

**FOOD SECURITY IN SEMI-ARID AREAS: AN ANALYSIS OF
SOCIO-ECONOMIC AND INSTITUTIONAL FACTORS WITH
REFERENCE TO MAKUENI DISTRICT, EASTERN KENYA**

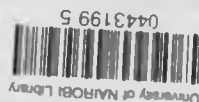
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B.ED (HONS), M.A. (Agricultural geography)

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy (Agricultural Geography) in the Department of Geography and Environmental Studies, Faculty of Arts, University of Nairobi.

MAY 2008



DECLARATION

This thesis is my own original work and has not been presented for a degree in any other university.

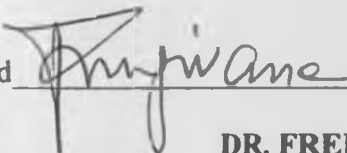
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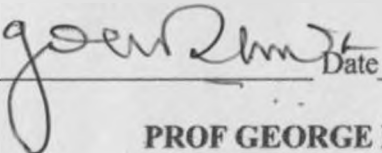
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DEDICATION

To my wife Ruth and my children Charity, Mercy and Kelly for their love, encouragement and support that made it possible for me to complete this thesis.

ABSTRACT

Using the case of Makueni District, Eastern Province, Kenya, the study analyzes the socio-economic and institutional aspects of food security problems in semi-arid areas. The district has experienced food shortages over the years, a problem that is todate-proving difficulty to solve. Indeed, the district has become a major recipient of food relief but the food problem persists. The approach used in this study deviates from the traditional way of associating food security problems with physical constraints in semi-arid areas. Instead, it focuses on human aspects as critical factors affecting household food availability and accessibility.

Broadly, this study analyzed the effects of socio-economic characteristics of households and the role of institutions in food security in semi-arid areas of Makueni District. The investigation focused on a number of key aspects, namely: (i) the status of household food security in the study area; (ii) the contribution of human factors in the decline of traditional crop production and consumption; (iii) the socio-economic factors affecting food security at household level; (iv) the institutional interventions affecting farm production support services and food distribution at domestic level; and (v) the coping strategies applied by households in the study area during food shortages.

This investigation was guided by two hypotheses. The first hypothesis was that there was no significant difference in food security between households of different socio-economic status. The second hypothesis was that no significant relationship exists between institutional support services and food security problems at the household level. These two hypotheses were based on the System Analysis Model approach that was applied in this investigation.

The study was based on data from primary and secondary sources. In particular, the primary data was collected from a sample survey of two hundred households conducted in five sub-locations within five divisions of Makueni District. The Cluster Sampling technique was used to select both the study sites and the sampling units. In addition, questionnaires were administered to the two hundred households in order to collect specific information related to socio-economic characteristics of the households and the role of institutional interventions on food security problems at household level. Moreover, secondary data from published and unpublished sources was used to get information on food security status in the study area. This

data was then analyzed using quantitative and qualitative methods. The quantitative techniques used consisted of the use of descriptive statistics, the Bivariate Regression Analysis, Multivariate Statistical methods and the Component Analysis.

The findings of the investigation indicate that, 70% of the households are at food risk and only 6.5% are food secure. The major factors contributing to food security problem in the study area emanates from socio-economic as well as institutional aspects. The main aspects include low household income; inadequate family assets; low production and consumption of traditional food crops; high post harvest losses; gender bias in on-farm and off-farm activities; poor infrastructural facilities and uncoordinated institutional interventions.

Therefore, the investigation concluded that, semi-arid areas suffer from persistent food insecurity. Either, most of the households do not produce adequate food from their farms; and or, many households cannot afford to buy the available food at the market. This was largely due to loss of production and purchase entitlements for the households.

The recommendations of this study are that there needs to be an improvement in the purchasing power of the rural household through diversification of on-farm and off-farm sources of income. There also needs to be a deliberate promotion of traditional crop production and consumption as well as an increase in the financial support provided to women. This will enhance better management of household resources to boost household food security. In addition, policies aimed at enhancing government and non-governmental participation in improving extension advisory services need to be adopted, including increased farm input facilities and credit facilities, and improvement on infrastructural facilities. This will ultimately contribute to increased household food production and accessibility.

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I would like to acknowledge, posthumously, the contribution of the late Professors Samuel Mutiso and Dunstan Obara who supervised this research from the proposal development to field survey level. Both passed away when in the duration of my data collection. I give special thanks to my supervisors Dr Dorothy N. Mutisya (Department of Geography Kenyatta University), Dr Fred Mugivane (Department of Agricultural Economics, University of Nairobi) and Professor George Rhoda (Department of Geography and Environmental Studies, University of Nairobi). I am immensely grateful to the three scholars for accepting to steer this research from the point my two late supervisors had reached, to its ultimate completion. They deserve my sincere gratitude for their guidance, advice, constructive criticism and encouragement. My supervisors were always available for consultation and gave their feedback promptly despite their busy schedules. Their comments were academically challenging, fulfilling and stimulated my imaginations by letting facts take the lead.

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ACRONYMS / ABREVIATIONS

- ASALS- Arid and Semi Arid Lands.
- AGOA- African Growth and Opportunity Act
- CBOs - Community Based Organizations
- DANIDA- Danish International Development Agency
- FEWS- Famine Early Warning Systems
- GAA- German Afro-Action
- HHs- Households
- HHH- Household head
- FHH- Female household managed
- MHH- Male household managed
- FMHH- Female/ male household managed
- Ha- Hectares
- FAO- Food and Agricultural Organization
- Kshs - Kenya shillings
- Kgs - Kilograms
- MDGs- Millennium Development Goals
- SSA- Sub-Saharan Africa
- SAPs- Structural Adjustment Policies
- MAP- Makeni Agricultural Program
- PRSP- Poverty Reduction Strategy Paper
- NGOs- Non-Governmental Organizations
- FRC- Famine Relief Committee
- FRRP- Famine Relief and Rehabilitation Programme
- WFP- World Food Programme
- KARI- Kenya Agricultural Research Institute
- TON- Tonnes
- IFPRI- International Food Program and Research Institute.
- KSPFS- Kenya Special Program for Food Security

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.0 INTRODUCTION

This chapter examined the background information to the Research Problem under investigation from a global, national and local perspective. An exposition of the Statement of the Problem, Research Objectives and Justification of the Research Problem are thereafter presented. Finally, the chapter examined the scope of the study, conceptual definition of terms used in the study and the organization of chapters forming this study.

1.1 BACKGROUND TO THE STUDY

Food insecurity has long been perceived to be primarily a problem of insufficient food production, rather than insufficient access to food. Nevertheless, despite the fact that sufficient food is being produced to meet the basic needs of every person in the world, the persistent food insecurity problem currently stands at approximately 840 million chronically undernourished people and 185 million malnourished pre-school children. This has often been attributed to difficulties in gaining access to sufficient food (Peters and Joachin 1999; Fewes Net, 2004; 2006). In particular, Sub-Saharan Africa (SSA) and other developing countries are the most affected by food security problems. According to Freeman (2004), food reserves in Sub-Saharan countries have been fluctuating markedly during the last four decades, thereby leading to persistent food shortages.

Many of these countries (Ethiopia, Sudan, Tanzania, and Kenya among others) are not able to produce enough food for their rapidly growing populations. This has resulted in a miss-match between food supply and demand. The agricultural growth rate in sub-Saharan Africa declined from 4% to 1.4% per annum, while the population growth rate expanded to 3.3% per annum during early 1980s to late 1990s (FAO 2000). Subsequently, the per capita Gross Domestic Product (GDP) has declined thereby leading to incidences of food scarcity increasing beyond 50% (FAO 2000; 2001). This translates to an increase in food insecurity at the household level, despite improvements in agricultural innovation.

In the sub-saharan region, Kenya is not exempt from problems concerning food security. Over the years, the country has faced increasing incidences of food deficit. This has been attributed to a high population growth (2.7%) per annum, increased urban population, climate change, prolonged droughts and low agricultural production (*Republic of Kenya 2001*). The semi arid areas are the most affected by this prevalence. Indeed, agriculture is essentially the major source of the country's food security and a stimulant to growth of the economy.

The need to enhance food security in Kenya was underscored as early as 1954 in one of the first rural development strategies popularly known as the 'Swynerton Plan', which encouraged the promotion of small scale farming for both cash and food crops (*FAO 2001*). Unfortunately, there was no clear food policy in Kenya until 1981 when the country was caught unprepared with nationwide food shortages. The effects of these shortages were particularly serious in semi-arid areas like Makueni District. This catastrophe jolted policy makers into realizing that there was a need for a national food policy. Subsequently, the first document entitled: "*Sessional Paper No. 4 of 1981 on National Food Policy*" was published. This food policy paper argued that intensified production was necessary to enable the country maintain self-sufficiency in the main food stuffs without using the country's foreign exchange on food imports. The paper also argued for the need to achieve a high degree of security in food supply to each area of the country. Furthermore, it would be necessary to ensure that these foodstuffs are distributed in such a manner that every member of the population has a nutritionally adequate diet. ✓

In response to the failure to meet the objectives outlined in *Sessional Paper, No. 4 of 1981*, the Government published another document entitled: *Sessional Paper No. 1 of 1986* on economic management for renewed growth. The paper endeavoured to provide mechanisms for enhancing food security for a projected population of almost 35 million by the year 2000. Similar to the previous *Sessional Paper No. 4 of 1981*, this paper focused on the need to make the country self-sufficient in basic food commodities such as maize, beans, potatoes, vegetables, milk, beef products and other food stuffs. In addition, the paper aimed at increasing rural incomes to ensure that rural households could be able to purchase food whenever necessary. To achieve these goals, the *Sessional Paper No. 1 of 1986* outlined strategies to encourage farmers to adopt more productive practices by using improved seed varieties,

fertilizers and having access to extension services oblivious of the liberalization policies which removed government subsidies on farm inputs

Unfortunately, the Second Sessional Paper did not adequately address the problem of food security. Consequently, *Sessional Paper No.2 of 1994* on national food policy was formulated. This paper emphasized that food security was basic to the survival of any family or individual. It focussed on achieving food security through self-sufficiency in the production of basic food commodities and the generation of foreign exchange, which could be used to import basic foods when the need arose. This sessional paper underscored the need to increase substantially public sector investment in physical infrastructure in order to improve the distribution of food as well as adequate and quality inputs to households. It was acknowledged in this third sessional paper that the ability of households and individuals to obtain sufficient food directly depends on whether they grow their own food as well as their ability to generate other forms of income.

It is pertinent to note that most of the issues raised in all these sessional papers have to date, not been consistently implemented. Subsequently, food insecurity continues to persist in the country, more so at household level. In addition, these policy papers have put more emphasis on overall national food sufficiency. This overemphasis disregards the fact that national or regional food security does not necessarily lead to household or individual food security. This is because the available food may not be distributed according to the households' needs and hence, households may not have equitable access to it.

Further measures to achieve food security were pursued during the development of Kenya Special Program for Food Security (KSPFS) in 2002 as well as the launching of Economic Recovery Strategy for Wealth Creation and Employment in 2003 to halt and reverse further economic degeneration and poverty (Kinyua 2004). In developing these programs, the Poverty Reduction Strategy Paper and the Kenya Rural Development Strategy were used to explain programs on food security (Kinyua 2004). These strategies describe measures needed to alleviate poverty in Kenya where majority of the poor and food insecure people live in rural areas with agriculture as their main economic activity.

Accordingly, the KSPFS is working towards the food security needs of the rural populace by encouraging and supporting farmers and community based organization (CBOs) in their efforts to improve agricultural productivity and other income generating activities. This move is as a result of the realization that growth of agricultural sector has declined from an annual average rate of 4.6 percent in the 1964-1973 period to less than 1.0 percent in the 1990's, thus leading to severe food shortages (FAO 2001; 2003). Subsequently, this has caused starvation, malnutrition, unproductive population and poverty. It is against this background that the food security problem in the country, and more so in the semi-arid environments needs to be addressed.

Kenya has a varied ecological environment, characterized by differences in agricultural potential and patterns of food production. Land is the main asset in agricultural production and generally, limited availability of productive land is a major constraint to increased agricultural production (Kinyua 2004). Only about 12 % of the total land area receives annual rainfall of more than 1400mm. This can be classified as high potential agricultural land. The remaining 80 percent receives less than 800mm and consists of semi-arid and arid environments (ASALS) with low to very low potential for agricultural production (Kaguthi 1995; *Republic of Kenya 2001*). This diversity in ecological condition contributes to variations in household food security in the country, with the semi-arid being negatively affected compared to the middle and high potential areas. The issue of food security in ASALS is further complicated by the fact that the majority of very poor people live in these areas. Hence, there is need to improve the households' livelihood through increased productivity and creation of employment opportunities that would enable them to equitably share the benefits of rural development and food security systems.

In the past few years, Kenya has witnessed an increasing level of rural – rural migration from densely arable agricultural areas to areas with only marginal agricultural potential (Kaguthi 1995). The expansion of cropping activities in such fragile ecosystems and the settlement of families on the same areas with unreliable rainfall and low crop production is likely to expose these families to risks of regular food shortages culminating in serious food insecurity. Furthermore, such activities could eventually lead to environmental degradation thus complicating the issue of food security. While increased settlement, partly due to rural–rural

migration and exploitation of these low agricultural potential lands, provide a basis for the livelihood of small-scale farmers, the results are appalling. The soils have over the years been subjected to serious erosion and low organic matter due to low density of plant life. This applies particularly to the soil located on steep slopes. Much of the natural covering for this rangelands has been degraded and indigenous vegetation depleted (through charcoal burning and firewood harvesting) thus leaving ground cover in some areas badly depleted (Tiffen 1994; Kliet 1985; *Republic of Kenya 2002*). Approximately 70 percent of all energy consumed in rural Kenya is generated from wood fuel thus accelerating the pace of devegetation and land degradation (*Republic of Kenya 2000*). The resulting depletion of the natural resources in ASALS can be attributed to anthropogenic (human related) factors and therefore pose a threat to the future generation who are expected to live on such marginal lands. According to Kinyua (2004), a similar situation is being replicated in other regions where poverty levels exceed the 50 percent mark and government intervention in poverty eradication and food provision is low.

Coupled with resource depletion from human activities, the semi-arid environments receive low amount of rainfall (500-800mm per year) which is highly variable in both space and time, poorly distributed with most of the concentration being in a short duration (Niewwolt 1987; Kliet 1985; Mutiso 1987; Tiffen *et al* 1994) as shown in figure 2.5. This scenario is further complicated by high temperatures (20^o-28^oC annual range) and evapo-transpiration rate of 1000-2000mm annual range, which exceeds rainfall annual range (Niewwolt 1987; Mutiso 1987; Harris 1989; Gicheru 1987) as shown in *Figure 2.6*. This situation is deteriorating due to climate changes as evidenced by increasing incidences of drought and crop failure as indicated in *Table 2.1*.

¶All these factors, combined with traditional methods of farming, low income and limited sources of livelihoods have cumulatively led to a low standard of living and food insecurity for most of the rural populace living in the semi-arid areas. The most affected socio-economic groups include low-income smallholder farmers with limited access to land, financial resources, and farm inputs supply, and social and physical infrastructural facilities, which are important in boosting food production. During times of rainfall deficiency, the Government of Kenya has had to divert scarce treasury funds towards famine relief for the seriously affected households. Similarly, development partners operating through world food organizations and

Non-governmental organizations (NGO's) have responded to this problem by sending emergency food relief amongst other forms of donations. However, since these efforts only address the symptoms of food insecurity, its devastating effects continue to worry both the Government and its citizens. Consequently, according to FAO's household food security index (FEWS NET, 1999), Kenya had been placed at position 51 out of 61 low-income food deficit countries,

Makueni District in southeastern Kenya is one of the marginal areas affected by recurrent food shortages. The annual average food supply from Makueni District has not been able to match the demand. For example, the average maize production between 1992 and 2001 was 85,146,000 tonnes against a demand of 140,272,000 tonnes, representing a 40 per cent maize deficit. The production of beans was 4,023,882 tonnes against a demand of 31,430,000 tonnes, leaving a food deficit of 87.2 per cent. Millet and sorghum production was 3,095,000 tonnes, while the demand was for 4,549,000 tonnes thus leaving a deficit of 32 per cent. Lastly, the production of pigeon peas was 4,340,000 tonnes against a demand of 12,520,000 tonnes and therefore represented a deficit of 65.4% (*Republic of Kenya 2000*).

When the average food shortage is computed from the foregoing statistics, it reveals that the district has been experiencing a food deficit of 56.15 per cent. This is a clear indication that food demand outstrips supply thereby leading to food insecurity. The problem has immensely contributed to human suffering, high rate of school drop out, rural-urban movement and poor health status among the disadvantaged members of household (mainly children, women and the elderly). The previous approaches used to examine the problem of food security have been based mainly on physical and environmental factors. However, this study deviated from the environmental perspective to a human-related approach in an effort to address socio-economic and institutional factors with a view to establishing their contribution towards the food security problem.

1.2 STATEMENT OF THE PROBLEM

Food security is an undisputed issue of concern in Kenya, especially with regard to the semi-arid areas. Studies show that although food security is one of the most debated issue concerning basic needs, it is perhaps the least resolved of them (*FAO 2000*). The problem of food security

has captured the attention of many scholars, scientists, researchers, policy makers, governments and non-governmental organizations. However, these efforts have not fully resolved the problem. Hence, the food problem persists, especially at the household level. Most of the existing studies (*FAO 1997; FEWS 2000; 2002; Republic of Kenya 2003*) have focused more on the physical environment as a key contributor to food insecurity. This approach deals with food security from a farm production (availability) perspective. Unfortunately, minimal attention is paid on food accessibility from other sources such as purchase from market and social safety nets. While we do acknowledge the importance of physical factors in addressing the food security problem, the human component that also has a role to play towards food security, has not been analysed comprehensively. Previous studies that applied the human approach focused on certain key aspects including land (*Breth 2002*), farm technology (*Republic of Kenya 2001; KARI 2003*), gender (*Okwosa 1999; FAO 2001*), farm inputs (*KARI 2004*) and marketing (*Mbogoh, 2000*).

However, there is an absence of research to integrate the role of socio-economic and institutional factors with persistent food problems in the country. Accordingly, the present investigation has deviated from the physical component in an endeavour to concentrate more on the role of socio-economic factors and institutional intervention on food security by using an integrated approach. These two human related factors appear to have either been understudied by researchers or given less attention by policy makers in relationship to food security.

A study of Makueni District shows that the District has experienced a marked fall in food production as previously mentioned in the background section. The short fall in household food experienced from farm production can be addressed by purchase of the food from the market. However, what has not been studied is the capability of these households to purchase the food. Household economic status cannot be viewed in isolation without considering the social aspects and institutional arrangements, which affect food security. Consequently, food security, whether through farm production, market purchase and social safety nets (donations and other assistance) will require an in-depth analysis of the interrelationship between socio-economic and institutional factors. This approach was based on the FAO (1999) philosophy, which established that food insecurity is largely a man made phenomena. Since human error or neglect creates it, only human resolve can eradicate it. In other words, the threat of food

security is directly linked to an intricate web of human related factors, which determine how food is produced, acquired, managed, distributed and consumed. This approach provides for options and strategies that can create pathways that may offer the food-poor-households to deal with food security problems.

Accordingly, this study investigated the socio-economic (household age, household size, educational level, income levels, farm size, gender factor, labour input, farm technologies and post-harvest food losses) and institutional factors (farm input supply, extension services, credit facilities, food relief services, and physical infrastructures). This was conducted with a view to understanding their role in the persistent food security problem in Makueni District. The study specifically addressed the following research questions:

- a) What is the food security situation in the study area?
- b) Are human-related factors responsible for the decline of drought resistant food crops?
- c) To what extent do socio-economic characteristics of households affect food security?
- d) What is the role of institutional factors in food security at household level?
- e) What intervention strategies have been used by households to fight the recurrent food shortages?

Each of these questions were analyzed during the investigation with the aim of establishing the primary causes of recurrent food shortages at household level, which have resulted in food insecurity within the semi-arid areas of Makueni District.

1.3 AIMS AND OBJECTIVES OF THE STUDY

The general objective of this study was to address the issue of household food security in the semi-arid areas of Kenya with special reference to Makueni District. This was done by analysing the underlying socio-economic and institutional aspects of food security in Makueni District. The specific objectives of the study were to:

- a) Examine the status of household food security in the study area;
- b) Investigate the contribution of human related factors on the decline of drought-resistant food crops in the study area;
- c) Analyze the socio-economic factors that affect household food security;
- d) Assess the role of institutional factors on farm production support services and food distribution at domestic level; and

- c) Establish coping strategies applied by households to meet their food security needs.

1.4 JUSTIFICATION OF THE STUDY

The rationale to conduct this investigation stems from widespread evidence that food security problems have become life threatening in ASALS. Moreover, the quality of land and crop productivity in ASALS is declining, thereby leading to increased household food insecurity (Rep 2000; FAO 2002; 2003). Population increases have been registered especially due to the migration of people from neighbouring densely settled areas. This trend puts more pressure on the fragile marginal areas that are already experiencing climate change and low livelihood systems sustainability (Gladwin et al 2001).

Subsequently, farm households are facing persistent decline in crop yields resulting from continuous farming without proper use of improved technologies and farm inputs. While farm yields are declining, households cannot meet their food demand because of rising poverty levels caused by low income and limited sources of improving livelihoods. This has led to reduced income earning capacity, poor health especially among children, and high school drop out rate, rural-urban migration and general human suffering.

In view of this, the current study investigates the causes of food insecurity with a view of establishing the coping strategies (fallback mechanisms to deal with short-term food insufficiencies, yet without depleting the household assets). In addition, the study examines the adapting strategies (long term measures in which households and individual acquire sufficient food or income to sustain them in face of food insecurity). The study is justified because it brings the human component on board in the on-going food debate. An understanding of the human-related dimension to the food problem will provide a credible solution to the food security problem.

It is pertinent to note that the research area (Makueni district) has been relying on food relief services for a number of years. However, this provision of food relief has not offered any long-term solution to household food security problems. Instead, it has perpetuated a dependency syndrome, which is often manipulated by politicians as a campaign tool. Hence, this

investigation on the food security problem at the household level will help to provide ways in which such households can be empowered in order to increase food accessibility during shortages, without necessarily relying on food relief or depleting family assets.

Food security is no longer a preserve of farm production but can be achieved through increased purchasing power. Subsequently, policy makers and planners in public and private sector will find results of this study useful in coming up with realistic policies aimed at achieving remarkable food security at the household level. This is in line with the Poverty Reduction Strategy Paper (PRSP) and the Millenium Development Goals (MDGs) where food security is viewed as a significant component.

Lastly, the study focused on semi-arid areas, which are now being seen as viable options left for population and agricultural expansion. As noted previously, the high potential areas are already densely populated, forcing people to move to the marginalized areas in search of land for settlement, farming and livestock keeping. Consequently, the current research is justified in addressing the improvement and expansion of livelihoods in marginal areas in order to reduce food insecurity and alleviate rural poverty. This is in line with the Government of Kenya policy to improve resources and facilities in semi-arid areas as articulated in the recent National Development Plans (*Republic of Kenya, 2003*). Such areas, and in particular, Makueni District lack viable cash crops as demonstrated by the collapse of cotton production due to low returns, low prices and high cost of inputs. Similarly, sunflower production, which would have been the alternative to cotton, did not take off well due to marketing problems. There is therefore a need to examine how semi-arid areas can be self-sustainable in food security despite the harsh climatic conditions.

1.5 SCOPE AND STUDY LIMITS

The study addresses the problem of household food security in semi-arid areas of Makueni District. Specifically the investigation analyzed the socio-economic factors affecting food production and food acquisition at household level. The key variables considered included household size, age and educational level of farmers, gender factor, household income levels, farm size, farm labour, farm technologies and post-harvest food management. The study also examined the role of institutional factors on food security such as government and non-

government intervention on extension services, credit facilities, farm inputs, food relief services and infrastructural facilities. However, the investigation did not address the physical factors as major players on food security because their contribution has already been widely researched, (FAO, 1999). Nevertheless, wherever physical factors were highlighted, this was meant to demonstrate how they influence human factors or facilitate understanding of human factors.

The study was confined to the lowland areas of Makueni District, which are classified as Semi-Arid Lands as shown in *Figure 3.2*. These lowland areas are frequently affected by food shortages even after experiencing successful rainy seasons. However, this investigation did not include the hill masses of Mbooni, Kilungu and Ukia, which are considered moderately high potential agricultural areas and fairly food secure.

