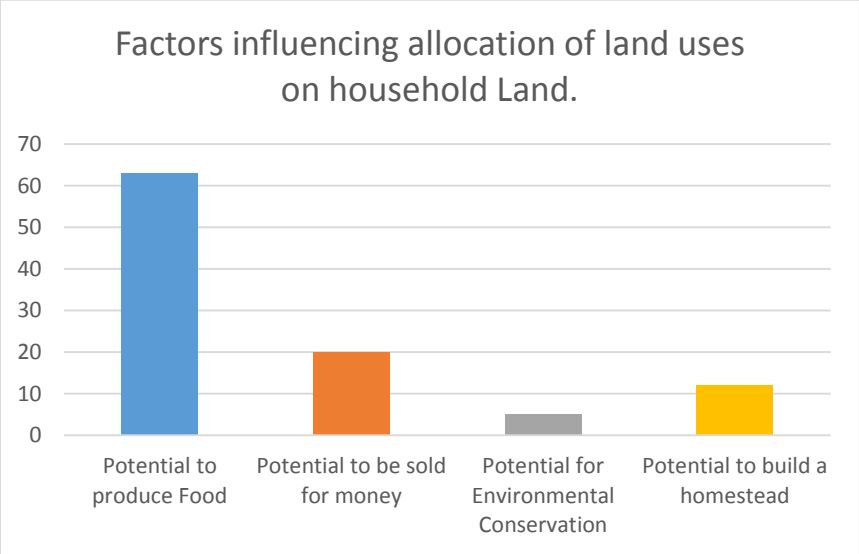
Factor	No. of Households	Percentage (%)	Cumulative %
Potential of to produce food	64	63	63
Potential to be sold for money	21	20	83
Potential for Ecological Value	5	5	88
Potential for Building a homestead	12	12	100
TOTAL	102	100	

Source: Survey Data, 2019.

65 % of the respondents reported that a land use's potential to produce food was the prime factor which influenced locals in the study area in allocating it space in the household land. This is consistent with the observation that farming activities in this study area is for subsistence. The urge to make money from farming activities was the next most influential factor for land use at 20%. Environmental conservation ranked lowly at 5% of the respondents reporting it to be influential. This may explain why the hillsides have been invaded and are being cultivated notwithstanding the environmental challenges this presents.

Only 12% of residents reported the establishment of a homestead as being a major factor to consider when allocating land uses on household land. This is important because it could be an indication that locals could be willing to settle in a centralised location so as to free household land for farming activities. This information is represented in a chart below:

Chart: Factors influencing allocation of land uses on household Land.



Source: Survey Data, 2019.

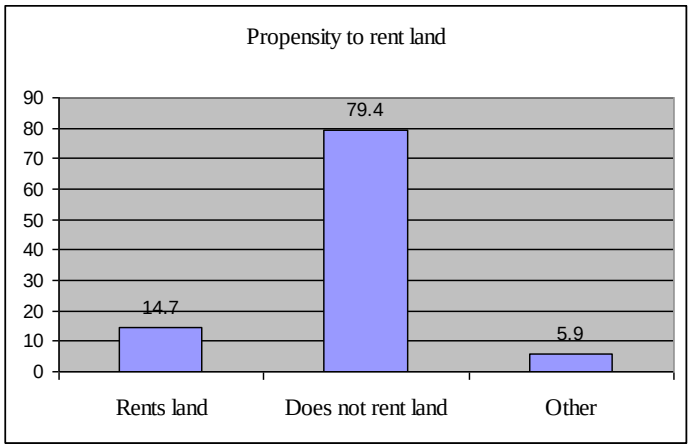
4.8 The land holding and ownership structure in the study area.

In this study, 62.7% of respondents surveyed reported that they owned land while 34.3% did not own land. The pieces of land owned ranged from just one (owned by 76.8% of respondents) to two (12.5% of respondents) or more than two (8.9% of respondents). Total land owned averaged 1.65 acres with the smallest piece being under 1.0 acres and the largest at 6.0 acres.

Respondents who listed the number of brothers at the time of inheriting land from their parents as follows: 1 brother (5.4%), 2 brothers (28.3%), 3 brothers (27.2%), 4 brothers (16.3%), 5 and above (21.7%). The mean number of brothers was 3.45 at the time the respondent inherited land from his parents. The study also found that in nearly all the cases (95.1%) respondents inherited equal shares of land from their parents.

The percentage of respondents having specified numbers of sisters at the time of inheriting land is as follows: 1 sister (27.3%), 2 sisters (27.3%), 3 sisters (24.7%), and 4 sisters (11.7%). The mean number of sisters at time of inheriting land was 2.49, a figure that is lower than of brothers, again indicating the higher number of brothers or males in this study area compared to females. Further, only 10.8% of respondents reported that their sisters inherited land from their parents, 65.7% said sisters were not given any land, while about a quarter (23.5%) had no response to this question, perhaps because it did not apply to their situation. In the case where sisters inherited land from parents, the mean size of land inherited was 1.16 acres. Slightly over a third of respondents reported that cultural practices influenced land use and inheritance (34.3%).

Chart 5: Respondents' propensity to rent land



Source: Survey Data, 2019.

In terms of spatial distribution, 69.2% of pieces were located within 10 kilometres of the respondents' home while the rest (30.8%) were over 10 kilometres away. The size of land owned under this arrangement averaged 0.84 acres with the smallest being just under one acre and the largest at eight (8) acres. The major mode of acquiring land was through inheritance (86.3%). Buying accounted for only 2.0% of land owned while 11.8% of land was acquired through other means.

4.9 The policy alternatives proposed to stem land fragmentation in the study area.

The study found that cultural practices as well as psychological considerations were the main factors influencing land use patterns. The former was reflected in the practice passed from generation to generation that children must inherit land from their parents. The psychological factors are captured in the innate desire to own property. Thus, although majority of respondents reported that land subdivision and fragmentation has been due to population increase (89.2%) and that it is probably not a good idea because it leads to low yields, they still insisted on getting their own shares. Accordingly, a significant percentage of respondents (63.7%) report that subdividing land is good. The remaining 36.3% felt that alternatives to subdivision should be explored as the land sizes were felt to be too small to be viable for farming activity should subdivision continue.

The study also found that the preferred pattern of human settlement was distributed among the following: clustered (5.9%), linear (35.3%), scattered (31.4%), and other (27.5%).

The land tenure system and cultural norms relating to land ownership coupled with a fast growing population in the study area have led to the uneconomical subdivision of land in the area. The subdivisions in turn led to unsuitable management practices of the banana based farming system. The result is a reduction in the proportion of land directly engaged for banana farming activities and degradation of the household food and livelihood security.

Any strategy of rural development has a strong implicit or explicit ideology orientation. A strategy would either be based on the principle of reciprocity or collective control or market orientation. An ideally formulated workable and consistent rural development plan would have many facets and be "optimally balanced". Optimal balance implies that different goals and targets, in addition to being feasible and mutually supportive, should be achievable with minimum input of effort and resources, ensuring efficiency and economy of resource use.

One approach to combat land fragmentation would be through land consolidation - consolidating land units and redistributing them in units of economical sizes. This happened in Kiambu in 1955/56. It addresses the case of dispersal of land units.

Another alternative strategy would be through individuals giving up land and finding alternative sources of livelihoods. This implies consolidation through expropriations of land or formation of group farms. This happened in England in 1500 AD. It also happened in Kenya by the colonialist

in the white highlands including the study area this brings efficiency through increased production by increasing economies of scale. i.e. benefits over and above the costs of inputs. It also brings efficiency in use of labour inputs and capital and enables use of mechanization to increase production.

CHAPTER FIVE:

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMENDATIONS.

5.1 SUMMARY OF FINDINGS.

The GoK (2016) states that the phenomenon of parcelation of also called land fragmentation (due to as this study has established, among other reasons, cultural practices of land inheritance couple with rapid population increase) is common in Kenya. This study set out to investigate the effects of land fragmentation on sustainable food and livelihood security using case data from Kisii highlands. Specifically this study identified how land rights are held in the study area, the effects of land size on food security and what factors affect land sizes in the study area. The study identified the minimum land size that could ensure the attainment of food security in Kisii County.

The most important study findings in relation to each of the study objectives are discussed below.

5.1.1. The current household land sizes in the study area

The study found that in the study area the average household land size was 0.67 acres. Majority of the household land sizes ranged from smaller than a quarter acre holding to the largest household land sizes being 6.0 acres.

The households surveyed in this study revealed that generally each household had sons and daughters with varying proportions of each gender in different households. The lowest number of sons found in the households surveyed the study was found to be one son while the highest incidence of sons was found to be seven. The mean number of sons in a typical household in the study area was established to be 2.34. The lowest number of daughters was 1 and highest 6. The Mean number of daughters in the households surveyed in the study was found to be 2.18. The study observed that dynamics of household size played a role in land sizes held by households in the study area.

The land size is reducing at a very rapid rate and the fertility rate in the study area is 2.1% one of the highest rates nationally. The residents in the study area should be sensitised on the benefits of family planning strategies with a view to controlling the rate of population growth. This is because the land resource is fixed and population growth should not overstretch the potential of the inelastic land resource to support food and livelihood security in the study area.

5.1.2. The factors which influence land sizes in the study area

The study established that Land Inheritance was the single most influential factor which determines household land sizes in the study area. Land inheritance is a deeply rooted cultural practice which involves the subdivision of land by the household patriarch among his sons. Anthropologists need to interrogate the reasons for its deep entrenchment with a view to reinterpret its application in a manner that does not lead to intergenerational reduction of land sizes in the study area.

Population dynamics was found to be the second most influential driver of reducing land sizes in the study area. Population is closely related to inheritance as land was shared among sons in the inheritance arrangements. Positive population growth can be explained by improved health services and awareness in the study area due to devolution of the services to the lowest units. Residents in the study area should take advantage of the enhanced close availability of health services to access family planning with a view to lowering the rate of population growth in Bonyanchaire Sublocation, and indeed the entire Kisii County.

The results of the study indicate that off farm also influence land sizes in the study area. This can be explained by the fact that those members of the community with alternative livelihood sources are able to save up and lease or outright purchase additional plots of land to supplement that which was inherited. Through purchase and lease, such members of the community are able to have bigger household land sizes. Community members with off farm incomes are also less likely to sell their plots to meet household needs such as paying school fees or paying for medical services.