Lastly, the study addressed the issue of food security from the standpoint of household consumption patterns (supply and demand perspective) without getting into the details of the actual composition of what actually constitutes a nutritional diet. Consequently, factors concerning calorie intake as a component of food security were excluded. Instead, the investigation focussed more on examining the demand and supply aspects which pertinent and realistic situations concerning food security as are perceived by households in the study area. Moreover, the study considered local food diet and taste to determine whether households were food secure or food insecure and the causes for the same.

1.6 DEFINITIONS OF KEY TERMS

Food

Harris (1976) defines food as the weight of wholesome edible material that could normally be consumed by a human being. Nkinyangi and Migot-Adholla (1980) further argue that the term food is financially and culturally defined. This implies that what is eaten with relish in one culture is frowned upon in another. The main crops providing such foodstuff in the semi-arid areas of Makueni District are maize and beans, which form the staple diet for the rural households in the Kamba community. Others include pigeon peas, millet, sorghum and cassava. Because of preferences and tastes, most of the household have narrowed their diets to maize, beans and pigeon peas, which can be purchased from the market. Nevertheless, maize remains

the key source of food to majority of rural households. Household food availability data was collected from the respondents on seasonal basis for all the food harvested from the family farm, food purchased from market and food received from other sources. However, details concerning nutrition intake are beyond the scope of this study.

Food security

Joachin et al (1992); IFPRI (1995); Chinyemba (1997); FAO (1997); Maxwell (1996) and Gladwin et al (2001) have defined food security as the physical and economic access by all human beings at all times to the basic foods they need to live a healthy and active life. This implies three key aspects, namely, availability, sustainability and accessibility. Subsequently, lack of this access, either by way of farm produce or market purchase results into food insecurity which could be either chronic or transitory. Chronic food insecurity is a long-term problem caused by lack of income or assets at household level to produce or buy adequate food for the household. ON the other hand, transitory food insecurity is a short-term problem caused by a shock to the food production or economic system, where income or resources necessary to adjust to the shock are not available (Gladwin 2001).

In view of the foregoing definitions, this investigation conceptualized food security as a household ability to command an adequate amount of food through one or combination of existing sources (production, purchase and donations). The security further includes households with sufficient and/or predictable command over one or a combination of existing sources of food. It also includes a situation where the command is not gained at the expense of other equally compelling needs. For purposes of this study, household food security was measured by taking the sum of amount of food produced from the farm, plus all other foods coming in to the household (purchased, relief supplies and food donations) against the amount required by the household. Subsequently, household with inadequate food supplies were those consuming less than 90kg of cereals and 45kg of pulses in addition to other foodstuffs per month. These households have an average population of six members. This implied that where households do not have enough food for their members by producing it themselves, they should have the ability to purchase it through adequate income or get it through relief supplies, donations among other sources. The amount of food coming into the household through farm produce,

market purchase, food donations and relief supplies was determined and then converted into kilograms to assess the level of food security per household.

Food poverty line

This is defined as the minimum levels of basic food needs, below which a decent material lifestyle is not possible. This is determined by considering the Food-Energy Intake (FEI), which aims at finding a monetary value at which basic food needs are met. According to Food and Agricultural Organization (FAO) and World Health Organization (WHO), the amount for rural areas is Ksh. 927 per adult person per month to cater for 2250 calories per day. The study adopted this definition but added a new dimension of calculating the food consumption per average household of six members, which translated into 135 kilograms (kgs) of cereals considered as diet suitable to local taste. It must be emphasized that this study did not address poverty in general but confined its analysis purely on food aspects.

High food insecure at household level

This refers to households with an average population of six members whose food consumption falls below 135 kgs of cereals per month. Such households cannot meet their basic food needs during the current season without reducing consumption or drawing down assets to such a degree that they compromise their future food security. These households resort to seeking food relief services or other social safety nets.

Moderate food insecure at household level

This refers to the food consumption of a household, which is proportional to their mean or medium income or expenditures. Their food availability fluctuates from an average of 135 kgs to below average per month. Such households meet their food needs in the current season, but only by drawing on savings or relying on secondary income activities. In such cases, no interventions are necessary (*Buzz 2000; Republic of Kenya 2000*).

Households

This study is about food security problem in the semi-arid areas of Kenya and this is conceptualized around the experiences of rural households in Makueni District. The 1989 National Population Census in Kenya refers to a household as a person or group of persons who

live together in same dwelling unit or homestead and eat from the same pot (Republic of Kenya 1989). The rural household and expenditure surveys conducted by the Central Bureau of Statistics (CBS) further defined a household as constituting one or more persons who eat together and have a common cash account (Republic of Kenya 1977; 1981). According to Alila *et al* (1993), a household comprises a person or group of person, generally bound by ties of kinship, who normally reside together under a single roof or several roofs within the same compound and who are answerable to the same head and share a common source of food. This study considers households in the same light but with a deliberate focus on the interaction of members of a household through shared residence and meals, using family labour for production and consumption activities, influencing decision-making and allocation of household resources and having a household manager.

Semi – Arid Areas

Semi-arid areas in Kenya are defined by the rainfall zones between 500-750 mm, temperatures relatively high (28^o C) and evapo-transpiration slightly more than the available rainfall (1500 mm per year). Soils are characterized by low organic matter due to low density of plant life and fast microbial activities. Soil fertility has been declining since fallow system has been breaking down without being replaced by high uses of purchased inputs. Growing days are 75-110 mainly in Agro-Ecological Zone IV-V. Farming systems are drought tolerant crops such as maize, sorghum, millet, cowpeas, and pigeon peas.

Arid and semi-arid lands (ASALS) make up over 80% of Kenya's total land surface, supporting over 25% of production. They have harsh and complex environment, with fragile ecosystems, which are quite susceptible to environmental destruction due to increased human and livestock utilization. However, with improvement in socio-economic conditions of the households, ASALS have potential of sustaining increased population. The study area is classified as semi-arid where farming and livestock systems are practiced.

Socio – Economic Factors

Socio-economic rather than economic factors is the term adapted to explicitly emphasize the interconnection between social and economic factors as seen from an agricultural standpoint. Hence, the term 'socio-economic' is applied in this study to refer to human factors relating to

social characteristics such as age, education level, household size, and gender factors. ON the other hand, economic status refers to household income, land size, labour input, farm technology and post-harvest losses of rural households in view to their contribution towards food security problem in the semi-arid areas of Makueni District. These socio-economic conditions do not operate in isolation but interacts with institutional interventions in processes involved in food security systems.

Institutional Factors

For purposes of this investigation, the term is used to refer to Government of Kenya (GOK), International Agencies and Non-Governmental Organizations (NGOs) intervention in food security. The international agencies and non-governmental organizations include financial institutions, donor agencies, churches and Community Based Organizations (CBOs) among others. Their intervention involves provision of agricultural production support services such as farm inputs, agricultural technologies, credit and loan facilities, and extension advisory services and information; food relief distribution and drought management; maintenance of physical infrastructural facilities to support food availability, accessibility, distribution and marketing; water accessibility. These factors were examined in view of their contribution towards household food security in the study area.

1.7 ORGANIZATION OF CHAPTERS

This study has been divided into seven chapters. Chapter One includes an exposition of the Background to the study, Statement of the Problem, Objectives and the Justification for the study. This chapter concludes with the scope and definition of concepts used. Chapter Two provides a critique of the Literature Review based on socio-economic and institutional factors. In addition, the chapter deals with the theoretical orientation of the study and concludes with formulation of hypotheses derived from the literature and theoretical framework.

Chapter Three examines the geographical background of the study area by highlighting the geological foundation and soil characteristics, climatic conditions, water resources, agricultural potential, human resource base and physical infrastructural facilities. This information gives a clear picture of the study area from a geographical point of view and in relationship to the problem being investigated. Chapter Four outlines the methodology used to collect, analyze,

interpret and present data. Sources and nature of relevant data, statistical tools for analysis and their validity are discussed comprehensively within this chapter.

Chapter Five and Six present the results of food security status and the socio-economic and institutional factors affecting food security. Descriptive and inferential statistical results are contained herein and analyzed in detail. The hypotheses previously presented in Chapter Two are tested. Finally, Chapter Seven gives a summary and conclusions of the findings, recommendations to policy makers and researchers and the contributions attributed to the study findings.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.0 Introduction

This chapter examines the literature relevant to this study, which is reviewed based on theoretical and empirical aspects of the food security problem with regard to global and national factors, which are also relevant to the local area of study. This literature is reviewed based on what other researchers have done in the field of food security problems. The objectives of the study acted as a guiding factor on the gaps identification from previous researches carried out on the same problem to avoid repeating the same. The Literature review provided significant insights in the development of the theoretical model used in this investigation. Lastly, both the literature review and the theoretical models were used to formulate the study hypotheses.

2.1 FOOD SECURITY IN SUB-SAHARAN AFRICA AND OTHER DEVELOPING COUNTRIES-AN OVERVIEW

According to most of the research carried out world wide, food security is one of the most debated basic needs, yet perhaps the least resolved of them. Clover (2003) argues that no human right has been so frequently and spectacularly violated in recent times as the right to food, despite the fact that it is one of international human rights law, as constantly reaffirmed by governments. According to Lathan (1997), each household must have the ability, knowledge and resources to produce or procure the amount of food that it needs. The International Food Policy Research Institute (IFPRI 2000) highlights that more than 800 million people in the developing countries face food insecurity. Of this number, 200 million live in Sub-Saharan Africa (SSA). Out of the 800 million people, an estimated 185 million pre-school children are malnourished and about 40,000 children die every day due to nutrition related illnesses (IFPRI 2000).

By 2003, the number of people affected by hunger in developing had countries increased to 820 million (Post not 2006). The numbers are not falling quickly enough to achieve the Millenium

Development Goals (MDGS) set by world leaders in 2000 with aim of reducing by half the proportion of people suffering from hunger by 2015. It is predicted that many regions will not reach their MDGS targets, particularly SSA where a third of the population is food insecure and there is an actual increase (through population growth) in the number of hungry people (post note 2006).

According to World Bank (2003), the wide spread problem of food insecurity in many developing countries is threatening the global economic, political and social stability. Furthermore, it is likely to compromise the IFPRI'S 2020 vision for food, agriculture and environment that aims at having a world where every person has access to adequate and quality food. The economic growth and prosperity of the people of SSA largely depends on strengthening, enhancing agricultural, and food security. In particular, the issue of food security in many places of the world and Africa in particular, is broad and complex. Numerous factors such as infrastructure and good governance, strategic food reserves, markets access and processing of agricultural products into high-value and marketable goods impacts on sustainable food security directly or indirectly (policy analysis 2006)

Sub-Saharan Africa is more affected by food insecurity than any other region in the developing world (FAO 2004). Acute food insecurity in 2003 had affected 38 million people in Africa with 24000 dying from hunger daily. Of the 39 countries worldwide that faced food emergencies at the beginning of 2003, 25 were found in Africa (Clover 2003). Africa, which reversed from being a key exporter of agricultural commodities into being a net food importer, has the highest percentage of undernourished persons and has shown the least progress on reducing the prevalence of under nourishment in the past 30 years (Clover 2003). The largest group of the hungry comprises members of households with low and variable income, limited assets and few marketable skills (FAO 1999). Most of the households are peasant farmers with limited land resources, unskilled and unemployed (Raikes 1988).

Nevertheless, empirical studies show that human factors on food security have comparatively been underemphasized compared with physical factors such as rainfall characteristics and soil productivity (FAO 1997; 1998; 2002; Republic of Kenya 2003). This leaves a research gap dealing with the effect of socio-economic and institutional factors on food security, hence the

need for the current study, which brings human dimension in the mentioned problem. Although physical environment places limits to resource exploitation, humans are capable of overcoming such limits through knowledge, capital and relevant technology. Subsequently, addressing human factors and institutional intervention is likely to shed more light towards improvement in food security.

Peters and Joachim (1999) observed that food security situation in SSA has been compromised by globalisation policy. They posit that the current and unprecedented transition from controlled market to open market economies has generated confusion about the appropriate role of governments and weakened their capacity to perform needed functions. Oligopolistic or monopolistic private firms, with little or no improvement in performance, have replaced the role of government and parastatals. This may have affected farm input prices and delivery services, credit and subsidies, extension services and physical infrastructural facilities. Many countries in SSA are trapped in a vicious circle where low income leads to low savings, low investment, low growth, continued poverty and low savings. Therefore, there is need to examine the effects of liberalization policies on household food security.

A survey carried by FAO (1999) on household food production in SSA revealed that social factors and cultural practices have a significant influence on crop choice and yields. The results of the FAO's survey indicated that certain food crops are neglected because of their taste or negative attitudes towards them. Subsequently, they end up disappearing from farmer's crop combination, thereby leading to chances of food insecurity. This situation has been observed in the study area where food crops such as millet, sorghum and cassava have drastically declined in yields and hectarage despite the fact that they are ideal in marginal areas (*Republic of Kenya 1994; 1997*). However, there is insufficient research on why production of these crops has declined within the study area. Consequently, there is a need to investigate exactly why households are shifting away from growing the traditional food crops (cassava, sorghum, millet) which are tolerant to environmental stress in semi-arid areas.

Sub-Saharan Africa leads among the recipients of emergency food relief in the world (*Buzz 2000; FAO 2004*). According to Clover (2003), approximately 30 million people require emergency food aid in any one year. Emergency relief is expensive and unpredictable and yet

in Africa even in 'normal' years over 20 million people rely on it to meet basic food needs. Despite the fact that events such as droughts are often cyclical, predictable to a certain extent, and build up slowly, relief is often given only when the situation has peaked, with suffering already high and assets lost (Fewes Net 2004). About 60% of the operations of the World Food Programmes (WFP) take place in Africa. During the course of 2002, Malawi, Zambia, Zimbabwe and Lesotho each declared a national disaster and appealed to the international community for help. The most critical food situation in Africa is developing in Zimbabwe, a country which until recently always had surplus food. This is an indication of the magnitude of food insecurity in SSA. Nevertheless, most researchers have concentrated on reporting cases of food insecurity in countries like Ethiopia, Eritrea, Chad, Senegal, Sudan, Somali, Mozambique, among others without addressing the root causes.

Policies for food security proposed by development agencies and governments generally focus on political solutions, without establishing clear links to agricultural systems that are sustainable, that help reduce poverty, and that help increase access to food by empowering people economically (Policy Analysis, 2006). Often, people die of starvation or go hungry not because there is no food in their area (or region), but because they cannot afford it and have no other means of access to it. According to Clover (2003), food insecurity and hunger are closely related to poverty and inability to purchase food. Dealing with the issue of inadequate food supplies cannot be solved by simply producing more food. This is because famines have occurred even where there has been an abundance of food. Many people buy food rather than produce it directly from the farm. In fact, very few people, including small-scale farmers are entirely self-sufficient in production (Clover 2003). Interestingly, researchers have not adequately addressed the issue of households being empowered to have means to provide themselves with their own food or earn the income with which to purchase it. Household purchasing power has greater effect on the solution to the problem of food insecurity even when environmental conditions are unfavourable.

Overall, agricultural policies do not adequately address the needs of women farmers adequately, yet women contribute 70% - 80% of the labour in household farm production within sub-Saharan Africa (FAO 2000). Research conducted by Chinyemba (1997) in Zimbabwe and Lesotho on gender and food security shows that in most cases, men make

decisions and women are the implementers. This has the unfortunate implication that men make decisions on situations in which they are not engaged. Women are becoming more and more responsible for nurturing the households of Africa and Asia as men move further into formal wage employment (Breth 2002). In Zambia, regardless of their marital status, most rural women, spend a significant amount of their time in agricultural work (Carr 1991). However, 90% of this land is classified as customary land with men being allocated land under customary laws to the disadvantage of the women who have no direct access to the same (Oduor 2006). The same problem is seen in Lesotho where although the law recognizes women's right to land, customary law denies them the rights to land and blocks inheritance of husbands' and families land.

Some of the key findings from IFPRI'S (2001) research program on the role of gender in agriculture in Burkina Faso indicate that agricultural productivity increases as much as 20% when women are given the same inputs as men. In Uganda, women account for 80% of the total labour force in agricultural production. In Malawi, women spend long hours in farming operations and food processing besides their involvement in various domestic activities (Carr 1991, FAO 1996). Despite this enormous contribution of women towards household food security, little research has been carried out in semi-arid areas to find out their roles in food security issues.

In a workshop held in Kampala Uganda in April 2003, it was noted that although women provide majority of agricultural labour in Africa, their rights to land were restricted (Mulamu 2004). According to African tradition, women acquire land only through marriage. In the event of death of the husband or divorce, they may lose the land. Eliminating gender discrimination and addressing laws that are unfair to women when it comes to ownership of land, remains a vital intervention to achieving a common ground between men and women, says IFPRI in Mulama (2004).

The contribution of women towards food security in ASALS is important because of male out-migration to urban areas in search of income. Gladwin (2001) in her work on food security in Africa via multiple livelihood strategies of women farmers clearly articulated that gender-related constraints that lower women's productivity are almost never mentioned as explanations

of Africa's food security problems. This research addressed constraints related to women productivity and survival in relation to food insecurity. However, further research is needed to establish ability of women to own economically viable property, access or ownership of productive assets, work distribution to determine whether they are overburdened without commensurate compensation as they perform most of the household chores.

Research done on economic factors influencing food insecurity in Bangladesh and India shows that, improvement in access to savings and credit schemes by poor people has helped to promote diversity in livelihood strategies (IFPRI 2001). A similar research was carried out by Haddan (1997) in South Africa and Senegal and the results showed that the rural poor gain more income from remittances and small scale trading than they do from farming. These two researches show the importance of empowering households with sources of income to enable food access from market when farm yields are low. The current study addresses the issue of household income and its effects on food availability and accessibility. The present investigation endeavoured to come up with recommendation on how to improve livelihoods in semi-arid areas to promote food security in face of harsh environmental conditions.

2.2 FOOD SECURITY IN KENYA AND THE STUDY AREA

2.2.1 Socio-economic aspects

Research carried out by Kliet (1985); Singh (1987); Harris (1989) and FAO (1997) on food security problem in Kenya concentrated more on physical factors as the major contributor to widespread food insecurity in semi-arid areas. This argument has further been expounded by FEWS NET (1993); FAO (2002); Republic of Kenya (2003). Low, unreliable and poorly distributed rainfall have been top on the agenda for most of the research on food shortages. This approach is based on the series of droughts witnessed in the semi-arid as discussed in chapter three of this thesis and negates the fact that food security is not an issue of farm production only, but also involves food accessibility through household purchasing power and food donations.

Nevertheless, availability does not always guarantee access because household availability of food requires that food be available at local or regional markets, which is determined by market

operations, infrastructure and information flow (Peters 1999). While the argument concerning rainfall appears valid based on environmental conditions in semi- arid ecosystems, it does not adequately answer the question of causes and management of food insecurity in semi-arid ecosystems. The majority of the poor Kenyans live in the rural areas, which are characterized by low agricultural productivity, lack of reliable income, limited employment opportunities, and poor social and economic infrastructure among others (Republic of Kenya 2001). The situation for households and individuals is usually conditioned by income. Subsequently, a gap in research has been created by emphasizing on the vagaries of weather, at expense of socio-economic issues of the farming households and their contemporary environment. The current study addressed this gap with a view of solving food insecurity problems.

Research on certain economic factors affecting food security has been conducted in some parts of Kenya. For example, FAO (2004) and Buzz (2000) research work on food security in semi-arid districts of Kenya revealed the crucial role played by income as part of economic factors towards food security. However, their findings concentrated on income factor on crop production without addressing the economic status at household level and its effects on household accessibility to food without necessarily relying on farm produce. A similar research conducted by the Republic of Kenya (2000) and FAO (1999) on food security and poverty alleviation observed that income is important in reducing poverty level in rural areas as a way to improving food security. However, these finding did not address various sources of household income at household level and their contribution to household food security.

Rural household income sources comprise both on farm and off farm sources. The level of income diversity in the study area has not been adequately addressed yet it is vital in alleviating food insecurity in areas where climatic constraints are perennial. It is assumed that those households that do not meet their food needs through cultivation can obtain additional supplies from the market (*Republic of Kenya 2000, FAO 2001; KARI 2003*). However, information is lacking on what proportion of households in the study area can access food from market without problem. Subsequently, this investigation will consider the levels of income of households and how they relate to food security problems. This is important because income gives household the capacity to produce adequate food supplies on a stable basis and in a sustainable manner.

Niehof A. (2004) in an article on the significance of diversification for rural livelihood system in the journal of food policy argues that poor people have low productivity and lack secure access to productive resources and remunerative employment. Investment in health care, education, clean water, sanitation and housing, which are essential for human resource development, are far below required levels, especially in rural areas of low-income developing countries. Many people are either food insecure or live with the risk of being affected. Moreover, their income is often so low that any sudden shocks, such as loss of employment or price fluctuations, could tip them into food insecurity. Consequently, there is a need to examine the income levels of the households in the study area in relationship to food security.

According to Kigutha (1995) in his research on the effect of climatic seasons on household food security in Nakuru district, economic factors that relate to food production include land issues such as farm size and land tenure system. The findings of this research reveal that land is the basis for the production of food and the influence of climatic and soil conditions. However, the focus of Kigutha just like other researchers (*Fews Net 1993; FAO 2002; Republic of Kenya 2003*) was physical conditions and that land factor was not given adequate attention from socio-economic point of view. The research does not address land as a source of income, employment and economic security for most of the rural people.

Bruce and Shem (1994) in their work on food security in Africa argue that the farm size and land tenure security increases the likelihood that the farmer will capture the investment returns as well as improving credit worthiness of the landholder. In addition, land security reduces the incidences of disputes and increases demand for complementary short-term farm inputs (FAO 1997, Breth 2002). Although issue of land was well addressed under these studies, the findings did not clearly explain how it is linked to food insecurity and especially in the semi-arid areas where land productivity, land tenure system and distribution is different compared to other agro-ecological areas.

Since land is the productive asset, which mainly determines income distribution and thus access to food in the rural areas, it should follow that food insecurity among rural people is closely related to land tenure status and the size of the land holdings. This view is further supported by Oduor and Malesu (2006) who argues that the linkages between land ownership and

agricultural productivity are often ignored, to the detriment of most countries in Sub-Saharan Africa. Land ownership is as important as it is profound. For this reason, the distribution of rural wealth and the incidence of poverty as shown by Elsevier (2005) are closely connected to the socio-economic order, which determines the type of access to land and its use in society. Laurie (1998) expressed similar views by noting that owning land makes one decide whether to consume or sell proceeds. Nevertheless, the problem of tenure and insufficient access to and security of land resources for many rural poor women has not been adequately addressed in semi-arid areas of Kenya. This study therefore sought to examine whether household farm size and tenure system have significant effect on household food security. This is important because it is assumed that semi-arid areas are not threatened by population pressure, which leads to land fragmentation. One of the questions not addressed by researchers is whether household farm size is a problem in ASALS and if it is adequate to allow crop diversification and livestock keeping.

The size of a household is another important human factor contributing to food insecurity. According to research carried out by IFPRI (1996) on food security in Africa, the results showed that African households contribute significantly towards rural labour force. The assumption was that households' size increases productivity. However, IFPRI findings did not focus on household size and food consumption as determinant factor on food security. Household size determines dependency ratio, which affects the rate at which food stores are depleted. To date, no research has been carried out in semi-arid areas to determine whether large families are more vulnerable to food insecurity than small ones. Research is also lacking on whether large families translates to more productivity. Accordingly, this study focussed on the level of contribution by household size towards food security. Examining household size is imperative because food secure household can slide to food insecurity due to the size of household population being fed.

Household characteristics also involve education levels among the members. FAO (2001) and Ellis (2004) recognized the importance of education in improving food production technologies and innovations. Farmers require education for better understanding of farm management practices, agronomic practices and use of farm inputs in the right ratio and at the right time (Republic, Kenya 2001). Issues of equitable access and dissemination of information will arise

as less educated households are by passed. However, these research initiatives did not focus on the literacy level in ASALS and how this relates to food security. Furthermore, there is an absence of information on whether there is significant difference in food security between households with better education and those with poor education background.

The importance of household farm labour cannot be overlooked in a study of socio-economic factors affecting food security. Unfortunately, there has been a misguided believe that large household in rural areas provide abundant farm labour (FAO 1996, Pratt 1997). In a research conducted by FAO 2003 that focused on food insecurity and vulnerability in Eastern Africa, it was observed that despite high population growth rates, family labour supply has decreased. These sentiments had earlier been expressed by Southland (1999) in an article on household food security in semi-arid Africa focusing on the contribution of participatory adaptive research and development to rural livelihoods in Eastern Kenya. His findings dwelt more on rural - urban migration as the cause of rural labour shortages.