Government policy was the least influential in determining household land sizes in the study area. This is an unfortunate state of affairs as the government has the responsibility to view rural land as a strategic national asset for food and livelihood security. As such the government should be concerned when such an asset is being subdivided uncontrollably. It is the opinion of this study that government should regulate subdivision of rural agricultural land in order to secure the strategic function of ensuring food and livelihood security for a great majority of Kenyans.

Government policy is expressed through the various legislations that focus on land use in Kenya. These laws include The Agriculture Land Act (Cap. 318), Crop Production and Livestock Act (Cap 321), Land Control Act (Cap 302), The Physical Planning Act (Cap 286), and The Environment

Management Control Act (..).There is no shortage of laws but the challenge may be that they are so widely spread and there is a need for consolidating them to eliminate any conflicts.

5.1.3. The effect of land sizes on household food security in the study area.

Chi Square analysis of survey data established that reduced land sizes have not resulted in food insecurity in the study area. This is consistent with the FEWS-NET data on food security in Kenya.

This may be explained by the fact that Kisii highlands is highly fertile and even small parcels of land are able to produce significant yields. Households are also able to purchase food from the open market to supplement any deficits. This is particularly made possible by a growing source of off farm incomes.

There has also been a significant out-migration from this community to other parts of Kenya, such as Trans Nzoia County and Molo in Nakuru County. These areas are high agriculturally productive areas which could serve as satellite production centres to supplement the food produced in the homeland. Outmigration of the Kisii diaspora is even international to such places as Minnesota in the United States of America. These could be a source of income flows that households can deploy to support local food and livelihood security.

However, reduced land sizes had resulted in significant reduction of yields of the main crops that the community relies on for food and livelihood security. Respondents indicated that declines in food yield have changed by up to by three-quarters. Thus, it can be seen that there has been a major change in food yield due to land subdivision. The reason given for this change is that smaller land sizes do not yield the same because the small plots are farmed on continuously without allowing fallow periods. This leads to degradation of the land, and even application of fertilizers cannot improve the conditions sufficiently.

5.1.4. The factors which influence the household land use patterns in the study area.

The study observed a significant of changing patterns of land use and an emerging trend of land use conflicts in and around the study area. Urban expansion in Suneka Township just adjacent to Bonyanchaire sublocation (due it housing the sub county headquarters) is increasingly encroaching upon prime arable land. The study found out that there is no coordinated planning of space and

direction of settlement expansion among the sub-urban and rural areas and among various categories of landowners.

Land use conflicts were found to increase between the agricultural and protected hills / forested sector as well as agricultural and the residential housing sectors. Conflicts also emerge as rural service and residential land encroaches onto agricultural land. These are caused by increased population pressure and the in-migration of land buyers into Bonyanchaire made possible by improved transport network in the study area. The respondents attributed these conflicts to a lack of a cohesive macro-economic development planning.

Inadequate land use policies and the lack of development coordination exacerbate the subdivision due to competing uses. This has allowed weaknesses in the land subdivision process due to various trigger factors leading to increased conflicts in land use assignment and land subdivision in the study area.

There were a total of 1808 number of subdivisions of all 3210 households between the 1990 and 2018. The high rate of land fragmentation for Bonyanchaire can be explained to the rapid population increase leading to rapid sub-urbanization of rural farming communities.

There is also the problem of subdivision of land through inheritance upon intestacy or gift. The law of Succession Act has elaborate provisions as to what happens to a deceased's estate (land and other property) through intestate devolution. Section 3 of the Act defines "agricultural land" as meaning land used for agricultural purposes which is not within a municipality or township or a market, but does not include land registered under the provisions of any written law. To the extent therefore that land is registered under any written law, the provisions of the Land Control Act concerning subdivision of land are ousted if such subdivision is through inheritance under the law of Succession.

Generally the land sizes observed in the study area (less than a half an acre) do not allow for a sustainable farming system within a minimum size of land for sub-division. The field study also observed that there had been encroachment onto protected hillsides and that the current land use patterns and holding units are not able to meet subsistence and social needs of the people as well as enhance sustainable natural resource management.

The study also observed that the subdivisions are not based on any carefully determined government guidelines; it is primarily based on willing buyer willing seller basis and equity among off-springs in case of inheritance.

5.1.5 Non-Farm Sources of Livelihood.

Respondents who reported having non-farm income were distributed into the following categories: beekeeping (2.0%), business (44.1%), farming (22.5%), and teaching (4.9%). Half of the respondents had off-farm income receipts 2 times a year, while the rest had frequency of income of 3 or 4 times. The lowest amount of non-farm income was Kenya Shillings 2,000 while the highest reported was Kenya Shillings 150,000. The mean non-farm income was Kenya Shillings 28,123 per year.

Respondents reported that Income from non-farm sources could be used to supplement household food stocks and household livelihood requirements such as school fees and health. Households with non-farm sources of income were observed to have a slightly different household land use pattern. Those engaged in non-farm income activities tended to be no resident on the farms hence their farms could be left fallow.

5.1.6. The land holding and ownership structure in the study area

The concept of land tenure is derived from the Latin word *tenere*, which means to hold. Tenure defines the method by which individuals or groups acquire, hold, transfer or transmit property rights in land. Wanjala, (2000) observes that there are Formal rules of land tenure which define ownership characteristics, that is, the nature and content of property rights which society will allow individuals or groups to hold over land, and the conditions under which those rights are to be held.

The Kenyan government policy on land tenure recognises not only individual tenure; it has also periodically restated its resolve to accelerate the process of adjudication, consolidation and registration. This is well articulated in the 1974-78 Development Plan, which stated that:

"*The need to increase production and create employment in the agricultural sector requires that land be used much more intensively. The Government will encourage this in several ways. The land adjudication and registration Programme to be continued on a large scale will encourage farmers to develop their land and help establish an active land market"* (Kenya, Republic of 1974).

This policy was premised on the argument similar to the one advanced by the colonial authorities to the effect that sound agricultural development is depended upon a tenure structure which released large tracts of land for farming in order to achieve optimal yields. But individualization of tenure through land subdivision and registration has not only led to a destruction of communal tenure; it has also led to unmitigated land fragmentation in the study area.

The distinctive and dominant characteristics of the land use of the Bonyanchaire Sublocation is the historical background of traditional scattered settlement and the dramatic socio-economic changes and heterogeneity following independence in 1963.

Post -independence farm sizes were determined as an average of 15-20 acres per farm, based on the agro-ecological quality of the land and the basic requirements of the average African household of small-scale farmers. Following further population growth and subdivision due to inheritance and the resultant land purchase deals by economically empowered individuals, a large part of commonly held such as swamps and hills have been transferred, subdivided and settled under small holder private arrangements. At present, the study shows that the minimum average farm size has been reduced far below half an acre.

The appropriateness of customary tenure systems for sustainable agriculture that supports food and livelihood security was questioned by Dornor (1972) , which is propagates land subdivision for traditional land inheritance from fathers to their sons. Harrison (1987) argued that because customary tenure systems are deeply embedded in cultural and political systems and generally offer members of particular social groups overlapping multiple rights of land use, they tend to exclude non-members of the group from transactions in land.

Thus customary land tenure systems distorts food and livelihood generation systems and undermine full integration of rural household food and livelihood security strategies into national and international food and livelihood strategies. In addition, because they permit partible inheritance, customary tenure practices contribute to land subdivision and encourage incessant and uneconomically wasteful litigation on land disputes.

5.1.6. Alternative policy measures which could be adopted to improve land resource management to support livelihoods in the study area.

To remedy the problems of unregulated land fragmentation, Bruce and Migot-Adhola (1994), have stated that development specialists favour intervention Programmes of land reform aimed at changing the rules governing access to land and introducing new institutions of land administration

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and the resultant land purchase deals by economically empowered individuals, a large part of commonly held such as swamps and hills have been transferred, subdivided and settled under small holder private arrangements. At present, the study shows that the minimum average farm size has been reduced far below half an acre.

5.2 CONCLUSIONS

The study concludes that land size and land subdivision does not lead to food and livelihood insecurity in the study area. This is a profound outcome of this study. Residents in this agri-ecological zone are connected to other agri-ecological cones and have established interdependencies through the open market system. Whenever there are food shortages are experienced in the study area, residents utilise non-farm incomes to purchase food in order to supplement their shortfall from other regions, notably the North Rift which is a major food basket in the country.

This study further concludes that land subdivision and reduced land sizes leads to a lowering of crop yield per acre from their farms. The respondents who participated in this study are residents of Bonyanchaire sublocation, Kisii County. They all engage in various farming activities on their farms. They report a reduced yield per acre from their farms with subsequent land subdivision. This is especially true where little technology has been adopted to improve their farming experience. Even though this reduction in yield has not resulted in food insecurity, it is worth noting and measures

Another conclusion from this study is that mixed strategies for food and livelihood security which combine agriculture and non-farm activities are important in securing sustainable provision of food and livelihoods for rural households. This study observed that non-farm incomes played a significant role in slowing down the rate of land fragmentation as households with alternative sources of income were less likely to subdivide land for sale to a third party.

5.3 RECOMMENDATIONS OF THE STUDY

This study makes recommendations that the Banana based farming system of Bonyanchaire sublocation, Kisii County requires to be envisioned from the perspective of achieving a balance and harmony between Cultural and Cosmological Interpretation of Social Meaning and the

practical need plan agricultural land use for sustainable food and livelihood security in the study area.

Following the findings of this study, the setting of specific objectives is recommended, in order to achieve the broad aspirations of achieving sustainable food and livelihood security in the study area, namely:

i. The formation of land reform programme to address both short, medium and long term problems and strategies as outlined in the study findings above. This will include the harmonization of the various land statutes that abet unregulated land subdivision, address the institutional arrangements for agricultural land use and management and implementation Farm Specific Spatial Plans.
ii. The institutionalization of mechanisms designed to induce landowners to adopt a land tenure system that discourages land subdivision and promotes the land holding to an optimally productive land size for sustained food production which ensures food and livelihood security in the study area.
iii. Public promotion of consolidation of land holdings and re-organization of settlement structure as a method of controlling sub-economic parcelation of agriculture land.