Toulmin (2003) in a research on transformation in West African agriculture and the role of family farms observed that a household with a relatively young labour force with a balance between the gender is considered much more sustainable than one where there are few children or where these are mainly girls or women. These findings are already biased against women as important rural labour suppliers. There is the assumption that men are the major farm labour contributors at household level. Although rural-urban migration contributes to labour shortages, there is need to address other causes of labour shortages such as free primary education system adopted in Kenya and household ability to employ labour even when such labour is available. It is therefore evident that the reasons for lack of rural labour supply have not been comprehensively researched in the rural semi-arid areas. The current research examines such issues with a view of determining whether the aspect of labour is a problem in food security and the causes of labour shortage as well as households coping strategies with labour shortages.

Farming technology has also been examined as an important economic component in improving farm production and consequently food security. According to a report by the *Republic of Kenya (2001)*, semi-arid areas with food deficit could be transformed into self-sustaining net food producer by replacing in part or in whole, the traditional farming methods

suitable to the area. Some of the technologies suitable in semi-arid areas and reasons why farmers have not adopted them are examined in this study. Many farmers may be aware of the importance of agronomic practices like early land preparation, early planting, timely weed control, among others. However, for various reasons, (most of which are of socio-economic nature); many farmers are unable to modernize their farm enterprises and subsequently this affect food security.

One of the common technologies used in Eastern Kenya is the oxen-driven plough. KARI (2003) indicates that the oxen plough system is labour saving per hectare as compared to hoe cultivation systems. However, little information exists on the use and ownership of this technology among household in semi-arid areas of Makueni District. Research is needed to establish how many households own a set of plough and oxen. This is important in timely planting and weeding in semi-arid areas where delay of one week can cause significant difference in crop yields. Household should be encouraged to use technologies such as oxen plough, which is appropriate in semi-arid area. (*Republic of Kenya, 1997: KARI, 2003*).

This study examines the gender factor as an important determinant of food security at household level. Gladwin (2001) emphasized lack of access to land, capital and credit as major limitation to women's contribution towards solving problem of food insecurity. However, this research did not do a comparison between female-headed households and male-headed households to determine whether there is significant difference in farm productivity and food accessibility. Whether or not female-headed households are food insecure in comparison to male-headed households varies from country to country and cannot therefore be generalized.

Consequently, there is need to examine gender role in food security in Makueni district. Okwosa (1999) and FAO (2003) addressed the issue of gender as related to food security by focusing on development planning process and the food security strategy pursued in Sub-Saharan Africa. They observed that women are often ignored at many decision-making levels. Kaendi (1999) and FAO (2001) also examined gender factor as key to sustainability and food security. However, most of these research works do not adequately address the socio-economic constraints women face in generating income and improving food production. This is important because agricultural production may not be rural households only source, or even their most

important source of income. In order to be secure, rural women must have diversified sources of income to cushion them against food insecurity.

Oduor and Malesu (2006) in their report on managing water for food self – sufficiency, highlights that the issues that surround the land question have endorsed the inequality of sexes in many parts of Africa. In Kenya for instance, the law appears to offer both sexes equal access to land but victimizes women by enforcing customary laws on agricultural land that block women's rights to inherit and own land. Most women lack title deeds, which is the absolute guarantor of land ownership. Without the legal document, they end up being technically landless. This is despite the 1981 Law of Succession Act, which grants equal rights of inheritance to boys and girls in the event their parents dying without writing a will (Oduor 2006). The Act extends similar privileges to widows and widowers, except that the former loses her rights when she remarries. Widows are given right to use the land but it denies them the power to sell or mortgage the land. However, this report did not find out how this bias is affecting household food security.

Pre-harvest, harvest and post-harvest grain management also affects food security. FAO (1999) and Oniang'o (1997) indicate that food security is being threatened by qualitative and quantitative losses during post-harvest storage. At post-harvest storage, grain losses are caused by attack from rodents, moulds, weevils, mites and microorganism (FAO 1984; Unklesbay 1992; Marina 1991). Republic of Kenya (2002; 2003) and KARI (2004) all agree food waste is significant in contributing to food shortages in Kenyan households. However, these findings are generalized without addressing the causes of post-harvest food losses and its magnitude on food security in the rural household set up. The issue that arises in connection with this is whether peasant farmers are aware of these losses and if so, how do they perceive them? This is an important area of research, which has been ignored in semi-arid areas of Kenya, yet it is significant in contributing to household food insecurity. Households have gone in to record of harvesting huge produce but the same households experience food shortage after a short time because of post-harvest poor management.

2.2.2 Institutional factors

The war against food insecurity cannot be complete without addressing government and other non-governmental interventions on food production and accessibility at household level. According to Republic of Kenya (2001), the role of government in the search for adequate food is largely viewed in terms of the formulation and implementation of policies that are likely to enhance or improve status of food security. The international organizations, NGOs, and other private institutions intervention in food security include sharing of information of the food situation in the country, mobilization of resources (food, water, seeds and other donations) to mitigate the effects of famine, capacity building of communities in farming technologies and extension advisory services. However, the involvement of these institutions typically lack coordination and timing in service delivery hence may lead to duplication of the same activities in one place or bias in the manner services are delivered. Consequently, such interventions may not solve food security problem at household level.

The problem of food security is compounded by a policy bias towards cash crops, as opposed to smallholder food crop production (FAO, 1998). This is subsequently followed by poor intervention in food production and accessibility support services such as extension services, credit facilities; farm input subsidies, food relief services and physical infrastructural facilities. In line with this, a report by the *Republic of Kenya (2001; 2003)* points out that food policy involves enabling households' access to improved seeds, agro-chemicals, fertilizers and farm implements on credit or subsidized terms. In addition, it also must involve facilitating extension services to help farmers in rural areas on how to improve farm production. Such policies are crucial in semi-arid areas where environmental conditions are harsh and household incomes are low.

The National Development Plan of 1994-1996 stated explicitly that the Government would develop mechanisms of directing agricultural financing and farming knowledge to disadvantaged, areas like ASALS. Nevertheless, there is little information to show the role of government in facilitating farmers' accessibility to extension services, inputs and good roads. FAO (2004) indicated that seed aid which is a relatively new response in the agricultural emergency in Kenya, involves transfer of seeds from commercial companies (formal seed sector) to beneficiaries (resource-poor farmers) through several institutions such as Danish

International Development Assistance(DANIDA), German Aid (GTZ), German Agro-Action (GAA), CARE-Kenya and World Vision, among other development Partners. Although this approach has its merits, there remains a need to examine whether it has transformed the beneficiaries into receivers, instead of enhancing their capacity to produce and access seed themselves.

Kinyua (2004) observed that there are many extension service providers within the Government, NGOs, private sector, religious organizations and Community Based Organizations (CBOs). Extensive successful experiences throughout the country in agricultural and extension points to the need of supporting farmer groups in order to improve their capacities in realizing their food security needs and increase the desire to correct the situation. Kinyua (2004) also noted that there are many resources (such as human, physical and financial) within these organizations. However, he acknowledges that such resources may be utilized in an uncoordinated manner with little impact on the communities they are directed to.

There is insufficient information on how government and non-governmental organizations are coordinated in service delivery and how this affects food security in the study area. In addition, most of the policies by public and private sectors ignore the fact that food security at household level is a combination of many factors such as accessibility, affordability, availability and adequate supply of nutritionally balanced food at all times. These policies give more emphasis on production and emergency supplies (Fews Net 2005). Subsequently, there is rationale to look into food security issues from a broad perspective.

The introduction of the Structural Adjustment Programmes (SAFS) in 1980s brought major policy reforms into the agricultural sector. This included liberalization of markets for farm produce and inputs; and withdrawal of subsidies on these inputs including extension services (Omosa 1998; Republic of Kenya 2000). These reforms were based on the premise that liberalisation will increase efficiency and subsequently result in adequate food, among other benefits. The assumption is that production for the market will bring about food surpluses at household level and that households that enjoy better returns from other sources of income will use income earned to acquire staple food on the market.

Nevertheless, little research has been done on whether these reforms are capable of promoting access to food at the rural household level. Adedeji (1988) argued that, rather than making poor people less vulnerable, SAPS are achieving the reverse. There is need to examine whether SAPS have brought prices down as anticipated through competition or whether prices went up after government withdrawal from giving subsidies. Information from the study area indicates that there is scanty information addressing the effect of structural adjustment policy on food security. This involves issues such as liberalization of grain marketing as well as inputs delivery and extension service provision. These changes have led to further complication in the national food policy and food security. The international financial community have insisted that governments adjust their spending and restructure public enterprises, which has led to cutting social welfare spending, readjusted exchange rates downwards. Therefore, this study examines the effects of liberalization policies on food security.

Institutional factors also cover infrastructural facilities like road transport and water facilities. A report by the Republic of Kenya (2000; 2002) pointed out that the state of infrastructure including roads, health and water facilities are vital in economic performance, which affects food security. Further, during the Poverty Reduction Strategy Paper (PRSP) consultative forum in Makueni District, poor physical infrastructure was identified as one of the major setbacks to rural development. Peters and Joachim (1999) in their research on food security, diversification and resource management argued that, availability of food in households requires that food be available at local or regional markets. This is determined by market operations, physical infrastructure and information flow. The available food may not be distributed according to the needs of households because of inadequacy in the infrastructural facilities. Nonetheless, researchers have not examined the contribution of physical facilities to price fluctuations and unavailability of food when required in the study area. Food may be available in the country or region but fail to reach the areas of demand if the infrastructural facilities are lacking.

Access to water for human needs, agricultural and livestock use poses a major problem in rural semi-arid areas. This is hampered by insufficient ground and surface water resources hence people trek long distances to fetch water. This leads to waste of valuable time, which can be invested in improving food security. Similarly, KARI (2003) indicated that physical infrastructure in semi-arid ecosystem is generally poor or non-existent. A report by the World

Bank (1993) further observed that distances from villages to major market centres are important in food distribution. However, details on the status of infrastructural facilities and how they are linked to food insecurity are lacking in the study area. There is need to examine the role of infrastructural facilities in view of food production, marketing, accessibility and distribution.

Lastly, the Government's policy on food security includes distribution and management of food aid services. FAO (2004) and Buzz (2000) in their review on food aid in semi-arid areas points out that governments are spending considerably huge resources on relief food but this is having relatively little impact in addressing the compounding problems of food security. Kinyua (2004) pointed out that, poor planning results in available resources being directed to interventions that do not give sustainable impact. For instance, when North Eastern parts of Kenya experienced extended drought for four consecutive seasons, the Government, United Nations Agencies and NGOs spent a total of 27.2 billion Kenya shilling or US\$ 340 million, on the provision of famine relief food to the affected 4.1 million people from March 2000 to September 2002. Approximately 20% of the amount was spent on food distribution and logistics (Kinyua 2004). With properly planning, this amount of money would go a long way towards establishing sustainable food security measures in the country. There is an absence of research on whether or not households have internalized relief food as a survival strategy. Similarly, information on relief food leaves the question of long-term effect of this food on the recipients. Subsequently, the study examines whether food relief is a strategy to help reduce or increase food insecurity in semi-arid areas.

From the discussion on relevant literature, it can be concluded that there are significant gaps, which either have not been addressed or have been inadequately addressed from a human and institutional perspective. This is mainly with regard to the causes of food insecurity both worldwide and within in the study area. The review has revealed that the majority of researchers have tended to focus largely on the physical factors influencing food security, at the expense of the human factors related to socio – economic and institutional aspects. Hence, the findings of these previous studies have proved inadequate in solving the food security problem.

Accordingly, the present investigation deliberately deviated from the Physical Limitation approach and used the Human Possibilism approach, which puts human beings as masters of the physical environment on condition that the right socio-economic and institutional systems are put in place. The human factors of relevance to this investigation were mainly the socio-economic and institutional factors affecting household food security problem. These factors have previously been enumerated as social characteristics of the household (i.e. family size, farmer's age and educational level); economic potential of the household (i.e. income levels, labour stability, land factor and post-harvest management); the gender factor in food production, institutional policies on farm inputs, credit facilities, food emergency services and infrastructural facilities. These factors have been reviewed and information gaps established concerning their effect on food security. This literature review provides a credible basis for the factors upon which the research hypotheses for this study were formulated. Furthermore, the review indicates cases where the above human factors have been researched in other parts of Kenya without focus on semi-arid areas and at household level.

An additional significant gap revealed in the Literature Review is that previous studies that made an effort to address socio – economic factors and institutional factors using a single approach failed to show how these factors are interrelated in their effect towards food security problems at the household level. This research therefore addressed socio-economic factors from an integrated approach by acknowledging that they are interrelated and interlinked from a spatial point of view. Addressing one factor as the sole contributor to food security problem may not give us in depth information on the root causes of food insecurity as well as coming up with possible strategies to alleviate this problem. Consequently, a geographical analysis based on multivariate relationship (a combination of socio-economic factors acting as independent variables and food security through production and purchase being the dependent variable) has been used in this study to help address the complex problem of food security.

2.3 THEORETICAL AND CONCEPTUAL FRAMEWORK ON FOOD SECURITY

Different theories have been applied in Agricultural Geography to explain the problem of food security. One of these theories is the old school of Environmental Determinism that argues that human activities are controlled by physical limitations (Simmons 1966; Harris 1969). Although this school of thought was challenged and rejected by the mid 20th century, researchers through

emphasis on physical factors as major limitation are still using the principle of environmental determinism to food security at the expense of other factors that are also important. Environmental Possibilism or Human Possibilism that was spear headed by scholars like Paul Vidal De Blanch and Febvre (quoted by Singh 1987) later replaced the school of Environmental Determinism. This school of thought advocates that man is changing the environment for his own good through technological innovation, capital and scientific knowledge. This implies that nature does not wholly determine the activities of human beings but creates possibilities from which people may make choices.

Modern geographers have adopted the two schools of thought and emerged with a model referred as Nature-Human Determinism that is a compromise between Environmental Determinism and Human Possibilism in agricultural production. The Nature-Human approach has been applied as System Analysis Approach in Agricultural Geography that provides the theoretical basis for this study. The System Analysis Approach emphasis on how agricultural production is determined by interrelationships between different components such as the biophysical, socio-economic and political attributes (Singh 1987; FAO 1990; Andrew 1997). Food security is a complex issue linked in a complex system composed of rainfall and soil characteristics, agronomic practices, socio-cultural and economic characteristic of the farmer and institutional arrangements.

The present investigation focussed solely on the socio-economic and institutional components of the System Analysis as they apply to food security issue. Although the biophysical environment imposes certain broad limits within which crops may be successfully grown, the scale, intensity and extent of production within these limits is determined by socio-economic factors and institutional support services. The system promotes the analysis of factors within their own settings and emphasizing their interactions with other factors within the system as shown in *Figure 2.1*. The theoretical orientation was used to direct systematic empirical research of the study.

The System Analysis Theory led to improvement and transformation approaches in agricultural production that lay more emphasis on agricultural modernization aimed at increasing the use of better technology for generating sufficient food supply. However, these approaches have

focussed on global and national food security without taking into consideration the aspect of food security at the household level. Similarly, more emphasis has been placed on national food self-sufficiency from farm production and imports rather than household food availability and accessibility from a combination of farm produce, market purchase and other sources.

In view of this, the current study examined the socio-economic and institutional components of System Analysis Theory that are more relevant to household food security based on farm production, market purchase, and social safety net among others. The System Analysis Approach does not adequately address the complexities of food insecurity at the household level. A case in point is that households' do not face food insecurity uniformly even when faced with widespread food shortages. This is because some of the households may be more food secure than others. To unravel this complexity, this study applied Amartya Sen's model of "entitlement system" which complements the System Analysis Model. This approach explains why some households face food insecurity while others remain food secure.

According to Amartya Sen, entitlements refer to what people own and what this ownership can command in terms of food security (Sen 1981; 1990; 1995). Ownership includes land, sources of income, labour, employment opportunities, assets and other resources. Consequently, the ability to command enough food depends on one's entitlement or ownership of the aforementioned factors. Sen's model posits that food security flows from possession and these stem from endowments which then constitute one's entitlement (Sen 1981). Sen further argues that entitlements can be classified as entitlement through market purchase, farm production based entitlement, own labour entitlement (sale of one's labour force to earn income to purchase food) and social safety net entitlement (right to own what is given by others). This approach is among one of the more recent models used to explain the problem of food security.

Omosa (1998) applied Sen's model in the study of food security in Kisii District. In this case, a farmer who owns land, labour, capital and other productive resources can either decide to grow his/her own food or purchase food using wages earned from selling his/her labour or growing other crops that can be marketed for cash. Such a farmer could also benefit from selling some of his/her assets like livestock, poultry, etc to purchase food. Sen's model has strong tenets in the view that food insecurity can exist without any decline in the general supply of food and

when shortages are experienced, households are not affected uniformly because of differences in entitlement and therefore, this model explains how food security is gained and lost at household level. Entitlement varies because what households own and how much they command in food accessibility tends to vary from place to place and household to household depending on social, economic, and institutional characteristics (Sen 1981). For instance, a household which owns land, labour and other productive resources could choose to grow own food or purchase food using income earned from selling ones labour and other cash crops. Such possibilities stand for the exchange entitlement of the household's endowment.

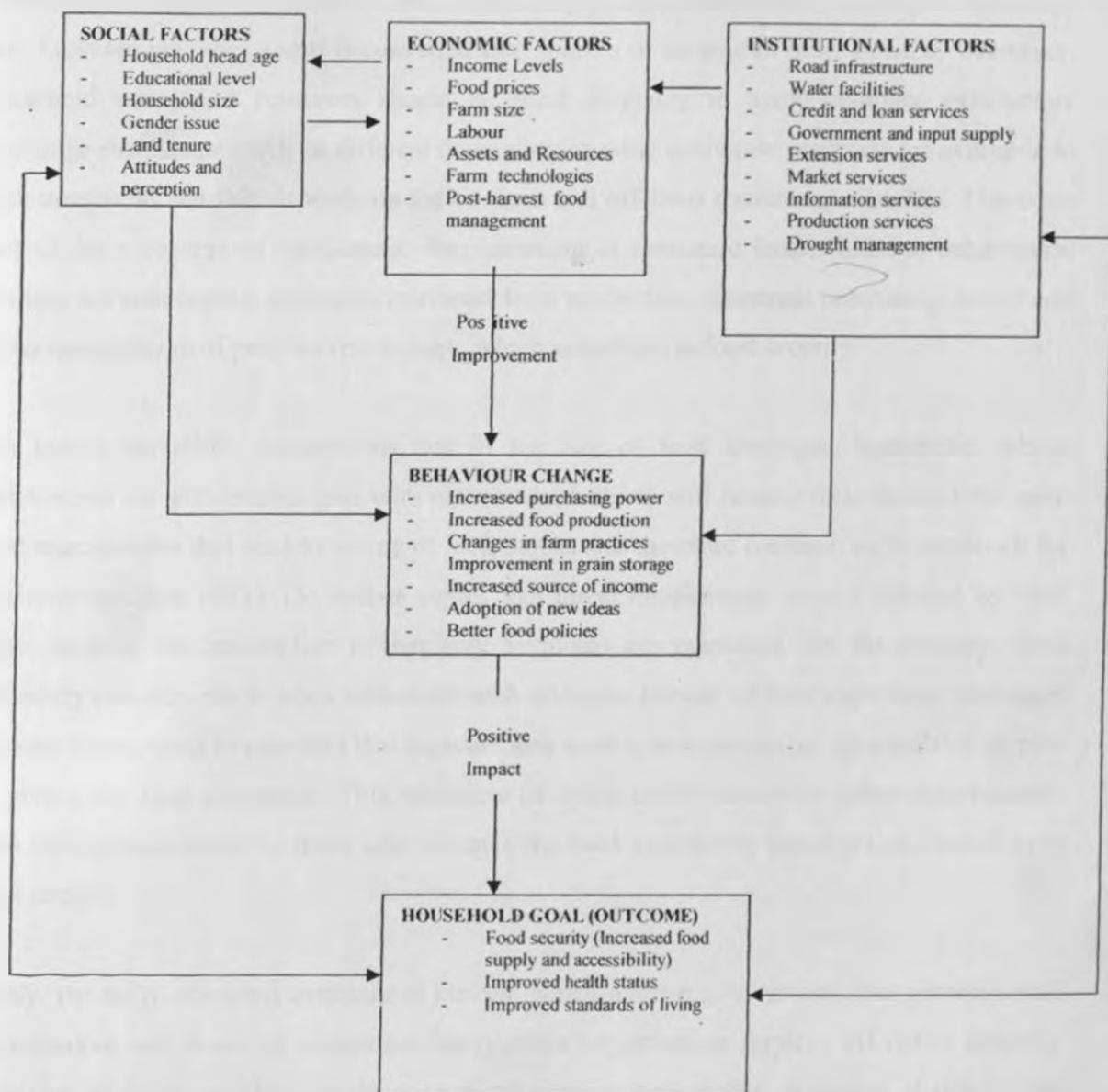
Loss of one's entitlement or possessions will lead to food insecurity. If people go hungry on a regular basis all the time, or seasonally, this may be explained by an entitlement system that fails to give these persons adequate means of securing enough food (Dreze and Sen 1989). This could be due to a fall in wages earned by an individual; a rise in food prices compared to the purchasing power of the household; loss of employment for the persons feeding the household; a drop in the prices of goods that one produces and sells (e.g. livestock); inability to store sufficient food quantities over long periods of , etc. People can fail to secure adequate food because they own nothing or because what they own cannot be exchanged for adequate food. Conversely, endowments may not always bring in adequate food supplies- on the contrary; they only provide the potential to secure food which household may not fully utilize. For instance, it has been argued that culture, habits, skills, and preference may limit their choices in spite of existing potential entitlements.

The present investigation addressed socio-economic factors with a view of examining how they can influence household's ability to command adequate food (whether through farm production or market purchase). Sen's model of entitlement approach introduces a useful dimension to the study of food security. Entitlement approach presents the search for food as embedded within a larger framework such as the social, economic and political processes in a given region. This interlinkage is demonstrated in *Figure 2.1* and it was used as basis for formulating the study hypotheses.

From the conceptual framework, it is evident that different social, economic and institutional factors interplay and influence the availability and accessibility of food at household level.

Social factors such as age and educational level will determine farmers' adaptation to technological changes, attitude and perception as well as food preferences. A combination of these social factors will affect food production. For example, crops such as sorghum, millet and cassava may be performing poorly because of attitude and perception as examined in this study. An improvement of these social factors as mentioned will lead to behavioural change hence improvement in food security.

Figure 2.1: A conceptual framework of integrated socio-economic and institutional factors affecting household food insecurity



(Figure 2.1 was compiled by the researcher to show the interrelationships among the independent variables (socio-economic and institutional factors) and their effects on the dependent variable (food security).

Economic factors such as household income have significant effect on household purchasing power. Subsequently, this determines how household are able to access food from the market. Income also affects the use of quality farm inputs, hiring of labour force, and ownership of farm implements among others. When sources of income are limited, chances of food insecurity are enhanced because of loss purchasing power entitlement according to Amartaya Sen. Land among other assets is converted into sources of income in times of need. However, household assets and resources should be used diligently to avoid complete exhaustion. Exchange entitlements will be different depending on what economic prospects are available to each household and this depends on the on-farm and off-farm resource availability. These are part of Sen's concept of entitlement. Improvement in economic factors leads to behavioural changes towards coping strategies, increased farm production, increased purchasing power and better management of post harvest storage, which contribute to food security.

Sen makes unrealistic assumptions that in the face of food shortages, households whose entitlements lie with exchanging with nature (cultivation) will reduce their demand for non-food commodities that lead to selling of food stocks and therefore maintain sufficient stock for consumption (Sen 1981). He further argues that direct entitlements are not affected by food sales, because the assumption is that only surpluses are marketed. On the contrary, food insecurity can take place when household with adequate harvest of food experience shortages because of engaging in practices that deplete those stocks, such as market sales without surplus or giving out food assistance. This weakness of Sen's model coincides rather unfortunately with assumptions made by those who advance the food availability paradigm as a solution to food security

Lastly, the study examines institutional factors, which involve government, non-governmental organizations and financial institutions intervention on extension services offered to farmers, provision of credit and loan facilities to disadvantaged households, provision of relief food when required, household access to water and improvement of road facilities to enable

distribution and transportation of foodstuff. Weak policies or poor interventions on these aspects will enhance food insecurity at household level. Sen conceptualizes state intervention as central to food security and, by so doing; he puts the role of state at the centre of entitlements. Many people have no legal right to demand provisions of food. Furthermore, a number of countries are plagued with poor distribution of relief food supplies, with little resistance from those entitled to these supplies since relief food has remained a gift, a non-entitlement. Positive changes will therefore lead to behavioural changes towards easy access to production services, improvement in livelihoods by empowering households economically, facilitating movement of grain from different parts of the country to the study area and making prices affordable to consumers by increasing supply.