Rural planning according to the World Bank is a strategy or process designed to improve the economic and social life of the rural farmers. It involves extending the benefits of planning and development to the poorest among those who seek a livelihood in the rural areas (WB, 1974). Emphasis should be in increasing agricultural production, raising productivity of the farming systems, increasing employment opportunities and mobilizing what land, labour and capital are available in the agro-ecological zone. It should also be noted that rural planning involves values quality of life issues and people should participate in activities and be involved in decision-making, what Chenery et all (1974) calls "growth with justice" or will lead the reduction of poverty in the study area.

5.3.1 Recommendations for Household Land Holding / Tenure.

One of the objectives of this study was determine the land ownership structure or land tenure system in the study area. Land tenure refers to the conditions under which access to land is obtained and its use managed. Literature review has revealed that the system of land tenure greatly

influences food and livelihood security of any agro ecological zone. The prevailing structure of land tenure in the study area places great social value in individual land ownership and therefore encourages land subdivision in order to bequeath individual sons in a household with a land lot. This has a negative bearing on the economic development of agricultural land for purposes of supporting household food and livelihoods in the study area.

Findings from this study have shown that individualised land ownership /tenure has a major social value to the members of the households in the study area. Secondly, individual land ownership / tenure has been practiced to an extent where it has resulted in subdivision of land to very small land sizes where food production has been negatively impacted and yields are depressed in the study area. The individualised land ownership structure / Tenure in the study area has contributed to increased incidence of land subdivision through the culture of land inheritance from a father to his heirs.

Furthermore, the study shows that the practice of land subdivision for individualised land ownership through land subdivision has not had the desired effects on improving access to household means of livelihood, land development and reduction of family disputes in Bonyanchaire Sublocation. The culture of land inheritance in the study area excludes women from owning land as they cannot inherit their father's land. Overall, unregulated land subdivision has tended to weaken women's access to land and significantly compromise household capacity to secure food and livelihoods in the study area.

The study recommends a review of land subdivision policies in the study area. It should identify specific problems, streamline and improve the process and therefore: -

i. Reform and enhance the procedures for land subdivision to involve a wider stakeholder group including relevant professionals so that small-scale farmers have proper information before subdividing land for any reason.
ii. Broaden household members understanding of the implications of subdivision of family and community land on the broader food and livelihood security strategies.
iii. Develop strategies that would reverse or at least minimize the undesirable consequences of land subdivision within households and entire communities.

5.3.2 Recommendations for Household Land Use Patterns.

This study set out to establish land use patterns in the study area. Literature review indicates that the land use patterns of agricultural land is very much linked to levels of food production and hence livelihood for households. Agricultural land use patterns require planning as a precedent to a meaningfully focus on agricultural production and hence food and livelihood security in the study area. A viable agricultural land use organisation should therefore desirably aim at reducing the rate of land degradation and wastage through land sub division which often impede access to and uninterrupted use of land resources for food production.

There is also a problem of informal subdivision of agricultural land into small uneconomic units contrary to the existing agricultural land laws and policies. The subdivision of agricultural land into uneconomical viable units should be stopped due to its negative effects on the environment and food production I the study area. Under the Land Control Act, all transactions in agricultural land must receive the consent of the land Control Board, and all applications for subdivision of agricultural land vetted by local agricultural committee before being taken to the board for consent. This procedure is currently not in use in the study area, especially where family land is being sub divided to satisfy cultural requirements of inheritance.

A viable agricultural land use policy should establish criteria to prevent land from being subdivided to such an extent that production is impaired or damage to the environment becomes inevitable. Some of the critical issues that should be considered under agricultural land use patterns include: -

i. The resulting land use pattern must be able to guarantee agricultural production that supports a family of average size in the area depending on the production potentials existing in the agro-ecological zones, availability of technology and average management skills.
ii. The areas that are currently forested and are providing watershed should not be subdivided, cleared or farmed. The growing demand for water, firewood, charcoal and timber requires the protection of such areas.
iii. Areas which are ecologically unique, provide habitat for the preservation of unique species and should not be subdivided for cropping.

iv. Some crops or animal enterprises economically do well in large units due to limitation of available production technology locally and consequently economies of scale. Therefore before subdivision is authorized, the economies of cropping change should be determined considering the available production technology.

5.3.3. Recommendations for How Household Land Size affect Food Security.

This study set out to find out how household land sizes affect food security. The study found out while the study area may not have become food insecure due to reduced land sizes, food production yields became lower. In response to the reduction of food yields, this study recommends Farm Specific Spatial Planning to guide production at the farm.

At the household farm level, the study recommends the preparation of a Farm Specific Spatial Plan (FSSP) to guide development and investment. Using the optimal production levels of various crops/enterprises as benchmarks i.e. using existing production data expressed both in yield/ha and the gross margins analysis, there should be identified production gaps by comparing the optimal with the farmers' production levels.

Although the Farm Specific Spatial Plan should form an important tool in extension, it should put emphasis on the technical possibilities of production, compatibility and conflict resolution in the farming system. The individual farmers will be expected to implement the FSSP, which aims at addressing his/her chosen priorities.

The planning of farm is recommended for the study area. It should begin with:

i. The design of farm spatial plan or the redesign of an existing farm development plan (if it exists). The farm spatial plan should address the issue of rational allocation of functions on the farm, even with land size challenges. Farm level spatial planning will eliminate wastage or underutilization of available land and enhance production.
ii. Farm level planning will identify the most suitable enterprise to be carried out on the limited farm space, out of an often large number of potential enterprises which could be included in the farm plan. This study relied on Von Thunen's theory of Land use which emphasises that the most profitable activity will occupy the most prominent space within the farm.

iii. Spatial Planning at the farm level will boost the Potential of households' farms to produce stable yields. This will be achieved through SWOT analysis of Households' farm production systems. Farm strengths will be enhanced while the households' farm weaknesses will be remedied.

Depending on the farmer's objectives and constraints, they should be weighed. A risk conscious farmer can attach more importance to stability of yields and prices while a profit minded one will thrive for maximum monetary returns, accepting the chance of failing at times.

Households Farm Specific Plans should then be consolidated to form Community Specific Spatial Plans covering a wider area. The Community Specific Spatial plans (CSSP) should be produced in which farmers' opportunities and problems are identified and solutions proposed. The CSSP should identify various activities for promoting the agricultural development in the area. The emphasis should be placed on the production, market access, linkages with other agri-ecological zones and empowerment of the marginalized groups within the communities.

5.4 AREAS FOR FURTHER RESEARCH.

Rural Land is a major national resource as it provides the setting for human settlement, agriculture, habitat for wildlife and recreation. However, this study has revealed that rural land is being subdivided to levels where its ability to support those functions is being compromised.

This study identifies that there is a need to conduct further study on the suitable strategies of land reform which can mitigate against unregulated land subdivision in rural land. Suitable land reform strategies are proposed in order help develop regulations to guide land subdivisions and choice of enterprise type in the study area. These guidelines should take cognizance of cultural imperatives of the locals relating to land inheritance as well as the nature of the predominant agricultural activity viable in the agro-ecological zone. This regulations should assist the land control board in arriving at the minimum viable land sizes for various agricultural enterprises in the study area. The land reform is urgent matter in the study area because population growth and land subdivision in the study area has led to plot sizes that are not viable for agriculture, especially if household food and livelihoods have to be supported in a sustainable way.

Another area that this study identifies as needing further research is the link between predominant crop in an agro-ecological zone and minimum land sizes required to engage sustainably in such an

agricultural enterprise. This will be helpful in guiding to determine minimum land sizes that land can be subdivided to in the various agro-ecological zones. The minimum land sizes of the predominant crop should be viewed from that aspect as well; what would be the spatial requirements if the crop is being farmed for subsistence to support household food requirements or what would be the spatial requirements when the crop is being farmed as a commercial enterprise to support livelihoods.

This study further recommends a study to investigate the potential for land consolidation in the study area, and indeed in the entire country. While literature reviews paint a glorious prospect of land consolidation, the study found that only a small fraction of the respondents have positive attitude towards clustered settlements that would allow land to be consolidated for agriculture.

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APPENDICES

Appendix I.

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

PROJECT TITLE: LAND FRAGMENTATION AND ITS EFFECTS ON SUSTAINABLE FOOD AND LIVELIHOOD SECURITY IN KENYA: *THE CASE OF BANANA FARMING SYSTEM OF KISII COUNTY.*

HOUSEHOLD QUESTIONNAIRE

(To be answered by the Household Head Only)

DECLARATION: Information generated through this questionnaire will be held professionally and will be used solely for research purposes.

Sub-location ……..……..

Questionnaire No……..….

Name of Interviewer……..…….……..…..…

Date of Interview…….

Telephone No. of Interviewer ……..

1.0 Respondent Profile

Tick (√) in the bracket provided, the appropriate answer.

1.1 Name of the respondent (Optional) ……

1.2 How old are you? (Years) …….

1.3 Marital status

Married ( ) Single ( ) Widowed ( ) Divorced ( ) Separated ( )

1.4 Gender or respondent Male ( ) Female ( )

2.0 Household Data

2.1 What is the size of your household? …….

2.2 How many are Sons? …….

2.3 How many are Daughters? .....

2.4 What is the number of other males living in your household? ……

2.5 What is the number of other females living in the household? ……..…….

2.6 What is the highest education level attained by the household members?

Household members	**Age**	**Education levels**					Occupation
		None	**Pre-primary**	**Primary**	**Secondary**	**Tertiary**	
Father							
Mother							
Son/Daughter							
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

2.7 How many brothers did you have at the time of land inheritance?…….

2.8 Did all of them inherit equal share of your parents' land?.....

2.9 How many sisters did you have at the time of inheriting land?..……..……..

2.10 Did any of them inherit land from your parents?. .....

2.11 If yes to 2.10 above, how many acres did each inherit?.....

2.12 Are there any cultural practices around the use and inheritance of land?.....
.....
.....

3.0 Land holding arrangements

3.1 Do you own land? Yes ( ) No ( )

3.2 If yes, how many pieces of land do you own?.....

3.3 What is the total owned family land size in acres?.....

3.4 Owned land characteristics

No.	**Spatial** **Location and distance (Km)**	**Size in** **Acres**	**Mode of** **acquisition**	**Main use**	**Tenure** **System**	**Ownership document**
1						
2						
3						
4						
5						
	Total					

3.5 Do you rent any land? Yes ( ) No ( )

3.6 If the answer to 3.5 is yes, then complete the table below.

No.	**Spatial** **Location and distance (km)**	**Size in** **Acres**	**Main use**	**Duration of renting**	**Cost of renting** **(annually)**
1					
2					
3					
4					
5					
	Total				