All these components are interrelated in such a way that social factors will affect economic and institutional factors and vice versa. The interplay between these factors is very important in managing food security issue. It also shows how Sen's model of "entitlement" can apply in solving food insecurity. It is not prudent to examine one factor in isolation because farm system interacts with socio-economic aspects. For example, purchase of farm inputs (e.g. seeds and fertilizers), labour provision and post harvest food management are influenced by purchasing power of the household as well as government policy on credit facilities. When household lose "entitlement" to food availability and accessibility factors, they face collapse in mechanisms of acquiring food and hence food insecurity.

In conclusion, food security is a function of household income level, availability of land and other assets, reasonable education level, unbiased gender participation, effective post-harvest food management and positive institutional interventions on food availability and accessibility. Increasing or improvement of these factors means improvement in livelihoods and subsequent increase in food security while on the other side poor performance of the same factors lead to food insecurity. The study conceptualizes that food security as a household ability to command an adequate amount of food through one or a combination of on-farm and off-farm sources. Food insecurity will remain if households have insufficient/little or unpredictable command over one or a combination of existing sources of food or this command is gained at the expense of other equally compelling needs.

2.4 RESEARCH HYPOTHESES

General hypothesis

The general hypothesis of this study has been derived from the review literature and theoretical framework is that the food security problem at household level is not influenced by socio - economic and institutional factors. For purposes of statistical testing, this general hypothesis is specifically stated in null form.

Specific hypotheses

Specific hypotheses stated in null form ($H_0; B = 0$) were posted for testing using F significance level. They are:

1. H_0 - There is no significant difference in food security problem between households of different socio - economic status such as educational level, income variation, farm size and post-harvest food management. The socio-economic factors represent the independent variables while food security problem represent the dependent variable.

H_1 - The alternative

2. H_0 - There is no significant role of institutional support services such as availability of farm inputs, extension services, and road infrastructural facilities on food security problem at household level. Any observed difference is by chance. The institutional factors represent the independent variables while food security problem represents the dependent variable.

H_1 - The alternative

2.5 CONCLUDING REMARKS

This chapter has addressed the socio-economic and institutional factors as they affect food security. It has emerged that most researchers have either understudied such factors or ignored them in favour of environmental factors. No research dealing with food security has adequately addressed socio-economic and institutional factors from intergrated approach. The

interrelationships of these factors are further highlighted under the System Approach Analysis. When the interrelationship is not functional, it may be because of loss of household entitlement

CHAPTER THREE

PHYSICAL AND HUMAN CHARACTERISTICS OF THE STUDY AREA

3.0 INTRODUCTION

This chapter presents the physical and human characteristics of the study area in relation to food security. Although physical aspects are not the focus of this investigation, they are highlighted in this chapter to indicate the circumstances under which socio-economic factors operate in explaining food security. The physical and human background information helps in understanding the geographical characteristics of the study area and the genesis of food security problem in the district.

Makueni District covers 7440 km² and is one of the twelve districts that form the Eastern Province of Kenya as shown in *Figure 3.1*. The district borders Kajiado District to the west, Taita Taveta District to the south, Kitui District to the east and Machakos District to the north. Makueni District was created from the former larger Machakos District in February 1992. Since then, many of the divisions have been subdivided from the original four divisions (Kilome, Makueni, Mbooni, Kibwezi) to the current 15. The new divisions are Wote, Kathonzweni, Kalawa, Kisau, Kaiti, Mbooni, Tulimani, Kasikeu, Kilome, Kilungu, Mulala, Matiliku, Makindu, Kibwezi and Mtito Andei (Republic of Kenya 1997 - 2001). Over two thirds of the entire area covered by the district can be classified under semi-arid lands. This mainly comprises Kathonzweni, Wote, Kibwezi, Mtito Andei, Makindu, Kalawa and Kasikeu. The study concentrated on Makindu, Kasikeu, Kibwezi, Kathonzweni and Wote as indicated in *Figure 3.2*.

FIGURE 3.1: LOCATION OF MAKUENI DISTRICT IN KENYA

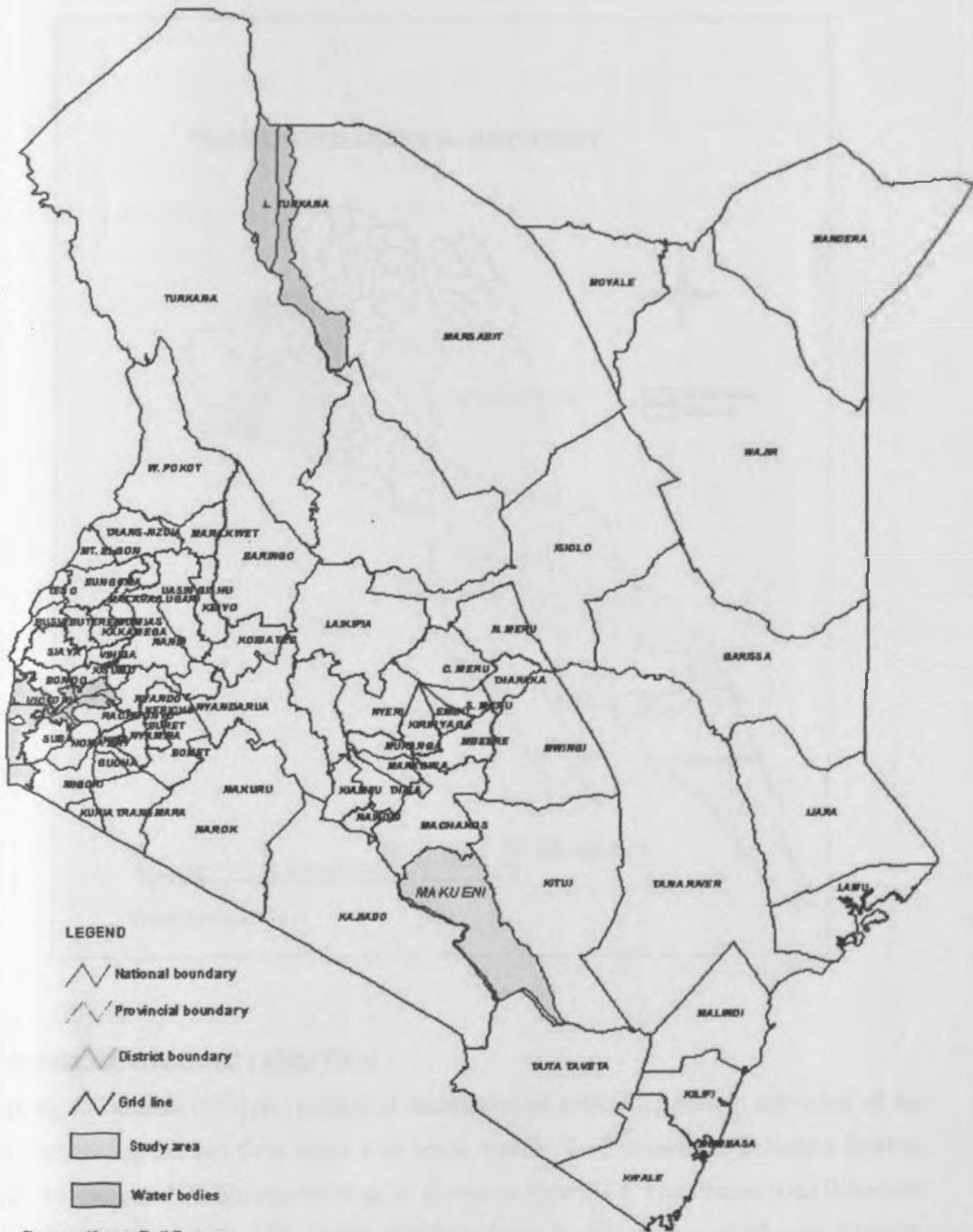
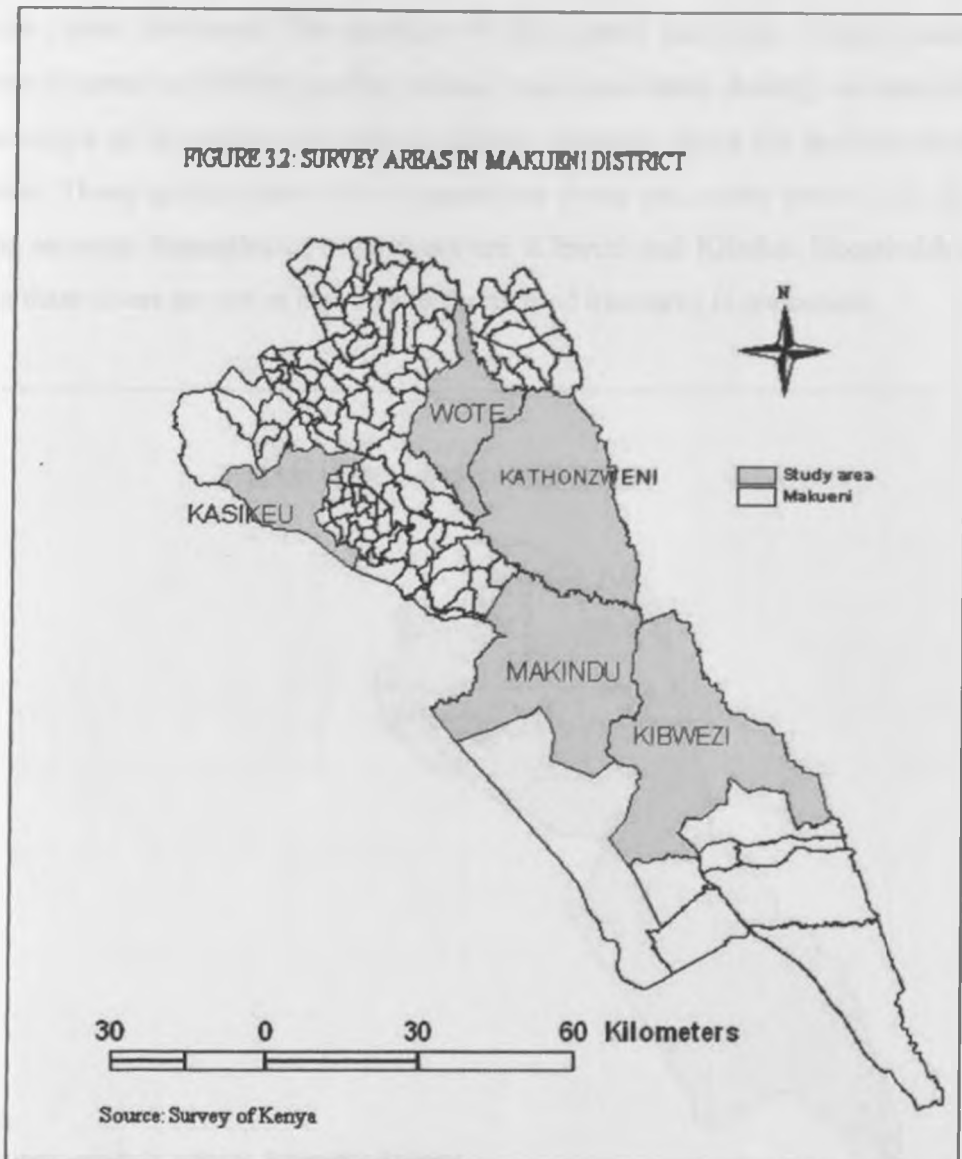


FIGURE 3.2: SURVEY AREAS IN MAKUENI DISTRICT

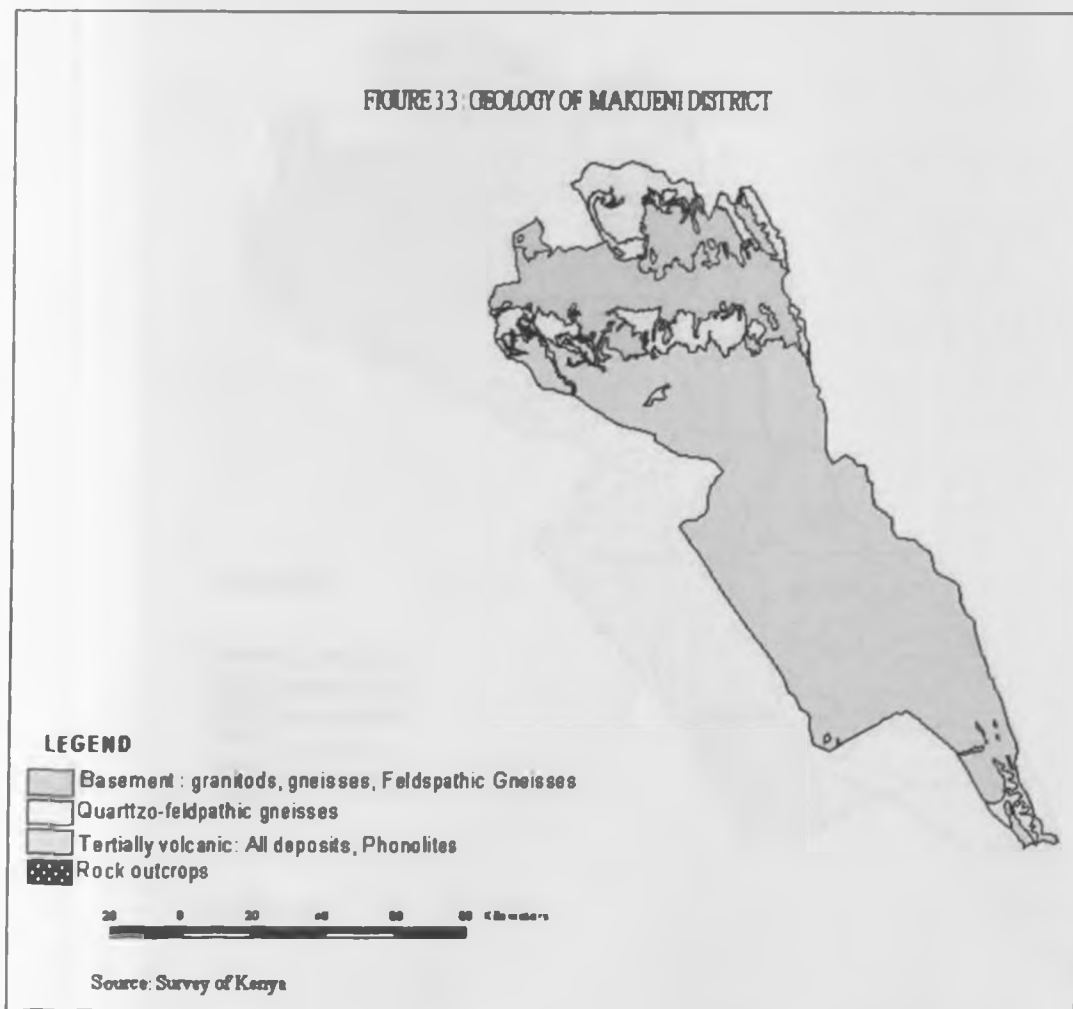


3.1 PHYSICAL CHARACTERISTICS

According to Dodson(1953),the geological foundation on which the present day relief of the entire district rests fall into three major rock types, namely; the Precambrian Basement System, Tertiary volcanic and Pleistocene volcanic as shown in *Figure 3.3*. The Precambrian Basement system covers greater part of the district, which includes the hill masses of Mbooni, Kilungu, Mbitini and Nzau, which are formed of granite rocks. The tertiary volcanic system includes the Miocene phonolites covering the Kapiti plains and the Yatta Plateau. The last geological

system is the quaternary volcanic activity (Pleistocene basalts), which is associated with the formation of Chyulu ranges and extension of basalts rocks covering parts of Kibwezi, Makindu and Mtito Andei Divisions. The geology of these areas has been of great importance to agriculture because rain falling on the volcanic rocks percolates through as underground flow and re-emerges on the surface in form of springs especially along the northern margin of the lava fields. These springs have led to permanent rivers and water points that are used for irrigation services. Examples of such rivers are Kibwezi and Kiboko. Households who have access to these rivers are not at high risk as far as food insecurity is concerned.

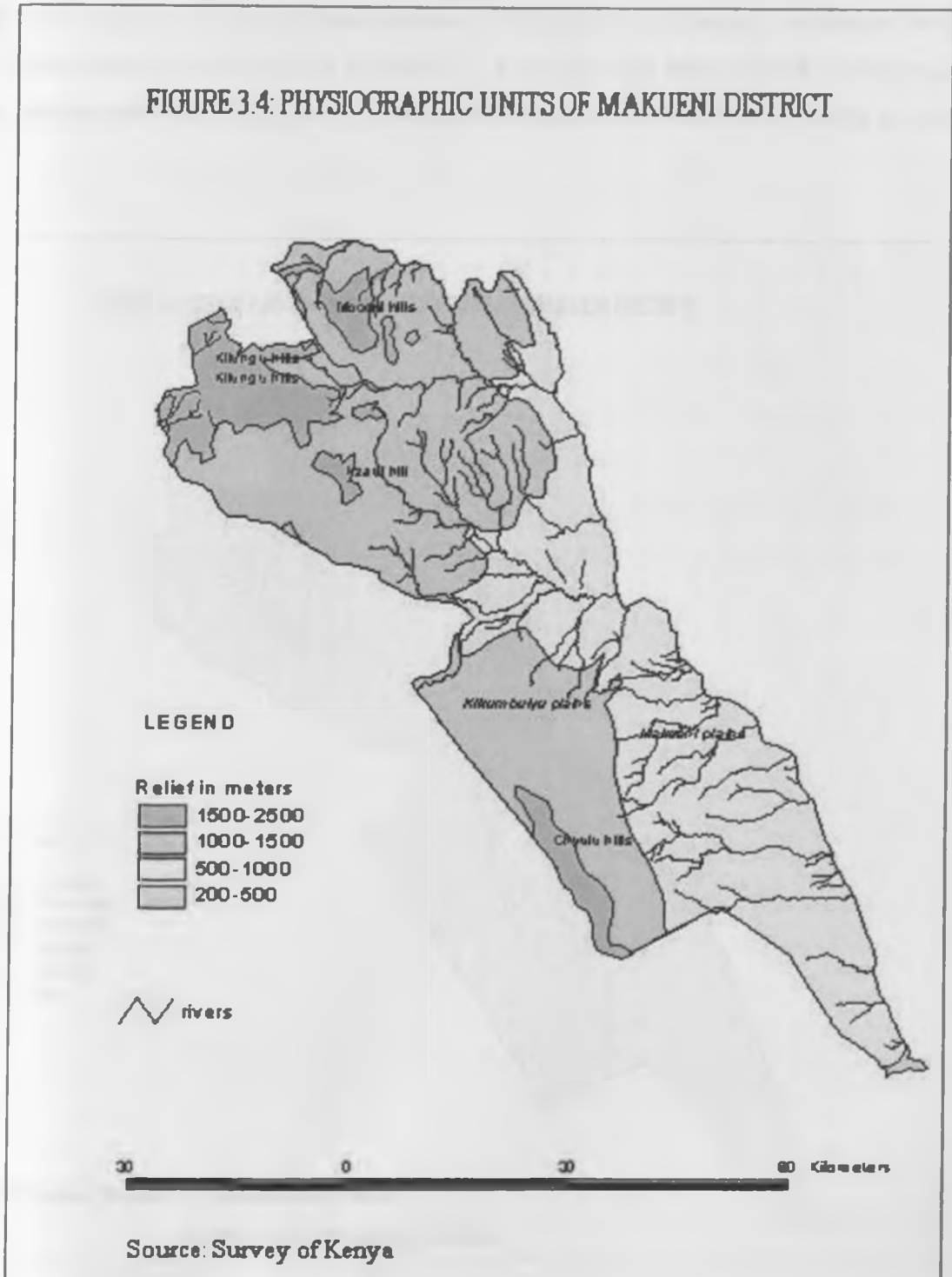
FIGURE 33: GEOLOGY OF MAKUENI DISTRICT



The relief of the district rises from slightly below 600m above sea level at Tsavo in the southern end of the district to 2500m above the sea level on the Kilungu Hills as shown in *Figure 3.4*. This puts the district into two physiological units namely the hill masses and the

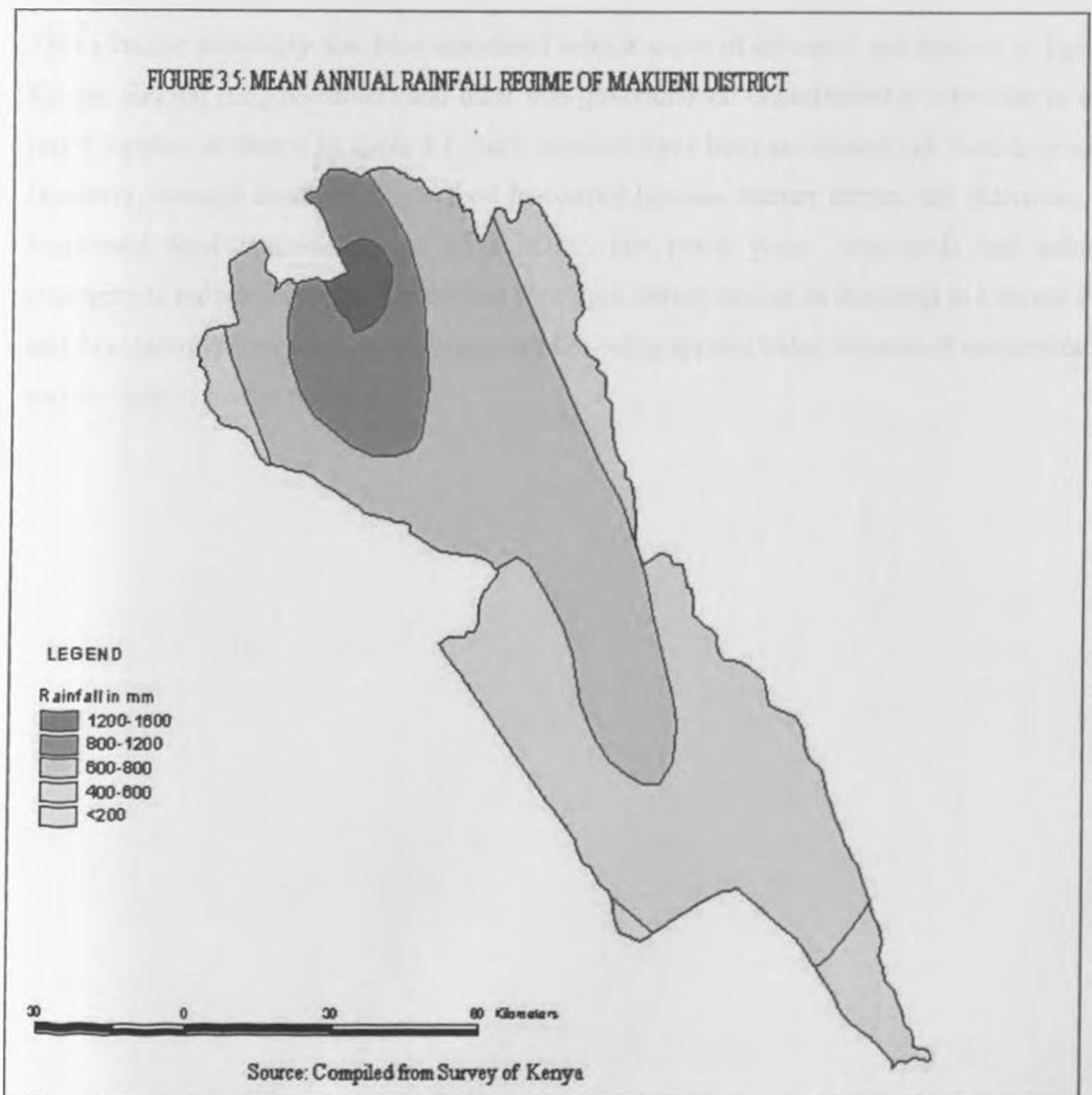
lowlands. It is the lowland areas of the district, which covers a big portion of semi-arid lands. Food insecurity is more pronounced within the lowland areas of Makueni and Kikumbulyu plains compared to the hill masses of Mbooni and Kilungu.