3.9 Off-farm income generating activities

Other Source of Income	Frequency	Estimated amount per year (Ksh)

3.10 How big was your parents` land parcel before any sub-division?.....acres

3.11 Have they done any sub-division?.....

3.12 If there has been any sub-division then to how many heirs or beneficiaries? ……..……

3.13 Do you think as a country we should continue sub-dividing land among heirs?……..……

3.14 If yes to 3.13 why do you think so? ……

3.15 If no to 3.13 what do you think we should do as a country?.....

3.16 State one major problem of land subdivision to a farmer……

3.17 In your opinion how much land would be enough for your household..... in acres?

3.18 Explain your reason for the preferred number of acres in 3.17 above……
……..…
……..……
……
……..……

4.0 Land uses, Food and Livelihood Security

4.1 What is the main economic activity that the household head engages in? .....

4.2 Do you practise any agriculture? Yes ( ) No ( )

4.3 If **Yes to 4.2**, what are the main crop and livestock land use activities on the farm?

Activity	**Area (Acres or Sq. Metres)**	**Yield (kgs) (other) in Seasons**		**Use (Kgs) (Other)**		**Price per unit weight (Min-Maximum)**		**Average income to the family (Kshs.)**
CROPS		**Season 1**	**Season 2**	**Consumed**	**Sold**	**Min**	**Max**	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

LIVESTOCK TYPE	**No. Animals**	**Yield/Animal/Year**	**Use (Kgs) (Other)**		**Value (Ksh)**	**Average income to the Family**
			Consumed	**Sold**		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Food and nutrition security

4.4 Compare the yield you get currently in your farm and the yields that used to come from your father's farm before sub-division.

Yields are the same ( ) Currently yields are lower ( )

Yields are more ( ) I`m not sure ( )

4.5 By how much has the yield change? A Quarter ( ) Half ( ) Three Quarters ( )

4.6 What do you think is the reason for the changes in yield? ……
……
……
……

4.7 For how many months in a year do the current yield from your farm feed your family?.....

4.8 If not 12 months – how many months in a year do you have the following situations

Intensity of scarcity		**Duration of farm yield availability (months)**	**Coping Strategies Employed**
A	Sufficient food	At least 12 Months	
B	Mild Scarcity	9 Months	
C	Moderate Scarcity	6 Months	
D	Severe Scarcity	3 Months	

4.9 In the last 3 months, has your family ever skipped a meal because of food shortage?

Yes ( ) No ( )

4.10 In a typical week, what are the main food types that your household feeds on?

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Morning							
Lunch							
Supper							

4.11 How often do you take the following meals?

Type of Meal/Food	Frequency of intake (Daily, Weekly, Monthly, Annually, Other)
Milk	
Beans	
Chicken	
Fish	
Beef	
Pork	
Mutton	
Goat Meat	
Fruits	

Views on Land Subdivision

Give your opinion or comment on the effect of land sub-division or fragmentation on food security. State whether you agree or disagree with the comment.

4.12 Land fragmentations exists due to population pressure Agree( )Disagree( )Not sure ( )

4.13 Small sub-divided parcels lead to low crop yield

Not true ( ) Agree ( ) Disagree ( ) Not sure ( )

4.14 Modern farming techniques can easily be applied on small land sizes

Agree ( ) Disagree ( ) Not sure ( )

4.15 With small land sizes, number of cattle kept has gone down

Agree ( ) Disagree ( ) Not sure ( )

4.16 If you agree in 4.15 above, the change was from how many to how many?.....

4.17 Land fragmentation has made people adopt new farming techniques and skills

Agree ( ) Disagree ( ) Not sure ( )

5.0 Human Settlement

5.1 Sketch the current arrangement of the homestead?

Home compound parameters	**Remarks**		
Total area of homestead compound (Sq. Metres)			
Main house total area (Square metres)			
Main house number of rooms			
Main house construction materials	Floor	Wall	Roof
Total **number** and Total **area** of other houses (Square meters)			
List other structures in the homestead (granary, firewood store, cowshed, chicken house, dog house etc.			

5.2 Given the way land is being sub-divided among heirs - what is your proposal on how farms should be organized in the future……..

5.3 Given the following possible patterns of human settlement – rank them in your order of preference.

a. Scattered
b. Linear
c. Clustered
d. Others - Specify

5.4 Do you have any question for us?

.....

Appendix II.

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

PROJECT TITLE: LAND FRAGMENTATION AND ITS EFFECTS ON SUSTAINABLE FOOD AND LIVELIHOOD SECURITY IN KENYA: *THE CASE OF BANANA FARMING SYSTEM OF KISII COUNTY.*

KEY INFORMANT GUIDE

(To be answered by the Key Informants Only)

DECLARATION: Information generated through this interview guide will be held professionally and will be used solely for research purposes.

A: PARTICULARS OF RESPONDENT

Interviewer ……date……..

Name of Respondent (optional)……..