FIGURE 3.4: PHYSIOGRAPHIC UNITS OF MAKUENI DISTRICT



3.2 CLIMATE

The district has a bimodal rainfall pattern namely the March-May long rains and October–December short rains. Rainfall ranges from 800mm–1200mm per year in the upper hill masses to 200mm–900mm per year for the lowland areas characterized by semi-arid conditions as indicated in figure 3.5. The lowlands are more vulnerable to food security problem as the effect of climate change becomes more pronounced. However, with improvement of human factors and institutional intervention, the environmental constraints on food security can be overcome.



Most crop production is undertaken during the crucial October – February short rains season, with most rains falling between October and December. Short rains production accounts for up to 70% of total annual production in Makueni District (FEWS NET 2000). The rainfall is characterized by low total amounts, strongly seasonal distribution and high temporal and spatial variation from year to year and from season to season (Mutiso 1988; Tiffen et al 1994). The erratic and unreliable rainfall not only affects farming and livestock production but also recharging of the ground water and river systems. Variability exhibits itself in the form of complete failure of rains in a given season thus giving rise to a continuous dry spell and subsequent drought (Republic of Kenya 2001).

This climatic variability has been associated with a series of droughts and famines in Eastern Kenya, forcing the government and other non-governmental organization to intervene in food relief supplies as shown in *Table 3.1*. Such droughts have been associated with food insecurity. However, drought does not imply food insecurity because human factors can determine the household food availability and accessibility. For many years, households had adapted strategies to reduce severe impact of food shortages during famine as discussed in Chapter Five and Six. However, some of the strategies are not being applied today because of modernization and changes in human perception.

TABLE 3.1: A CHRONOLOGY OF DROUGHT AND FAMINES IN MAKUENI DISTRICT

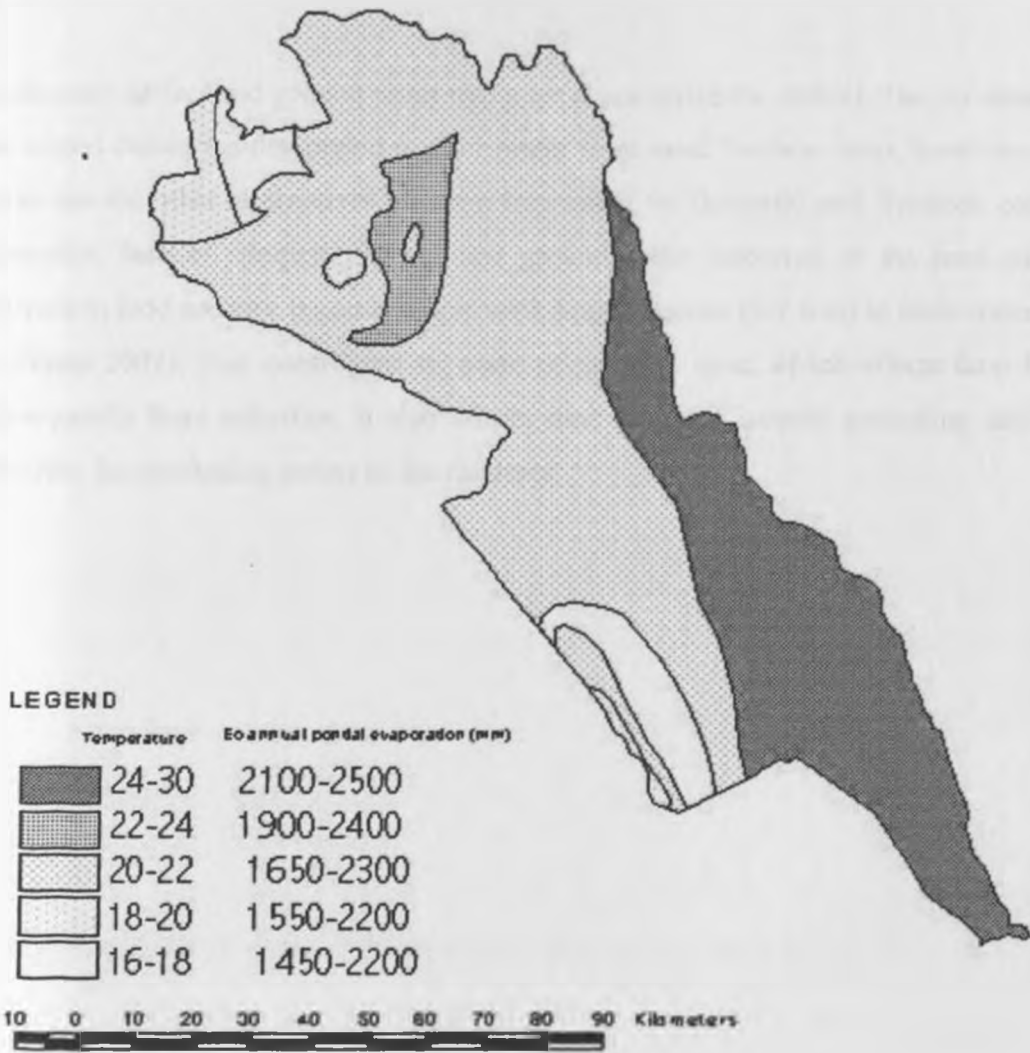
year	nature	name of famine	impact caused	causes of famine	Government intervention
1895-96	Severe	"yua ya ngali" (the carriage railway famine)	Food shortage	Drought, smallpox, war	None
1897-98	moderate	"yua ya mvunga" (food delivered in sacks)	Human deaths	drought	None
1907	moderate		Food shortage	drought	None
1915	moderate	"yua ya malakwe"	Food shortage	drought	None
1928-29	light	"yua ya nzalukangye/kakuti" (looking everywhere to find food)	Food shortages Denudation of grassland livestock death	Drought locust	Appeal for famine relief dismissed by the government
1934	severe	"yua ya ukuku"	Food shortages Livestock death	Drought locusts	Maize and pigeon peas were distributed Cattle tax suspended
1942	moderate	"yua a munyoloka"	Food shortages	Drought, locusts	Maize imports food relief given
1943	moderate	"yuaya mbulunga" (castle seeds sold to buy food)		Drought locusts	Food relief given
1949	moderate	"yua ya makonge" (sisal sold to buy food)	Food shortages	drought	Famine relief given, soil conservation, resettlement
1960-61	severe	"yua ya ndeke" (food dropped by aeroplanes due to floods)	Food shortage Livestock death	Drought followed by floods	Food relief dropped by aeroplanes
1968	moderate	"yua ya ata" (people ate Atta wheat flour)	Food and fodder shortages	drought	Food imported
1973-74	severe	"yua ya longosa" (famine which caused movement and death of cattle)	Fodder shortages High cattle death rate	drought	Government provided food aid Emphasis on planting drought resistant crops Livestock improvement scheme
1980	light	"yua ya katokelele" (famine of yellow maize consumption)	Food shortages	Drought depletion of maize stocks by early exports	MIDP provided food Relief food of yellow maize Emphasis of terracing programs
1984	moderate	"yua ya nikwa ngwete" (famine where people died even though they had money to buy food)	Food shortages	Drought, high food prices	NGO provided food for work programmes Yellow maize was provided
1997-98	light	"yua ya mbua ya El Nino" Food shortage due to El Nino rains	Food shortages followed by bumper harvest Soil erosion Loss of property due to floods	Heavy El Nino Rains	Food relief given

Source : (Compiled from Tiffen, 1994; Owako, 1969; Republic of Kenya, 2000)

The district experiences high temperatures during the day and low temperatures during the night. During the dry season between May and October, extreme heat (27°C) is experienced in the low-lying parts of the district while the high altitude areas experience minimum cool temperatures (11°C). The high temperatures experienced in the low land areas caused high evapo-transpiration and subsequent soil moisture stress that affects crops as shown in figure 3.6. The mean annual potential evaporation (EO) of the district ranges from 1700mm at Kiima Kiu to 2265mm at the lowlands of *Kikumbulyu* plains (Njoroge 1996). The ratio of rainfall to potential evapo-transpiration (R/EO) ranges from 19% to 70% that places the district in various agro-climatic zones (Sombroek et al 1982; Njoroge 1996).

Estimates of the rates of evaporation are an important research component in semi-arid areas of Kenya where crops are likely to suffer seasonal moisture deficit at least in one stage of the growth period. Subsequently, findings from Kenya Agricultural Research Institute (KARI) recommend planting of *Katumani* maize variety, sorghum and millet that are drought resistant and with short maturity period. *Katumani* maize variety was developed to meet the agro-climatic challenges such as shortness of the growing seasons and the frequency of droughts in some parts of Eastern Kenya, which affected crop husbandry. Shortness of season, therefore, calls for a crop that can develop quickly so that, by the rains end, it has completed those developmental stages most sensitive to water stress. High probability of drought calls for the crop that yields well under drought conditions. These factors led to development of *Katumani* Maize Composite. Chapter five has addressed in details the adoption rate of the *Katumani* maize in Makueni District.

FIGURE 3.6: MEAN ANNUAL TEMPERATURE AND EVAPOTRANSPIRATION



Source: Compiled from Survey of Kenya

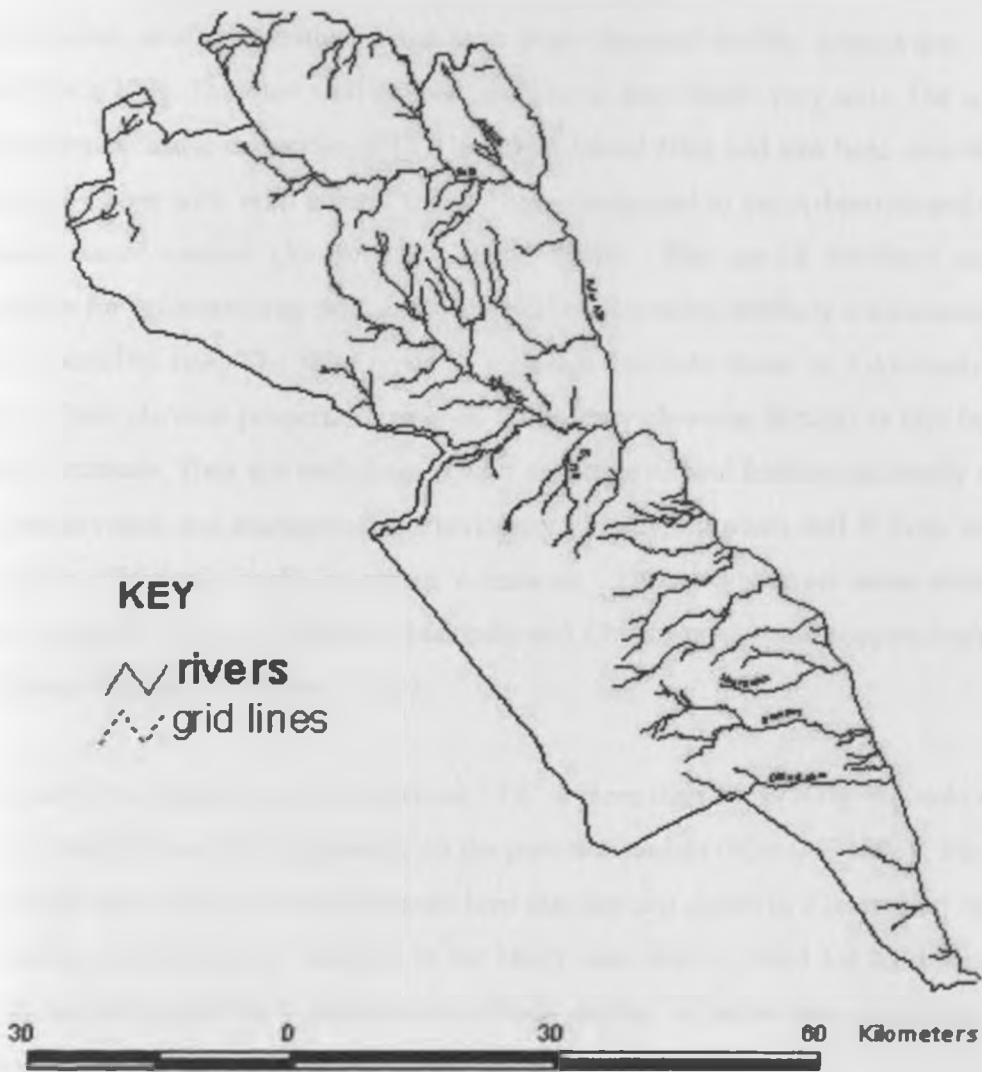
3.3 DRAINAGE AND WATER RESOURCES

The overall drainage pattern is from West to East due to the relief of the district. Most of the streams are intermittent and only flow during the two rainy seasons. There are few permanent rivers in Makueni District as shown in Figure 3.7. Athi River is the major perennial river and drains most of the district. The southern part of the district, which covers the lowland semi-arid

areas, is drained by Kibwezi, Kambu, Kiboko and Mtito Andei all, which are tributaries of Athi River. Some of these tributaries such as Kiboko and Kibwezi have led to development of small – scale irrigation schemes specializing in horticultural crop production (Wambua 1992). These crops are produced for domestic and export market thus earning income to purchase household food.

Inadequate surface and ground water resources characterize the district. The dry seasonal rivers are mined during the dry period to fetch water from sand. Surface dams, boreholes and water tanks are the other alternatives of water harvesting for domestic and livestock consumption. Generally, lack of adequate surface and ground water resources in the semi-arid areas is relevant to food security because people walk long distances (3-7 Km) to fetch water (*Republic of Kenya 2001*). This contributes to waste of valuable time, which affects farm labour and subsequently farm activities. It also affects time spent on income generating activities thus affecting the purchasing power of the residents

FIGURE 3.7: DRAINAGE SYSTEMS AND WATER RESOURCES



Source: Compiled from Survey of Kenya

3.4 SOILS

The nature of the underlying bedrock, climate and relief have played a major role in determining soil distribution, characteristics, fertility and types in Makueni District. The study area has a wide range of different types of soils as indicated in *Figure 3.8*. However, only the major soil types are examined which include Arenosols, found in Mbooni, Kalawa and parts of Kasikeu divisions. These soils are excessively drained, shallow to very deep, loose to friable and with low Cation Exchange Capacity (CEC) of 8.3 to 14Me/100g with characteristics of low

moisture storage capacity per unit volume and low fertility status. Hence, the use of fertilizers and manure is important to improve production. The second types of soils in the study area are ferrasols, found in Kasikeu, Matiliku, Mito Andei, Kaiti and Kisau divisions. These soils are well drained, strongly weathered and have poor chemical fertility content and low CEC less than 16M.e/100g. They are well drained, shallow to deep friable clay soils. The soils have very low cation exchange capacities (CEC) less than 16me/ 100g and low base saturation. They are chemically poor soils with natural fertility being restricted to the A-horizon and related to the organic matter content (*Kenya Soil Survey, 1996*). The use of fertilizers and manure is necessary for optimum crop production and soil conservation methods are necessary because of high erodability rate. The third types of soils are Luvisols found in Kikumbulyu and Kapiti plains. Their physical properties are good while their chemical fertility is low but better than that of Ferrasols. They are well drained with moderate natural fertility and easily eroded hence soil conservation and management is necessary. Lastly, alluvium soil is from volcanic ashes and other pyroclastic rocks or recent volcanoes. These soils cover areas within piedmont plains, volcanic plains of Kibwezi, Makindu and Chyulu ranges and support high agricultural production (*Kenya Soil Survey, 1996*).

Other soil types include cambisols whose CEC is more than 24me/100g, regosols and lithosols whose fertility is variable depending on the parent materials (Njoroge, 1996). However, there are several other soil types not discussed here but they are shown in *Figure 3.8*. In conclusion, to increase productivity of the soils in the study area, there is need for fertilizer and manure application, necessary soil conservation methods and use of proper crop combination. All this requires capital, labour and relevant agricultural information.

FIGURE 3.8: SOILS OF MAKUENI DISTRICT

LEGEND

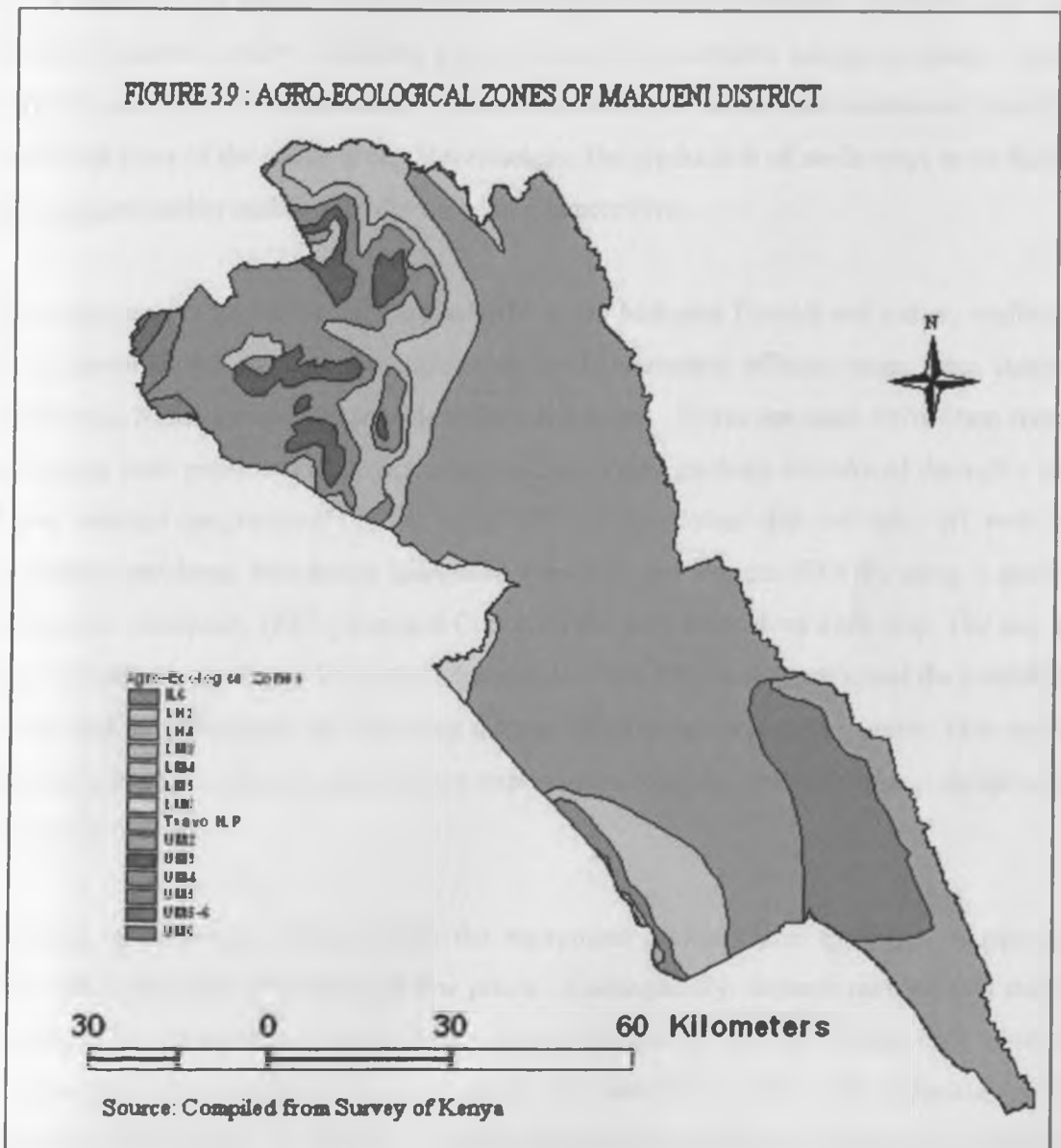
- ACRISOLS
- ANDOSOLS
- ARENOSOLS
- CAMBISOLS
- CHERNOZEMS
- FERRALSOLS
- FLUVISOLS
- GLEYSOLS
- LITHOSOLS
- LIXISOLS
- LIXISSOLS
- LUVISOLS
- NITISOLS
- PLITHOSOLS
- REGOSOLS
- VERTISOLS
- ANDOSOLS+CHERNOZ
- ROCK-OUTCROP
- LAVA
- Not classified



Source: M. J. S. S. S. S.

3.5 AGRICULTURAL POTENTIAL

The district falls under three categories of land potentiality as shown in *Figure 3.9*. The first is the high potential zone II labelled LH2 with favourable ecological conditions, well-distributed seasonal rainfall and better soils that are suitable for food crop production. This zone covers 19.3% of the total district agricultural area that include the hill masses of Mbooni, Chyulu and Kilungu. The main land use activities are coffee, maize, peas and horticultural crops. This zone does not face severe food insecurity compared to the lowland area and is not part of study area.



Secondly, the medium potential zone III labelled LM3, UM3, LM4, and UM4 covers 2.4% of the district's agricultural area. This area comprises the lower hill slopes and areas adjacent to Nziu, Nzau, Ukia, Mbitini, Mukaa, Kaiti and Kilome. Crops grown in this zone are coffee, maize, cotton, beans and citrus fruits among others. The third areas, in terms of agricultural productivity are the lowland potential zone IV and V labelled LM5, LM6 and UM6. This zone falls under the area of study and covers 56.5% of the district's agricultural area, which is classified under semi-arid lands. Areas under this zone are Wote, Makindu, Kathonzweni and Kibwezi divisions. The common crops grown in these low potential areas are Maize and beans in an agro-ecology better suited to more drought-tolerant and faster maturing crop varieties such as Katumani maize, sorghum, pigeon peas, millet, cassava, and green grams. These crop varieties are highly recommended by crop scientists due to low and unreliable rainfall in the semi-arid parts of the study area. Nevertheless, the production of such crops is on the decline as explained earlier and further discussed in Chapter Five.

The main cash crops viable on the lowlands of the Makueni District are cotton, sunflower and horticultural crops. Cotton was introduced by Government officers using semi compulsory methods in Nzau location in the late 1930's but failed. It was not until 1976 when cotton and sunflower were promoted through a credit and extension package introduced through a national donor assisted programme (Tiffen *et al* 1994). Sunflower did not take off well due to marketing problems. Machakos Integrated Development Project (MIDP) using a grant from European Community (EC) promoted Cotton as the only alternative cash crop. The aim was to expand credit to small and large-scale farmers in 1978. MIDP also improved the availability of inputs and the efficiency of marketing through Machakos cooperative union. This move was important because cotton requires heavy expenditure on agro-chemicals, pump equipments and labour for harvest.

However, there were problems with the repayment of loans due to delays in payment of delivered cotton lint in addition to low prices. Consequently, farmers realized that they were producing this crop at a loss hence slowly they abandoned production. Today, only a handful of farmers grow cotton in the study area despite the fact that it is the only industrial cash crop suitable to the climatic conditions of the study area. The only cotton ginnery in Wote town closed down in late 1980's due to lack of cotton produce. Subsequently, households in the

study area have no reliable cash crop to generate income and therefore highly exposed to food insecurity.

Although the Government has been trying to revive collapsed cotton sector, to date, minimal gains have been made. There is need of concerted efforts from public and private sector in reviving cotton industry to take advantage of the market opportunities opened up by the signing of the African Growth and Opportunity Act (AGOA) by the United States. This will go along way in reducing poverty within Makueni District once farmers are convinced that the market for cotton produce will improve.

Households in Makueni District have recently tried to compensate for the falling attraction of cotton by increasing the production of horticultural crops for sale. These crops which includes fruits, local and *Asian* vegetables such as brijals, okra, cucumbers among others are grown in small holding under irrigation condition and serves both commercial and subsistence needs. *Kibwezi* and *Makindu* divisions are the main producing areas using perennial rivers originating from Chyulu hills (Wambua, 1992). However, many households have no access to this water due to distances from the rivers. The few who practice irrigation technology have not benefited adequately due to poor market structure. Since the horticultural sector is mainly handled by the private sector, the marketing chain has attracted many intermediate dealers who exploit the farmers by offering low prices.

Water for irrigation is also becoming a bottleneck due to inadequate and over-exploited ground and surface water resources. Other horticultural crops grown outside irrigation conditions are bananas, mangoes and pawpaw. Banana production has been confined to river valleys and the highlands, where soil moisture conditions are more favourable than the lowlands. However, this study established that farmers are now growing bananas outside the favoured spots because of its cash value and its importance in stabilizing the soils on bench terraces. Although moisture stress is a significant limitation to banana productivity, farmers have resorted to digging deep bench terraces that can trap and hold surface runoff water as means of soil and water conservation. Consequently, household lack better option to counter low yields from food crops due to limited cash crops. Often the food crops serve as cash crops to meet financial needs even though not sufficient for food need.