Position of Respondent (e.g. chief, Sub-County Administrator, etc.)……

1. Is there a district physical development plan? Yes/no
2. What are your tools for land use planning in this area?
3. What role do you play in land use planning?
4. What can you say is the pattern of settlement in Bonyanchaire sublocation?
5. What was the pattern 10 years ago?
6. What guidelines do you follow during subdivision of agricultural land?
7. How do you ensure these guidelines are followed?
8. Does the pattern of land subdivision affect food security in this area?
8. How would you rate the food security situation in this area?
9. Which are the factors that contribute to food security in the county?
10. How would you rate the livelihood security of residents of this area?
11. Do you find the current land use patterns in this area to contribute to sustainable food security?
12. What needs to be done to ensure sustained food and livestock security in this area?

Appendix III.

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

PROJECT TITLE: LAND FRAGMENTATION AND ITS EFFECTS ON SUSTAINABLE FOOD AND LIVELIHOOD SECURITY IN KENYA: *THE CASE OF BANANA FARMING SYSTEM OF KISII COUNTY.*

FOCUS GROUP DISCUSSION GUIDELINES.

(To be answered by the Key Informants Only)

DECLARATION: Information generated through this interview guide will be held professionally and will be used solely for research purposes.

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1. Introduction

1.1. Site name

1.2. Site description (landforms, land use, vegetation, settlement, proximity to roads, streams, markets, landmarks)

1.3. Group name or description

1.4. If formal group: purpose, history, total number of members, and type of people who are members

Purpose

History

1.5. Where did the group members originate

Elder generation

Farmer Association?

Church related activities?

2. Livelihoods and land use

2.1 Ask about the types of land use and production systems practiced locally. E.g. these systems may focus on commercial cropping; dairying; mixed farming with crops and livestock or subsistence farming.

2.2 What do people do to make a living? List specific occupations and activities of men, women and children, both paid and unpaid.

2.3. Do some people work for wages? Do they earn wages locally or outside the area? Where? For whom?

Type of job who: number and type of people where (men, women, children?)

3.0. Land Subdivision and Land-use History and the changing Situation of Food Security

3.1. What was the area like when the eldest members of the group were young, or when they first settled there?

Land

Water

Soil

Vegetation_

Wildlife •

Land use

Local economy

Erosion features/conditions

(Sketch this remembered landscape on paper, note time period, include features such as forests,

grasslands, croplands, water resources, roads and settlements).

3.2. What major changes in land use have taken place? List these, ask and when they took place and note them on the sketches.

Original land use ……change ……..where……..when……

3.3. Have government or outside organizations introduced any special land administration practices? Which practices? When? What were the results? How did people feel about these practices?

Ask the group to describe these practices.

3.4. Have government or outside organizations introduced any special food production strategies? Which strategies? When? What were the results? How did people feel about these practices?

Practice organization where when results

3.5. Have government or outside organizations introduced any special household livelihood strategies? Which practices? When? What were the results? How did people feel about these strategies?

4.0 Farming System.

4.1. What crops are grown? Ask people to name the crops and compile a list. Ask which are for home use, for sale or both and note these on the list. Also get rough estimate of how many members, among those present, grow each of those crops

Crop variety	*sale*	*who grows (works on) it*	*who owns it*	*where*
	Home use	*group/number*	*group/number*	

4.2. Do most people have one field for cropping, or more? If more, why? What size are most people's cropped fields?

5.0. Land subdivisions

5.1. What are the main causes of land subdivision in this area?

1 economic factors:

2. social factors:

3. cultural factors:

4. physical/environmental:

6.0. Problems associated with the land-use system

6.1 What are the major problems in household food security?

Discus these in terms of domestic needs, such as food, water, fuel, shelter, cash, investment, inheritance, raw materials and resources to meet social obligation *{prioritize the problems to indicate which ranks first etc).*

Problem	*where*	*who*

6.2 What are the major problems in production systems at the community level? Are there resource-management, supply or production problems specific to particular places in the landscape or to particular types of land cropland? Grazing land? Settlements? Water sources? Drainage features? Roads and trails? Public markets and meeting places?

Problem	*where*	*who*

6.3. What have people done about these problems in the past? What succeeded, what failed and why?

Problem	*previous response*	*results*

Appendix IV.

UNIVERSITY OF NAIROBI

DEPARTMENT OF URBAN AND REGIONAL PLANNING

PROJECT TITLE: LAND FRAGMENTATION AND ITS EFFECTS ON SUSTAINABLE FOOD AND LIVELIHOOD SECURITY IN KENYA: *THE CASE OF BANANA FARMING SYSTEM OF KISII COUNTY.*

Sub Chief Questionnaire

(To be answered by the officer in charge)

Confidential: The information provided under the survey shall be used for this study (Research) only and not for any other purpose.

Please support your explanation with relevant data

Interviewer_____ Date _____

Respondents name (optional)_____

1. What is the importance of bananas for the people in your sub-location [as source of food or source of income from sale of the crop]?

2. In your assessment, what is average size of household farmland in this county / sub-location?

3. How has banana production been affected by subdivision of household land in this county / sub-location?

4. How has peoples' food and livelihood security been affected by subdivision of land in this county / sub-location?

5. Why, in your view, is the subdivision of land happening at this rate in this county / sub-location?

6. How has this land subdivision affected the production of food and cash crops of farms in this county / sub-location?

7. What should be done to regulate the trend for subdividing agricultural land in this subdivision in this county / sub-location?

8. What do you foresee happening to livelihoods of residents of this county / sub-location in the event subdivision continuing unregulated?