In addition to farming, households keep livestock as a strategy to counter food crop production deficiencies and crop failure (Kaendi 1999; Nyariki and Musimba 1997; Tiffen 1994). The main livestock reared include the indigenous zebu cattle and goats. A few households keep sheep and rabbits. Livestock products include Meat, hides, milk and manure. These products sometimes are traded with grain or cash. However, marketing remains a bottleneck especially during dry periods. Cattle (oxen) are highly used as drought animals during ploughing. More animals are now being kept in medium to low potential zones where parcels of land are bigger than the high potential areas (*Republic of Kenya 2002-2008*). The number of domestic animals is continuously declining due to diminishing farm sizes and poor pasturage. Bee keeping is also becoming an important occupation in the lowland areas dominated by acacia trees such as *Acacia Commiphora*, *Acacia Tortilis* and *Acacia Combretum*. The honey is harvested and sold in the local markets and to the traditional beer brewers to earn income.

3.5.1 Non- agricultural activities

The district does not possess commercial gemstones. The only lucrative mining activity is sand mining in the seasonal riverbeds. The sand has high demand in the construction industry in Nairobi, Athi River, Machakos and other urban centres. The county councils in the district manage the sand mining with local Sand Cooperative Societies. Households where the rivers traverse have been benefiting from sand sales. Sand mining however is associated with serious environmental degradation that affects ground water resources leading to seasonal rivers.

Brick making for house construction is another income activity especially in Makindu division. Bricks are in high demand due to durability and affordability. There are some limestone deposits, which can be exploited for cement manufacture around Kasikeu division. Due to presence of wildlife around the Chyulu hills, *Tsavo* west and East National parks and Kiboko Game Reserve (which borders the district), the area receives good number of tourists along the Nairobi - Mombasa highway market centres such as Mlito Andei, Mbui Nzau, Kiboko and Kibwezi. Tourism has created employment opportunities as witnessed at Mbui Nzau wood curving industry, Makindu Division. These curios are sold to local and foreign tourists thus enhancing sources of income. Generally, all these activities help in promoting income sources, which is used to finance food accessibility from market.

3.6 HUMAN RESOURCE BASE

In order to understand the human resource base, it is pertinent to highlight the population status of the study area in terms of numbers, densities and dependency ratios. According to the latest population census of 1999, Makueni District has a total population of 771,545 as compared to the previous population census of 1989 when the population was 636,996. The number of females according to the latest census is 398,906 and males are 372,639 (Table 4.2). These figures have implications on household farm labour force. Out of 771,545 people in the district, 353,744 (slightly over 50%) are categorized as economically inactive implying high dependency ratio. Females under this category are 195,476 and males are 158,268 that imply women dominate labour force in the district. About 6,019 males and 23,324 females are in paid employment, while 14,291 males and 16,054 females are in family business (Republic of Kenya 2001). These statistics are important in assessing accessibility to food by households during food shortages. The dependency ratio is quite high thus putting pressure on the income resources. The few people with income feed the majority without income thus increasing rural poverty.

Table 3.2 the population density per division in Makueni District

Division	Area (Km ²)	Males	Females	Total	HH	Density
Tulimani	126	15,354	17,353	32,707	6,301	266
Mbooni	141	26,348	29,635	55,983	10,331	395
Kisau	301.2	23,804	26,706	50,510	9,224	168
Kalawa	330	12,673	13,660	26,333	4,357	80
Kilome	359.4	22319	23885	46204	8631	129
Kilungu	178.3	31556	36185	67741	12740	380
Kaiti	239.8	22052	24055	46107	8529	192
*Kasikeu	2709	17370	18349	35719	6852	132
Mbitini	229.7	23411	25318	48729	8947	212
*Wote	362.7	20092	20,261	40,253	7744	111
Matiliku	240.5	18333	20,534	38867	6893	162
*Kathonzweni	886.7	31397	34,341	65738	10798	75
Nguu	350.3	9529	9722	19251	3345	55
*Makindu	880.2	24917	25382	50299	9907	57
*Kibwezi	944.8	39797	40441	80236	16282	85
Mtito Andei	931.2	33601	33062	66663	13354	72
TOTAL	7966	372639	398906	771545	144320	97

*Divisions sampled for study

Source: *Population Census 1999*

Mbooni, found in AEZ 2 is the most densely populated division with 395 persons per Km² by 1999 compared to 333 persons per Km² in 1987 as shown in table 3.2. This division has high population pressure, which has led to land fragmentation. Most of the farms range from 0.5 hectares to 3 hectares per household. Nguu division, which was recently carved from Makindu division, is the least densely populated area with 55 persons per KM². Nguu division lies within AEZ 4-5 where farms are large, ranging from five ha – 20 ha per household. The high population found in Mbooni and Kilungu divisions is attributed to good, reliable and effective rainfall as well as high potential in soils while low population found in Nguu, Kathonzweni, Makindu and Kibwezi is due to low land potential because of unreliable rainfall and poorly developed soils. Variations in population densities within the divisions also occur because of the influence of the upcoming urban and market centres (*Table 3.3*), which offer various investment and employment opportunities. This urban growth has triggered a seasonal rural-urban migration.

Although the population has grown remarkably over the last ten years, the inter-censal growth rate has declined from 3.4% in 1969 to 2.9% in 1999. The rapid increase of the districts population is partly attributed to immigration of people from neighbouring districts into the 'settlement schemes' located in the district. These newly opened settlement schemes are in Kibwezi, Makindu, Mtito Andei and Nguu divisions (Kibwezi, Kiboko, Nguu, Masongaleni and Mikululo settlement schemes). Majority of the people moving to the lowland areas are from Mbooni, Kilungu, Mukaa, Kasikeu and other parts of the district where land is constrained. The urban population in the district is shown below:

Table 3.3 Urban/Market Population

Urban/Market	Males	Females	TOTAL
*Wote	28,675	29,520	58,195
Mtito Andei	27,237	26,508	53,745
*Makindu	3,108	3,118	6,226
*Sultan Hamud	2,273	2,179	4,454
*Kibwezi	1915	1909	3824
Emali	1929	1720	3649
Kikima	946	925	1871

Source: *Population Census, 1999*

*Urban centres within the survey area

Income levels in Makueni District remain unevenly distributed. For instance, the income of the people living in divisions covering the high potential areas (Kilome and Mbooni divisions) are higher than those of the people living in the low potential divisions of Kibwezi, Kathonzweni, Kasikeu, Makindu and Wote which were the focus of this study. The lower divisions of the district are generally dry and hot and therefore farming activities both agricultural and livestock products are limited. Consequently, the population resource base has an influence on food security in the study area through availability and accessibility of food.

3.7 PHYSICAL INFRASTRUCTURE

The district has a total of 1593 km of both classified and unclassified roads, out of which 271km is of bitumen type, 447.9km is of gravel type and 874.1km is of earth type. The only international trunk road in the district is the Nairobi – Mombasa Road, which covers a length of 220.4 kilometres. All the primary roads in the district are of gravel type and include Emali – Kilala Road, Wote – Kathonzweni – Makindu Road (currently being tarmacked), and Wote – Kaumoni – Masii and Kibwezi – Athi River Kitui. Salama – Nunguni – Kikoko and Machakos – Mukuyuni – Wote are the only tarmacked secondary roads in the district (*Republic of Kenya 2006*).

The majority of road networks within the district are of Class E and above, which consists of both minor and special purpose roads making up to 64% of the districts' total road network.

Due to their poor state, many of these roads are under utilized and during the rainy seasons, they remain impassable due to their muddy conditions and flooding at crossing points. The poor state of these roads hinders transportation of agricultural produce within and outside the district and does in a way contribute to food insecurity. The worst affected divisions are Makindu, Kathonzweni, Mtito Andei, Kibwezi and Kalawa (*Republic of Kenya 2001*).

Construction of new roads is essential in order to open up the yet unconnected and inaccessible area thereby facilitating the smooth transportation of farm inputs and produce to and from the market centres. The high potential areas of Mbooni, Kilome, Kilungu, Tulimani and Kisau have had agricultural development activities being negatively affected by poor road network especially during rainy seasons. Marketing of perishable produce such as horticultural and dairy products require good roads.

3.8 CONCLUDING REMARKS

Environmental and human factors in the study area are directly related to food security. This is clearly seen from climatic and socio-economic patterns that leaves the hilly masses more productive and densely populated compared to the lowland areas, which are characterized by food shortages. The District is not well endowed with natural resources. Cash crop economy is not well established. This leaves the inhabitants with few sources of income that enhance food security problem.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.0 INTRODUCTION

This chapter examines the methodological aspects of the study including data collection methods, as well as the analysis and interpretation of data. The methodology used in this study took into consideration the study problem, objectives of the study, area under investigation, types of data required and their sources, sampling techniques and methods of data analysis. The objectives of the investigation were to examine problems affecting food security at household level and thereafter, postulate possible solutions to improve food security. This is with a view to bringing households in marginal areas into the mainstream national food security development. Such a move will contribute immensely towards stemming down rural household poverty in semi-arid areas of Kenya.

4.1 SAMPLING DESIGN AND SAMPLING TECHNIQUES

The investigation entailed conducting a sample survey in Makueni District where data was collected in order to analyze the study objectives, test hypotheses and provide empirical support for explanations and predictions of research findings. The target population of study for purposes of this research were households located in the semi-arid areas of Makueni District. The sample survey of 200 households was conducted in order to obtain specific certain information on the socio-economic characteristics of households and institutional intervention in household food security. The geographical area for this investigation was not only extensive, but also there was no existing register or sampling frame list of the households. This was because they do not belong to any cooperative society or any other registered organization. These households consisted of the majority peasant farmers in the rural areas and therefore to construct a sampling frame is expensive in terms of finance and time taken. Area cluster sampling therefore proved to be the best technique applicable in this investigation in order to derive a sample of 200 households, which was considered representative of the entire study population. On the other hand, cluster sampling was used because of the following advantages:

- a) The approach make the sampling procedure relatively easier and increases the efficiency of fieldwork, particularly in the case of the personal interviews conducted in this study. It is less costly than simple or stratified random sampling if the cost of obtaining a frame that list all population elements is very high or if the cost of obtaining observations increases as the distance separating the elements increases.
- b) The technique is best applicable in a population that does not have a defined sampling frame or complete lists of elements of a population under investigation. Since households in the study area are not registered under any cooperative society, designing a frame list would have proved too costly and time consuming.
- c) Lastly, the technique permits careful planning of the data collecting process. It makes the field interviewers more efficient since interviewers can do many interviews at each location (Kothari 1990; Bless 1995; Nachmis 1996)

The cluster sampling procedure was applied in the following manner: the first stage-involved division of the area into clusters represented by administrative divisions. The study area has ten divisions that are classified as having 50% semi-arid characteristics. Using the simple random sampling technique, five of these ten divisions were selected as the primary sampling units for the study (see figure 3.2 in chapter one). The process involved writing names of the ten divisions on pieces of paper and putting the same papers in a small box. The researcher shuffled the pieces of papers in the box and selected five of them at random thus giving a good representation of 50% of the study area.

The second stage-involved selection of one location from each division as the secondary sampling unit using simple random method as discussed. Five locations (one in each division) were selected out of twenty locations in the five divisions. The selected locations were Kasikeu in Kasikeu Division; Kikumbulyu in Kibwezi Division; Kathonzweni in Kathonzweni Division; Kambi-mawe in Wote Division and Mbui Nzau in Makindu Division.

The third stage involved selection of one sub-location from each sampled location in the division using simple random sampling method. Five sub-locations from the aforementioned locations were selected out of fifteen sub-locations in the five locations. The selected sub-locations were Kasikeu sub-location in Kasikeu location, Ngandani sub-location in

Kikumbulyu location; Syumile sub-location in Makindu, Kwakavisi sub-location in Kathonzweni location and Kambi mawe sub-location in Wote location (refer to *Appendix 3*).

The fourth stage-involved households in selected sub-locations as the tertiary unit of sampling and a final sample of 200 households was accordingly selected from the total number of 3295 households in the five sub-locations thus forming the representative of the target population in all respects. Each sub-location had 40 households selected as sample units. The process ensured the numbers of households were spread across the sub-location

The process of selecting the households was done using systematic random technique that consists of selecting every k th sampling unit of the population after the first sampling unit is selected at random from the total sampling units. Therefore, a sample of 200 households from a population of 3295 rural households who were involved in cultivation was selected at interval of 16 (i.e. $3295/200 = 16$). The first household was randomly selected as the 5th and the sample then consisted of 5th, 21st, 37th...until the 640th in each sub-location. The process was applied in all the 5 sampled sub-locations to select a total of 200 households. The sub-chiefs' office was arbitrarily chosen as the starting point and thereafter, the researcher proceeded as discussed. This ensured a wide geographical coverage and spatial distribution to achieve good representation. The Head of Household (HHH) who makes day-to-day decisions of farm management was the key respondent during oral interviews. This happened to be either the husband or the wife. In certain cases, the elder son played the role of household head in the absence of the father.

Systematic random sampling technique was used in this study because of the following advantages:

- a) It is an improvement over a simple random sample in as much as the systematic sample is spread more evenly over the entire population.
- b) It is an easier and less costly method of sampling and can be conveniently used in case of large population like the study area (Kothari 1990)
- c) Each sampling unit in the population has a $1/k$ probability of being included in the sample.

However, if there is a hidden periodicity in the population, systematic sampling may be inefficient. Nevertheless, the characteristics of households sampled and the nature of information required in this study, did not qualify for this kind of limitation.

The sample size that represents 6% of the population was purposively selected because of the nature and characteristics of the universe. The universe is homogeneous and therefore a small sample of 200 was considered optimum and served the purpose of the study. Increasing the sample could not make a significant difference because of the similarities in household characteristics and geographical dispersion of the households. According to Bless (1995) one of the major criterion to use when deciding on sample size is the extent to which the sample is distributed in the same way as the population. The other consideration taken on board was the size of the questionnaire that was detailed to capture adequate information on the objectives of the study and the formulated hypotheses.

Random sampling was used because it ensured that the law of statistical regularity which states that if on an average the sample chosen is a random one, the sample will have the same composition and characteristics as the universe (Kothari 1990)

4.2 TYPES AND SOURCES OF DATA

Primary and secondary sources of data were used to gather information for qualitative and quantitative analysis. These sources were also used to generate and corroborate information useful in explanations of the study problem.

4.2.1 Primary sources

Primary data was collected through oral interviews and field observations. Oral interviews were administered through two structured questionnaires. The first questionnaire was purposely designed to collect information on household socio-economic characteristics and the role of institutions on food security problem in the study area. First, the questionnaire was used to collect data on socio-economic characteristics of households namely; the age of the household head, educational level, family size, gender factor in food security, income level, farm size, labour and farm technologies and how they affect food security. Also included were pre-harvest, harvest and post-harvest food losses. Second, the questionnaire was used to collect

information on government and non-government interventions on farm input supply, credit and loan facilities, performance of extension workers, food relief services, water facilities and status of road infrastructure and its implication on food distribution and price stability. Third, the questionnaire was used to gather information on household food security status through farm production and market purchase. Lastly, the questionnaire was used to collect information concerning household food coping strategies used during periods of food shortages.

The second questionnaire was designed to collect information from government officials in the ministry of agriculture, provincial administration and officials from non-governmental organizations. This particular questionnaire was open ended in order to capture data on production statistics, farm technologies applied, climatic conditions, Agro-ecological Zones, extension services among others. Information from this questionnaire enabled comparison between data from the households and other sources.

The household-based questionnaire was designed with questions having fixed wording and sequence of presentation to enable coding for computer analysis. The scheduled structure interviews were used in this research to make sure that any variations between responses could be attributed to the actual differences between the respondents and not to variations in the interviews. The researcher was sensitive to the fact that there was a risk of misinterpreting the wording of questions that may have elicited vast differences in responses. In addition, four research assistants were engaged, trained and briefed on how to carry out the exercise. Field checks were made to ensure that interviewers were neither cheating, nor deviating from instructions given to them for performing their job efficiently. Field and central editing were both done as soon as possible after the interviews to eliminate wrong abbreviations or illegible forms at the time of recording the respondent responses.

Details concerning merits and demerits of administered structured interviews are outlined in Kothari (1990) and Nachmias (1996). In this investigation, the merits considered included flexibility in the questioning process in order to clarify terms that were unclear to the respondents. This was done in order to avoid omitting vital information. In addition, it was pertinent to control the time set for the interview process since the area covered was too vast. It was also necessary to ensure privacy during the oral interviews. Lastly, it was necessary to

overcome misunderstanding and misinterpretation of words or questions bearing in mind most of the rural farmers are either illiterate or semi-illiterate. Nevertheless, the researcher used his own discretion to administer open interviews and note down the main points from groups or individual responses. This format of interviews applied only in cases where issues raised affected the entire area of study. The approach was particularly important in cases where the information could not be quantified e.g. gender role in resource ownership and management for food security. It also applied in getting information on infrastructural facilities.

Direct field observation and measurements were also used to supplement information from oral interviews. Observations concerning soil and water conservation methods, farm preparation, land degradation, intercropping patterns as well as farm size were made. Other aspects incorporated under observation methods were status of storage facilities, post harvest grain management, physical infrastructural facilities, and water facilities among others. According to Kothari (1990), the observation method is allowed as long as it is systematically planned, recorded and related to what are current events. Its main advantage is that subjective bias is eliminated, if observation is done accurately. It is independent of respondents' willingness to respond and as such is relatively less demanding of active cooperation on the part of respondents as happens to the case in the interview method. It should be subjected to checks and controls on validity and reliability. The researcher tried to adhere to these research ethics. The method was used sparingly because information provided by this method is very limited. In addition, unforeseen factors could interfere with the observational tasks. All these were put into consideration.

During the field survey, the researcher used the chiefs' or district officers' community *harazas* for purpose of enlightening households on the objectives and importance of this study. Cooperation from these government officials was made easier through use of research permit from office of the president. The researcher outlined the nature and objectives of the research and assured the farmers that the information provided would be treated as strictly confidential and that they would be contacted later for an interview. Women group organizations referred to as *Mwethya* were used by the researcher to introduce the activities of the study. These approaches helped to clear suspicions from respondents.

Before the actual research commenced, a pilot survey was carried out between March and August 2000 to test the research tools in particular the questionnaire. This pilot survey enabled the researcher to redesign some aspects of the questionnaire to conform to the reality on the ground without changing the research objectives. The period of actual field data collection took place between February 2001 and March 2003. This duration of data collection was prolonged to capture household activities during pre-harvest, harvest and post-harvest management. The process aimed at getting information on household food during good harvest and bad harvest (food shortages). This helped the researcher to assess food management and acquisition during periods of harvest and scarcity.

4.2.2 Secondary Data ✓

Secondary data was collected from a variety of published and unpublished sources. District agricultural offices, Central Bureau of Statistics and Ministry of Agriculture and Livestock Development provided vital information on annual production statistics, hectareage under food and cash crops, statistics on food relief services including the sources, household population, and commodity price fluctuation, and extension services among others. Data from these secondary sources were analyzed alongside the data collected from the primary sources.

Secondary sources also included institutions such as public university libraries, Kenya Agricultural Research Institute (KARI), International Organizations such as Food and Agricultural Organization (FAO), International Centre for Research and Agro-Forestry (ICRAF), International Centre for Insects and Pests Entomology (ICIPE), World Bank and United Nations Environmental Programmes (UNEP). These sources provided information on background issues to food security in general and specifically in Kenya and the study area.

Maps and diagrams were also used to generate secondary data on climatic conditions, water resources, Agro-ecological zones, and infrastructural facilities in the study area. These data were useful in bringing understanding of the study area and how search information relates to food security problem.

4.3 METHODS OF DATA ANALYSIS AND PRESENTATION

4.3.1 Data processing.

Data collected using the questionnaire was edited and cleaned to check errors and omissions in the raw data and correct the same where possible. This data was then edited to ensure the information was accurate, consisted with other facts gathered, well arranged to facilitate coding. After editing, data coding was conducted using the Statistical Package for Social Sciences (SPSS) computer programme to classify responses into meaningful categories for analysis interpretation and presentation. Microsoft word and Microsoft Excel for Windows XP were used in one way or another during data analysis process. Several replies were reduced to a small number of classes that contained critical information required for analysis. The Coding decision was taken during designing stage of the questionnaire. Both qualitative and quantitative methods of data analysis and presentation were applied. Specifically, descriptive and inferential statistics were used. The following analyses were performed.

4.3.2 Descriptive Statistics

The data was subjected to descriptive statistics in order to summarize and organize them in a simplified statistical representation for easy understanding. The descriptive statistics involved frequency distribution tables for coded variables, graphics and charts, percentage distribution, measures of central tendency and dispersion. This basic level of analysis was important in explaining the association between socio-economic factors and food security before proceeding to higher order statistical techniques. The data was further subjected to inferential statistical techniques as noted below.

4.3.3 Bivariate Analysis

The data was further subjected to simple regression analysis using SPSS computer programme to determine the simple relationship between an independent variable (the 'cause'), labelled x , and a dependent variable (the 'effect'), labelled y as shown in table 4.1, using the formula $y = a + bx$. Where; a represents the intercept or constant and b is the slope. This equation implies that if x increases then y increases too, hence it can be used in prediction of y given x values if the relationship is strong. This equation was used to generate linear relationship graphs between x and y or scatter plot diagrams which shows regression line for x and y . The simple

correlation coefficient is represented by r also known as Pearson correlation coefficient (shows strength of relationship between x and y) and explains the relationship and contribution of each socio-economic and institutional factor to food security problem

Consequently, all the major variables under socio-economic and institutional factors were subjected to a simple regression analysis to determine how each variable contributed to food insecurity in the study area. This regression analysis was performed using SPSS computer software and the results are given in chapters five and six. Simple regression was used in this study because it shows the strength of the relationship between single independent variable against the dependent variable. The technique is widely applied in geographical research (Obara 1986).

4.3.4 Multivariate Analysis

Having analysed the variables on bivariate basis, higher level of analysis involving multivariate techniques was done using SPSS programme to establish contribution of all the independent variables selected towards the dependent variable. Multiple regressions are a widely used technique in geographical research because of their power to analyze complex interacting variables. Multivariate techniques are largely empirical and deals with the reality; they possess the ability to analyze data and gives realistic results (Kothari 1990: Nachmias 1996).

One of the basic objective underlying Multivariate techniques is to represent a collection of large data in a simplified way to reflect as much information as possible contained in the raw data obtained. Obara (1983), Ogoti (1989) Mbwesa (1988) and Wambua (1992) have used the technique in the field of Agricultural Geography. Multivariate analysis was conducted using the Step-wise Multiple Regression analysis to determine relationships between the dependent variable or criterion variable (household food security) and the listed independent variables or predictor variables (socio-economic and institutional factors as discussed in Chapter One). As part of the data analysis procedure, the Step-wise Multiple regression was used to test the null hypotheses stated in Chapter Two. Hypothesis one was tested and analyzed in Chapter Five, while hypothesis two was tested and analyzed in Chapter Six. *Table 4.1* show operational definitions of the specific dependent and independent variables used for analysis in this

research. Geographical research involves multiple factors and therefore, multivariate analysis was the most relevant technique in this analysis

Table 4.1 Operational definition of analyzed variables

<u>Dependent Variable</u>	<u>Measurement</u>
Household food security	Food produced from the farm as well as all other foods coming into the household (purchased, relief, donations). Food insecure applies to the consumption of less than 90kg of Cereals and 45kg of pulses per month for an average family of 6 members excluding other food stuff.
<u>Independent Variable</u>	<u>Measurement</u>
- Age	-Number of years
- Gender	-Food security management between female headed households and male headed households.
- Household size	- Number of family members
- Educational level	- Academic level - no. of years in school
- Household income	- Monthly income in Kenya shillings from on-farm and off-farm activities.
- Traditional crop production	- Yields per season in kgs.
- Farm labour	- Cost of hire in Kenya shillings per month
- Farm size	- Number of hectares
- Farm inputs (seeds, fertilizers, agro-chemicals)	- Cost of purchase per season in Kenya shillings
- Food relief services.	- Quantity given in kgs
- Credit facilities	- Amount given in Kenya shillings
- Post-harvest grain management	- Percentage of grain wasted because of being unfit for human consumption
- Extension services	- Frequency of visit per year
- Road infrastructure	- status of the road networks in food transportation and distribution

Food security is a phenomenon which is difficult to measure especially where subsistence production is harvested piece meal and is neither measured nor recorded. However, the method used in this study to determine status of food security was estimating gross household production and purchases over a period of one season based on monthly count. The process

involved determining food in and food out balance. This study assumed that the food that had come into the households' possession through social safety nets, donations and relief programs among others was part of household food stock to supplement farm production and market purchase. For a relatively food secure household, the consumption was put at 90kg of cereals and 45kg of pulses per month for an average household of six members, who formed majority in the sample interviewed. The average market value of 90kg of maize in the study area is Ksh. 1500 while that of 45kg of beans is Ksh. 2250. In addition, families spend approximately Ksh. 100 per day (i.e. 3000 per month) on items like vegetables, cooking oil, flour milling, salt, sugar and milk. On average a family of six members is expected to spend a minimum of Ksh. 6000 on food only. This amount does not include expenses on beef, rice, milk and other food stuff which are regarded as luxury depending on the purchasing power of different households.

FAO uses nutritional requirement, which is 2250 calories per adult person per day. In monetary terms, this has been calculated as the equivalent of Ksh 927 per adult person per month in rural areas (FAO 2004). This implies that a family of six members is required to spend Ksh. 927 multiplied by six = Ksh. 5562 per month on food. Subsequently, households of members spending less than this amount were considered food insecure. However, FAO'S figures have been overtaken by inflation and therefore the amount suggested is now little to sustain food security.

Apart from measuring correlation between dependent variable and independent variables as indicated above, the Step-wise Multiple Regression showed significance of the independent variables on the dependent variable. The Stepwise Multiple Regression equation used is outlined as follows:

$$Y = a_0 + b_1x_1 + b_2x_2 + b_3x_3 + \dots + b_kx_k + e_1 \quad \text{Equation 1}$$

Where Y = dependent variable (household food security)

$x_1x_2x_3 \dots x_k$ = Independent variables (Education level, age, income per month, farm size, percentage of food losses, frequency of visit by extension officers, access to credit facilities, cost of labour, access to farm inputs mainly seeds, fertilizers and agro-chemicals).

a = Intercept value (The average value of Y when each independent variable equals zero)

$b_1 b_2 b_3 \dots B_k =$ Partial regression coefficients (Slope of the regression line)

$e_i =$ Error term (residuals)

Stepwise multiple regression was preferred in this study because of the following advantages.

- i) It offers a full explanation of the dependent variable since few phenomena are products of a single cause. Household food availability and accessibility cannot be attributed to one factor but several factors. The model is a useful means of finding structural relations and will provide explanation seemingly complex as multivariate relationship between socio-economic factors and household food insecurity.
- ii) Stepwise multiple regression analysis has a means of controlling other confounding factors in order to evaluate the contribution of a specific independent or a set of independent variable influencing household food security. One would be able to know the most significant factors because the procedure yields the best selection from a set of variables entered into the programme.

The multiple correlation coefficients R_1 used to index the strength of the relationship whether positive or negative between a dependent variable and a set of independent variable (Household food security and the effect of socio-economic and institutional factors). R was computed using Karl Pearson correlation coefficient. A small R in value means a poor correlation while large R in value shows good correlation. If the computed R is greater than R critical, then the correlation was significant. When R is squared, it changes to coefficient of multiple determinations (R^2), which indicates the proportion of the variance in the dependent variable accounted for by the regression model when the effects of all other variables are controlled. R^2 is an index of goodness of fit of the regression line or of the degree of perfection of the relationship. The coefficient measures the amount of variation in household food security statistically explained.

F – Statistic test was used to select the most important variables to be incorporated in a regression equation as well as testing the research hypotheses. Each of the hypotheses was tested to confirm whether observed differences are actually due to chance or whether they are really significant. This study utilized a 0.01 significant level as the lowest cut off point for

variables entered in the equation. This significance level was determined in advance before testing the hypotheses. Cases where F computed was greater than the critical F in the table, the hypothesis was rejected. If F is significant, it means that the regression line account for a significant amount of variation. SPSS computer programme was used to run stepwise multiple regression analysis and perform the following statistical analysis, which were of importance to the analysis of data for this study.

- a. Analysis of variance (A NOVA)
- b. Standard error of regression equation
- c. Standardization of unstandardized data into beta weights to facilitate direct comparison
- d. Residuals
- e. Correlation coefficients (R) and coefficient of multiple determination (R^2)
- f. F – Statistical test
- g. Regression coefficients

Transformation of data into Beta weights changed the equation to assume.

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 \dots \dots \dots \beta_kx_k \quad E_i \qquad \text{Equation 2}$$

Details of this equation are explained under equation 1. Beta weights indicate how much change in the dependent variable is produced by a standardized change in one of the independent variables when others are controlled (Nie, 1975; Johnstone, 1980; and Shaw, 1983). To ensure that multicollinearity does not exist in the explanatory variables affecting food insecurity in the semi-arid areas of Makueni District, the data was further subjected to Principal Component Analysis, which is a component of Factor Analysis.

4.3.5 Principal Component Analysis

Principle Component Analysis (PCA), which is one of the Factor analyses, was used in this study as a means of investigating the possibility that a large number of variables have a small number of components in common that give rise to inter-correlations existing within these variables. The primary purpose of Component Analysis is to reduce the original set of data or variables to a smaller possible collection of independent variables (components) without any

significant loss of information. A computer programme was used to perform principle component model values such as:

(a) Communalities

Communalities refer to the proportion of the variance of a variable explained by the common components (i.e. that which is shared with other variable). It shows how much of each variable is accounted for by the underlying factor taken together. A high value of communality means that not much of the variable is left over after whatever the factors represent is taken into consideration (Kothari 1990).

(b) Component loading

Is the square of correlation coefficients that indicates the proportion of variation in the variables that is associated with the variation in the component.

(c) Eigen values

Refers to the sum of the squared component loadings used to determine the proportion of total variation summarized by the component in question. It indicates the relative importance of each factor in accounting for the particular set of variables being analysed.

(d) Component scores

Component scores show the highest scores for a particular observation unit on a component. This is indicated by those units that are highest in association with that particular component, whereas the lowest scores indicate the opposite.

(e) Varimax rotation

The purpose of this rotation is to place the component axes in a unique position such that the component can be interpreted by a large loading as possible relating to the fewest variables possible.

(f) Scree plot

Plot of the total variance associated with each component. The plot shows a distinct break between the steep slope of the large components and the gradual trailing of the rest of the

components. This gradual trailing off is called the scree because it resembles the rubble that forms at the foot of a mountain.

The Principle Component Analysis model was applicable to this study because of the following advantages:

- a) It is used in solving the problem of large data and collinearity. The technique can reveal amongst the independent variables, the factors that are dependent on each other and those that are independent. Therefore, the model largely rules out all information that is of little significance for the differentiation of units, whereas it reinforces the significance of information differentiating the studied materials.
- b) The Principal Component Analysis seeks to maximize the sum of squared loadings of each factor component extracted in turn.
- c) The technique explains more variance than would the loadings obtained from any other method of factoring.
- d) The principal components are uncorrelated (orthogonal). The first principal component has the maximum variance; the second principal component has the next maximum variance and so on.

However, the method has a number of limitations including the following:

- a) Principal Component Analysis, like all multivariate techniques, involves laborious computation involving heavy cost burden. However, with the aid of computer technology, the Principal Component Analysis has become relatively faster and easier although still very expensive to administer.
- b) Determining component levels is still unclear and relies on researchers' interpretation. Despite all the said limitations, when it works well, principal component analysis helps the investigator make sense of large bodies of intertwined data.

4.4 RESEARCH LIMITATIONS

This investigation was confronted by certain limitations particularly during the field survey data collection. For instance, data on income was not easily accessible because of lack of proper record keeping from off-farm and on-farm sources of income. Furthermore, the majority of respondents were unable or unwilling to recall the details of monthly incomes received and

transactions undertaken. Such a situation was experienced in households where the family members were pursuing both collective and individual income generating activities based on non-formal employment or regular business. The household head was rarely able to speak on behalf of many individuals within the family and their private patterns of income and spending. However, time and effort were spent in studying pattern of expenditure from the respondents in order to relate the same with income levels. In cases where figures were suspected to have been inflated or deflated, average monthly expenditure were computed to derive monthly estimate income for purposes of data analysis.

Secondly, collecting data from households managed by women on their own or on behalf of their husbands working in urban areas or elsewhere posed a great challenge. The women expressed fears of disclosing family matters without permission from either their husbands or elder sons. This highlighted of the gender imbalance in resource mobilization and management. However, the researcher devoted adequate time to assure the respondents that their views were confidential and not for public domain. Similarly, other respondents were reluctant to be interviewed because they complained that researchers collect information and disappear never to be seen again after eliciting information. They argued that the results do not trickle back to them for action. Nevertheless, efforts were made to explain the objective of the study and how their participation can help in solving the problem of food insecurity. In some cases, sub chiefs' barazas and women group organizations were used as forums to explain the purpose of the research to the respondent. This approach eased the suspiciousness between the researcher and the respondent.

Thirdly, some of the sampled heads of household had low education level hence could not recall their farm production and consumption quantities. They argued that keeping records on food production and consumption is tedious and does not help them in solving the problem of food shortage. To solve this problem, the researcher had to re-construct some of the production and consumption data from estimates and averages given by the respondents. These estimates were further corroborated with secondary data acquired from district agricultural offices and Central Bureau of Statistics (CBS). In some cases, the researcher had to get some of the information from observation methods such as farm size, farm fragmentation, and status of storage facilities and post harvest grain handling.

Finally, movement in the study area was not easy due to lack of rural access roads in some of the villages. The area covered is vast and required time to reach all the households scheduled for interviews. Subsequently, many a time the researcher had to miss or postpone appointments for interviews with household respondents. The problem was managed by using bicycle services popularly known as "*boda boda*" to reach some of the households. This extra effort was made to ensure fair distribution of the sampled households.

4.5 CONCLUDING REMARKS

The methodology discussed in this chapter shows the importance of using descriptive and inferential statistics in this study. Multivariate Regression Analysis and Principal Component Analysis were used to support or reject the hypotheses formulated in Chapter Two of this study. Such techniques are suitable in geographical analysis, which comprises of complex spatial data. The next two chapters are largely based on qualitative and quantitative analysis of the field survey data and secondary data.

CHAPTER FIVE

ANALYSIS OF THE IMPACT OF SOCIO-ECONOMIC FACTORS ON FOOD SECURITY IN SEMI-ARID AREAS OF MAKUENI DISTRICT

5.0 INTRODUCTION

This chapter examines the status of food security in semi arid areas of Makueni District. Spatial and temporal variations of the main food crops production from 1992 to 2001 is highlighted as indicators of food security status in the district. The situation of household food security for the sampled divisions is also presented. Finally, the chapter presents a detailed analysis of the impacts of socio-economic factors on household food security in the study area using both qualitative and quantitative methods. The presentation starts with qualitative approach and Simple regression statistical analysis of the field survey data. Thereafter, Stepwise Multiple Regression Analysis was applied to analyse data and test the null hypothesis.

5.1 STATUS OF FOOD SECURITY IN MAKUENI DISTRICT

The first objective one of this investigation study was to address the status of food security in the study area. This objective was achieved by examining farm production data obtained mainly from secondary sources for a period of ten years ranging from 1992-2001. This information was supplemented with household primary data on food availability and accessibility collected during the field survey. The year 1992 was preferred because that is when the district under study was curved from the former Machakos district.

5.1.1: Seasonal trends in food crop production

The patterns of food production in Makueni District are characterized by considerable seasonal fluctuations, which contribute to unstable levels of food availability in some of the households in the semi arid parts of the district. The instability in food production results into widespread food shortages only for the households relying on cultivation only. The areas highly affected are agro-ecological zones IV and V of the study area. The popular view given by farmers concerning the cause of food shortages was poor weather conditions. However, the study findings established that some households realized adequate yields than others under the same

ecological conditions. This variation could only be explained by differences in socio-economic and institutional factors such as farm management skills, inputs applied, technologies used, farm size and status of physical infrastructural facilities in the study area as discussed in this chapter and chapter six.

(a) Maize production

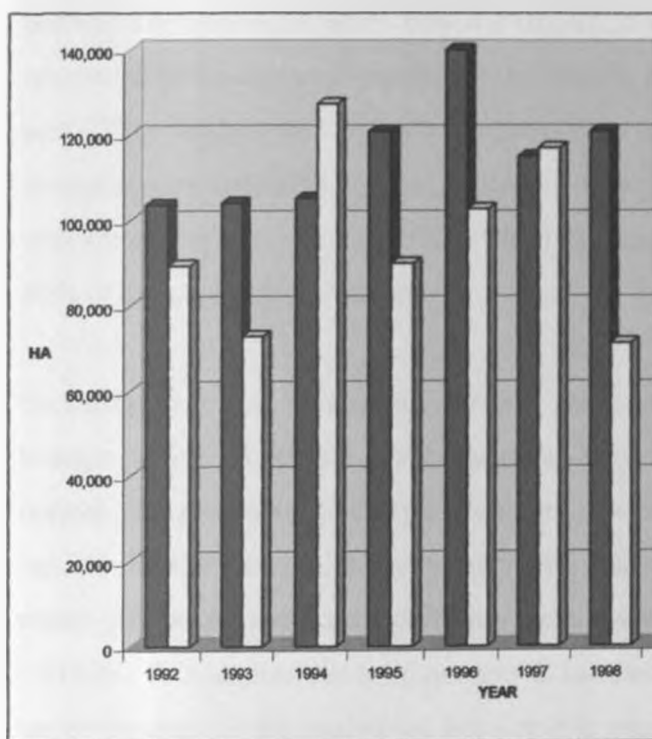
Maize is the most popular crop among the farming households. Seasonal production of maize shows significant fluctuation as indicated in *Table 5.1, Figures 5.1a and 5.1b* respectively.

Table 5.1 Maize production in tonnes ('000) and hectares in 1992 - 2001 in Makueni District.

Year	Target ha	Achieved ha	Target tons (demand)	Achieved tons (Supply).
1992	103,680	89,446	129,600	53,667
1993	104,150	72,905	145,810	80,196
1994	105,300	147,350	147,420	81,042
1995	120,900	13,700	175,305	80,000
1996	140,000	102,700	140,000	26,000
1997	115,000	117,000	103,500	69,975
1998	121,000	71,250	120,000	176,000
1999	130,000	60,000	130,000	85,000
2000	122,000	25,000	115,000	50,000
2001	130,000	75,000	140,000	92,000

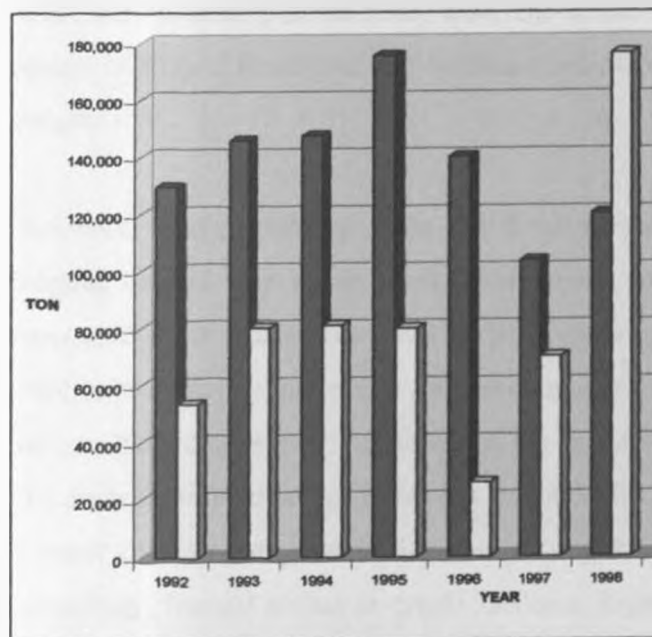
Source: Makueni District Agricultural Office, Annual Reports

Fig 5.1a: Hectares under maize in 1992-2001



Source: Makueni District Agricultural Office, Annual

Fig 5.1b Maize production in tonnes in 1992-2001



Source: Makueni District Agricultural Office, Annual

The Tables just presented show the projected maize production (demand) against actual yields (supply) for 10 years running. The figures shown include both long and short rain seasons because the area experiences bimodal rainfall. It is clear from the figures that maize yield has not matched the expected production to feed the rapid growing population (2.9%) in the study area. This implies that households have been unable to meet food security through farm production as indicated by the difference between expected yield (demand) and the actual yields (supply) especially in 1992, 1996, 1997, and 2000 when actual production was far below 50% of the expected production.

Similarly, the figures show that hectares under maize have been fluctuating downwards. The average maize production per hectare has been 0.5 tonnes as opposed to 1.4 tonnes under normal circumstances. Subsequently, there is a huge food deficit that requires other sources outside farm production. Bivariate statistical analysis on data collected from households shows maize production and accessibility has positive correlation with food security as indicated by $r = 0.486$. This implies that food security is increased by increasing maize yields and household maize purchase in the study area because it is regarded as the popular foodstuff. Similarly, the field survey data indicates that hectares under maize production influenced food security. It shows that as farm size under maize increases, food security problem is reduced because maize is the dominant crop in the study area. The details of statistical output are shown in correlation matrix table 6.12 in chapter six. Variables indicated in the matrix are explained in table 5.21 in chapter five.

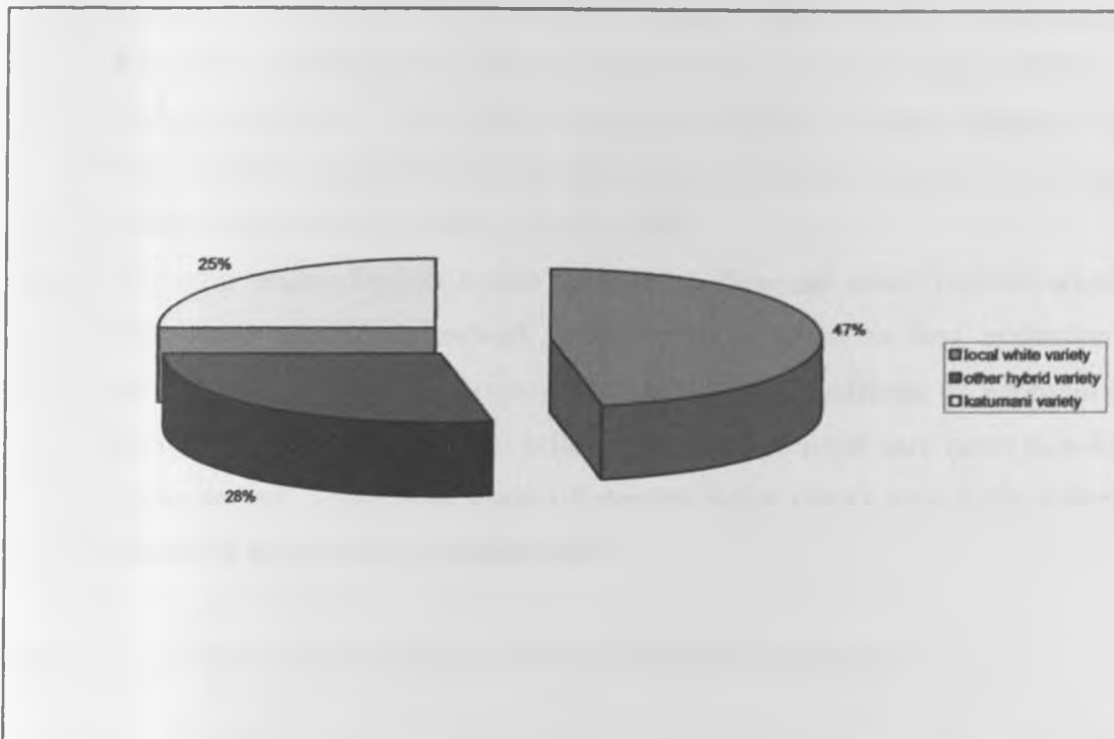
However, results gathered from the field shows that socio-economic factors have played integral role in low maize production among other crops. It was noted that even during successful rainy season like 1998 El Nino episode, some households who harvested sufficient yield immediately experienced food shortages because of post-harvest losses. This challenges the assertion that rainfall variability is the major cause of food insecurity in semi-arid areas. The analysis of field survey data also indicated that low maize production in the study area was a result of decreasing farm size due to population growth, inadequate use of appropriate technology, limited access to credit facilities, high cost of farm inputs and poor institutional intervention which have been counter productive as discussed in Chapter Five and Six.

Efforts to improve maize production in the semi-arid lowlands of Makueni District were made through the introduction of *Katamani* composite variety in 1966. Kenya Agricultural Research Institute at Katamani Dry land Research Station in Machakos developed this variety. The idea was to come up with maize variety with drought resistant and drought evading characteristics. Drought resistant implies the crop can resume growth without permanent injury during dry spells while drought evading requires rapid development to maturity period so that, by the time the rains end, it has completed those development stages most sensitive to water stress.

The *Katamani* maize variety has these characteristics and it matures within 90 to 120 days before the available soil moisture is used up or evaporated. This counters the shortness of the growing seasons and frequency of dry spells. The technology was introduced to deal with climatic constraints but the adoption has not been very successful due to diverse human factors and poor extension advisory services. By 1975, it was estimated that only 44% of the maize area was planted with *Katamani* maize varieties (Tiffen 1994). This percentage increased in 1983 – 1984 to 71% in the lowlands of Wote and Kathonzwi divisions (Mohammed *et al* 1985).

However, by the time when this research was being carried out (2001 - 2003), the percentage of area devoted to *Katamani* maize compared to other maize varieties had dropped to approximately 25% among the small holder farming households at Kasikeu, Kibwezi, Wote, Makindu and Kathonzwi divisions. This contributes to one of the factors leading to spatial and temporal variations in maize yields in the study area. Bivariate statistical analysis on field survey data shows that hectares under *Katamani* maize variety had positive correlation with food security ($r = 0.590$). This implies that greater use of *Katamani* maize variety could contribute to more food especially when rains are uncertain hence reduction in food insecurity. When rated among the other maize varieties, the percentage of households planting *Katamani* maize was low as shown in *Figure 5.2*.

Fig 5.2: percentage of different maize varieties grown by households



Source: Field Survey data 2001 – 2006

The chart just presented shows that over 75% of the household are currently not growing *Katumani* maize in spite of its suitability in such marginal environments. Households prefer growing the local white maize that they are used to but whose performance is vulnerable to weather vagaries. *Katumani* maize is slowly being replaced by other varieties such as Pioneer and Panar whose suitability favours medium potential areas and not low potential areas. Subsequently, this has been attributed to low yields especially when rains are not favourable because of planting varieties not recommended for low potential areas. Reasons given by the households interviewed concerning low adoption rate for *Katumani* varieties were as follows:

- (i) About 30% of the households argued that the cobs and grains for *Katumani* variety were smaller than local white maize. They also complained that the maize stalk is short and subsequently, the cobs are much lower down, where they are vulnerable to destruction by rabbits, rats, antelopes and other vermin.
- (ii) Some of the households (20%) indicated that the grain does not keep for long without rotting and weevils easily attack it during post – harvest storage.

- (iii) Majority of the household (50%) complained that the certified *Katumani* seeds are too expensive for most of the small-scale farmers. The price for the 2kg packet was Ksh.300 – Ksh.400 in the agro-chemical shops. One requires approximately 6kg per hectare (Ksh.900 – Ksh.1200) which is too expensive for the ordinary households. Subsequently, many of the households resorted to using the end off-season seeds whose yields are low compared to the certified seeds.
- (iv) The other reason for incomplete adoption of *Katumani* maize varieties according to field survey data is household ambivalence, rooted in on-farm evaluation of the performance of local and improved varieties under conditions of uncertain rainfall. Between 35-50% of households believed that, local varieties were better than *Katumani* maize variety. Those who planted *Katumani* maize variety gave early maturity as a reason for adoption but not high yields.

(b) Lesson learnt from the failure of *Katumani* maize technology

When the foregoing reasons given by households for not growing *Katumani* maize variety are corroborated, it emerged that most of them lacked scientific merit. However, some of the reasons given make sense from socio- economic point of view. For instant, grain attack by weevil has more to do with poor preservation methods applied in post – harvest management. If households cannot afford the right agro – chemicals for preservation as in the case of the study area, the grain is likely to suffer grain waste. The issue of seed cost being high was valid based on the low purchasing power for most of the small scale farming households in the study area.

Despite the suitability of *Katumani* maize variety in the marginal area of Makeni District, many households due to socio- economic factors have not accepted it. Subsequently, the adoption of *Katumani* maize variety is incomplete and this paves way to high chances of crop failure, as households continue using maize seed varieties not suitable to the marginal areas. This problem is more of perception as shown by field results, which indicate that negative attitude towards planting *Katumani* maize, contributes high chances of food insecurity. The effect has increased food security problem at household level. If *Katumani* maize was highly adopted and sustained over long period, the production trends already shown from 1992-2002

would be different because of maximizing yields under the constraint of a variable semi-arid rainfall regime.

(c) Pulses

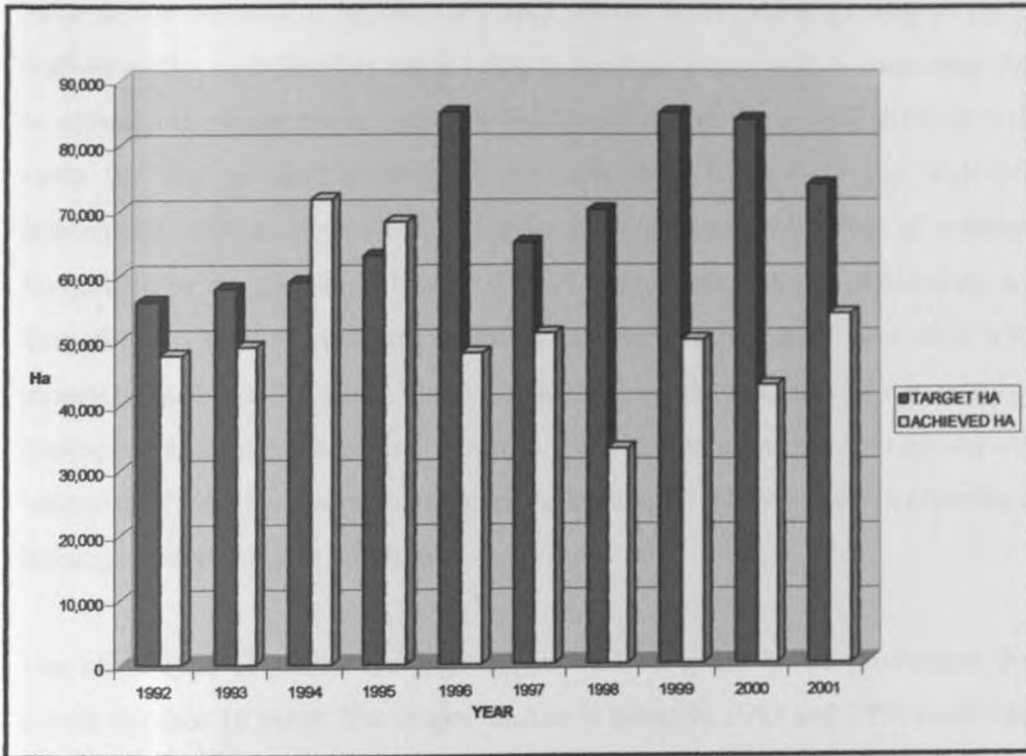
The second common food crops in the study area are pulses including mainly beans, pigeon peas and cowpeas. These pulses are important because they are mixed with maize to prepare a popular meal that the Akamba call *Muthokoi*. Bivariate Statistical Analysis of field survey shows that beans production has positive relationship with food security as shown by $r = 0.634$ and correlation matrix 6.12. This implies that increasing beans production or accessibility leads to improved food security due to its popularity among households. However, beans production just as maize has also plummeted as shown below. Beans production has declined by 20% on average for the last 10 years while the hectareage under the same crop dropped by 25%. The year 1994 experienced improvement in beans production with 43,032 tonnes. However, these gains were lost in the subsequent years as shown in *Table 5.2, Figures 5.3a and 5.3b* respectively. The year 1997 was the worst as production went down to 12,116 tonnes compared to expected production of 30,150 tonnes (50% declines).

Table 5.2 Beans production in tonnes ('000) and hectares between 1992 – 2001

Year	Target ha	Achieved ha	Target tons	Achieved tons
1992	56,000	47,700	25,200	21,465
1993	58,000	49,000	29,000	27,115
1994	59,000	71,720	35,000	43,032
1995	63,000	68,200	37,800	27,800
1996	85,000	48,000	63,000	50,000
1997	65,000	51,000	30,150	12,116
1998	70,500	33,200	70,000	55,530
1999	85,000	50,000	50,000	20,000
2000	84,000	43,000	40,500	22,800
2001	74,000	54,000	50,000	30,870

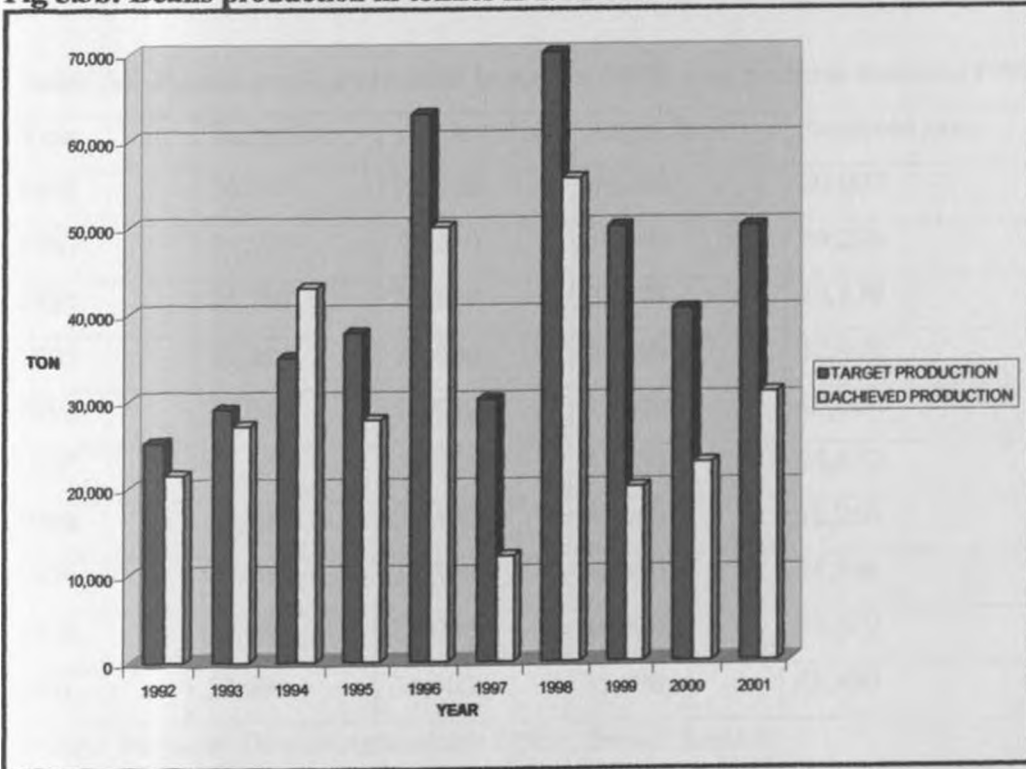
Source: Makueni District Agriculture office, Annual Reports

Fig 5.3a: Hectares under beans in 1992-2001



Source: Makueni District Agricultural Office, Annual Reports

Fig 5.3b: Beans production in tonnes in 1992-2001



Source: Makueni District Agricultural Office, Annual Reports

One of the major contributing factors to low production is lack of seeds during planting season. Most of the households deplete their seed reserve before the beginning of the planting season. Subsequently, such families are not able to purchase other seeds because they are too expensive to afford. One kilogram of ordinary bean seeds ranges between Ksh.60 to Ksh.100 while the same for the certified seeds goes for more than Ksh.200. These high prices left many households with no choice but to forego planting beans regardless of whether the season is favourable or not and hence low produce. The production is also affected by scarcity of seeds. Sometimes it becomes difficult to access bean seeds in the study area even when a farmer has money to purchase the same. This is caused by high demand against low supply. Consequently, production has been fluctuating based on these human related factors among others and hence, bean availability has become a precarious basis upon which to feed a growing population thus leading to food security problem.

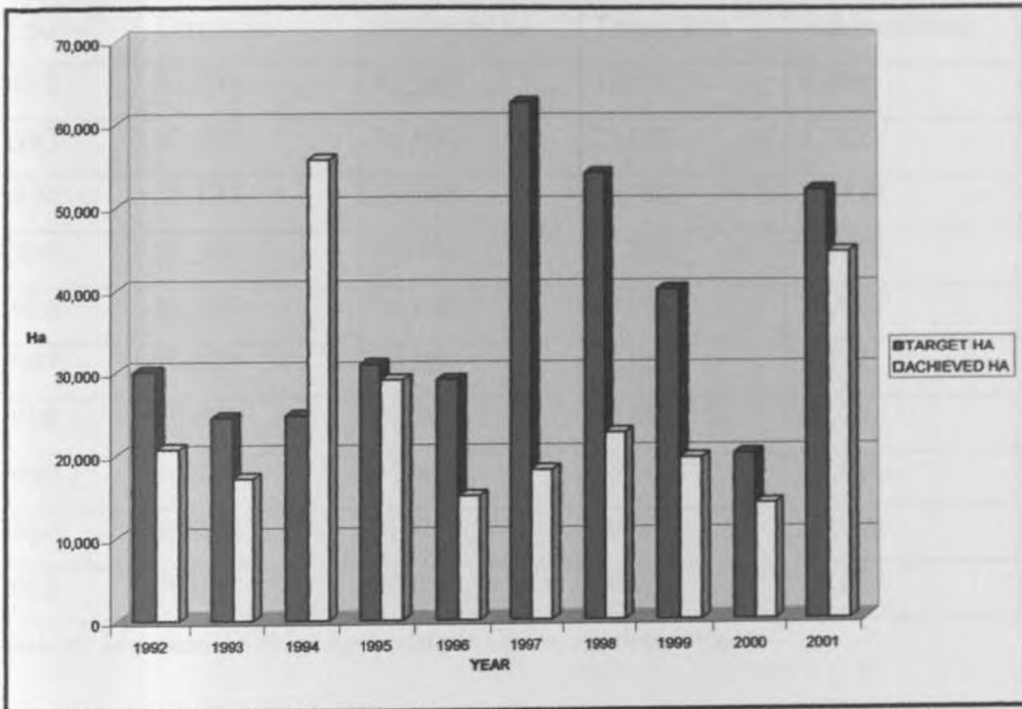
The other type of pulses are pigeon peas and cowpeas whose production dropped by 19% during the last 10 years. The major decline is noted in 1993 and 1995 as shown in *Tables 5.3* and *Table 5.4*. (See also *Figures 5.4a, 5.4b, 5.5a* and *5.5b* respectively. These figures show hectares and the production statistics for the mentioned crops.

Table 5.3 Pigeon peas production in tonnes ('000) and hectares between 1992 – 2001

Year	Target ha	Achieved ha	Target tons	Achieved tons
1992	30,000	20,700	40,000	20,000
1993	24,500	17,150	19,600	10,290
1994	24,750	55,660	22,275	36,179
1995	30,900	29,000	40,500	12,400
1996	29,000	15,000	32,000	10,000
1997	62,500	18,090	43,250	25,452
1998	54,000	22,570	50,000	16,250
1999	40,000	19,500	30,000	21,888
2000	20,000	14,000	40,000	20,500
2001	52,000	44,500	35,000	41,480

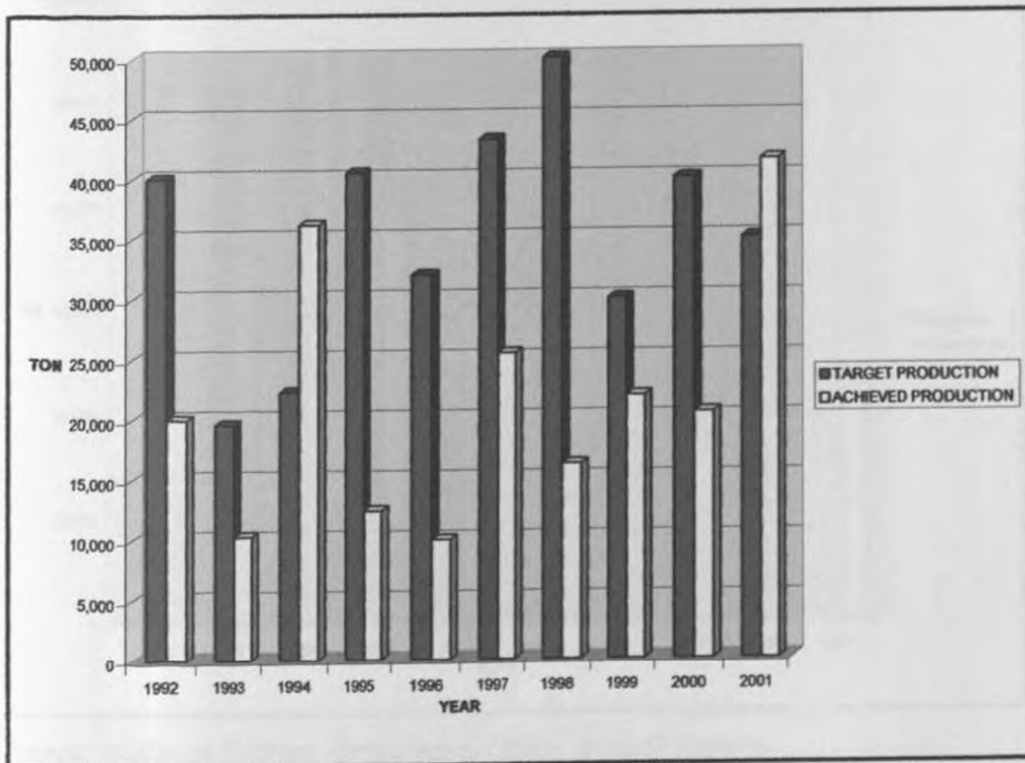
Source: Makueni District Agriculture Office, Annual Reports

Fig 5.4a: Hectares under pigeon peas in 1992-2001



Source: District Agricultural Office

Figure 5.4b Pigeon peas production in tonnes in 1992-2001



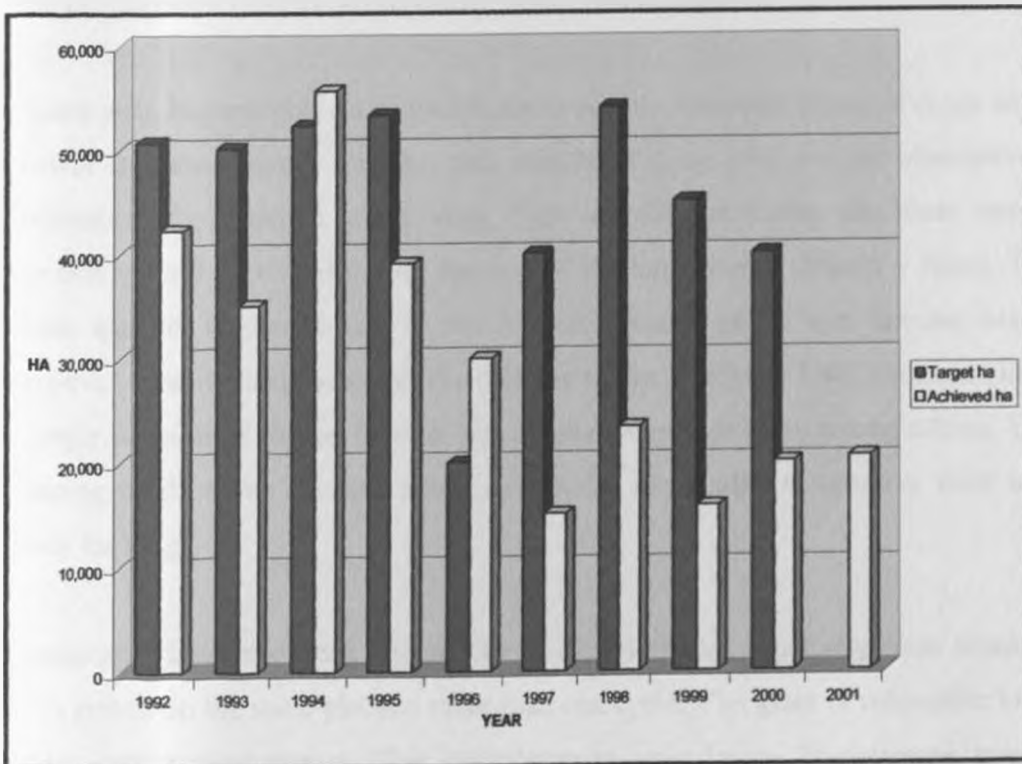
Source: Makueni District Agricultural Office, Annual Reports

Table 5.4: cowpeas production in tonnes ('000) and hectares 1992-2001

Year	Target ha	Achieved ha	Target tons	Achieved tons
1992	50,700	42,280	22,531	9,026
1993	50,120	35,084	25,060	7,542
1994	50,100	55,660	25,000	36,179
1995	52,300	39,100	32,000	12,750
1996	53,000	30,000	30,000	20,000
1997	20,000	15,080	12,600	7,777
1998	40,000	23,400	25,000	8,100
1999	54,000	15,800	35,000	18,818
2000	45,000	20,000	40,000	23,000
2001	40,000	20,500	30,000	12,663

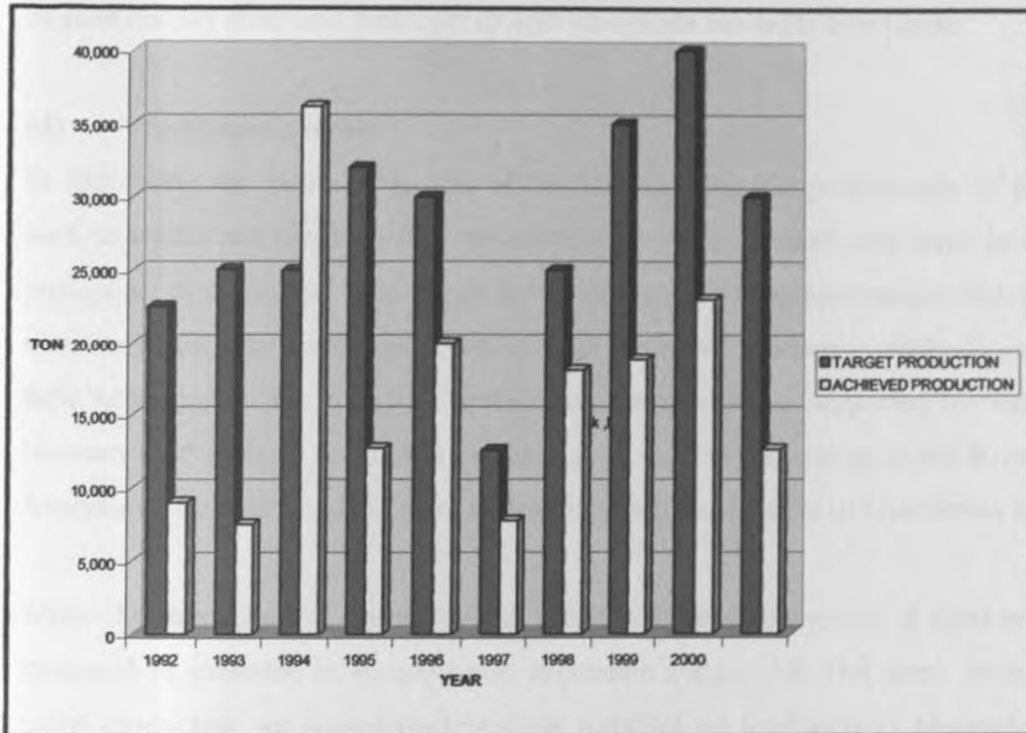
Source: Makueni District Agricultural Office, Annual Reports

Fig 5.5a: Hectares under cowpeas in 1992-2001



Source: Makueni District Agricultural Office, Annual Reports

Fig 5.5b: cowpeas production in tonnes ('000) in 1992-2001



Source: Makeni District Agricultural Office, Annual Reports

Pigeon peas in particular act as an insurance against complete failure of crops as their planting growth is spread across the two rain seasons. Pigeon peas are the alternative to beans in preparation for Akamba staple diet. They are planted during the short rains (October – December) and harvested during the end of the long season (March – June). Therefore, low yields amount to double loss to the farmers because of the two farming seasons covered. However, despite the production fluctuations shown in *Figure 5.4b*, Makeni District has been a major supplier of pigeon peas to Nairobi and Mombasa cities among others. The scarcity of planting seeds exists because many households are unable to preserve their end off-season seeds for long.

Pigeon peas have also been affected by pests and disease especially areas where the crop has been grown on the same plot for more than one cycle. The grain is vulnerable to weevil attack during post-harvest storage. This contributes to grain losses. Furthermore, many households cannot afford to purchase adequate agro-chemicals to eradicate pests and diseases hence this contributes to low yields and post harvest losses. Cowpeas suffer from similar problem. It is an

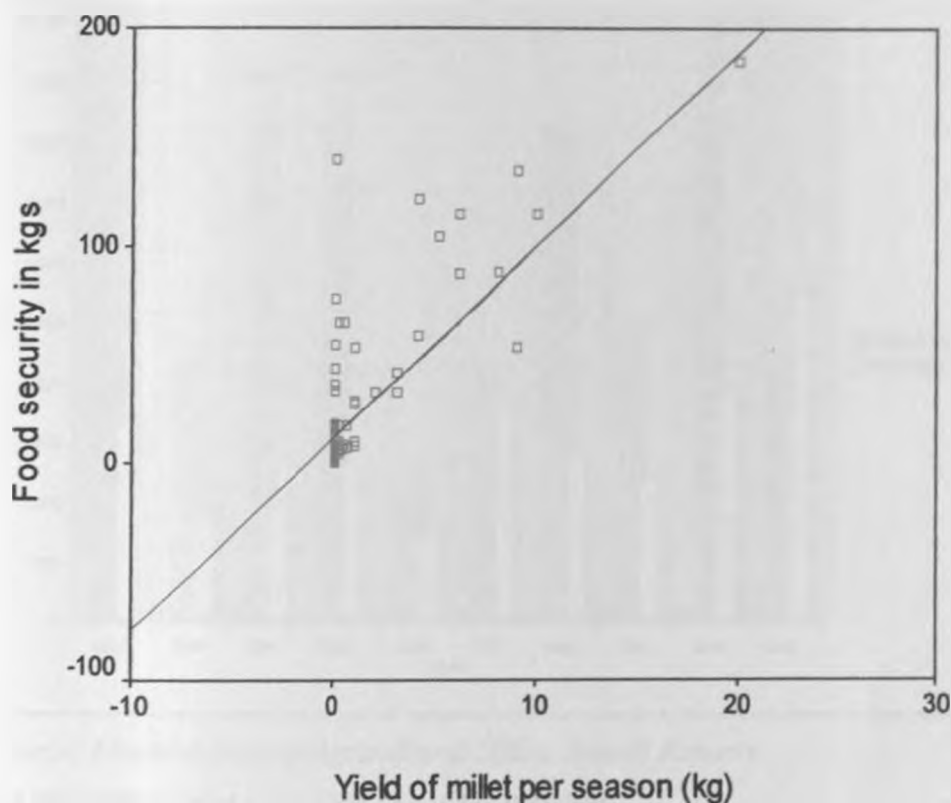
important crop because it provides grain and vegetables for consumption. However, due to use of poor quality seeds and high cost of agro-chemicals has led to low yields.

(d) Traditional cereals

In addressing the second objective of this investigation, the performance of traditional crops such as millet and sorghum that are suitable for marginal semi-arid areas is discussed. The promotion of traditional food crops is one of the promising alternatives that can bring about increase in the total food production through improved production methods and expansion of their hectareage in the marginal areas. This observation is supported by strong correlation between food security and millet production ($r = 0.791$) according to the Bivariate Statistical Analysis of field survey data (refer to details of statistical output in Correlation Matrix 6.12).

When the production of the traditional crops is increased, chances of food security are also increased as indicated in simple linear regression *Figure 5.6*. The graph shows the effect of millet production per season (independent variable) on food security (dependent variable) at household level. This underscores the importance of traditional food crops in semi-arid areas of Makueni District. According to KARI (2003), millet and sorghum are drought resistant and can survive better in poor soil conditions. Moreover, they also last longer under storage and thus, provide the assurance of continuous food supply. Unfortunately, the production of sorghum and millet has declined by 40-50% while the hectareage for the same has declined by 50% in 1992 – 2001 as shown in *Table 5.6* and *Table 5.7*. This data is presented graphically in *Figures 5.7a, 5.7b and 5.8a, 5.8b* respectively.

Fig. 5.6. Food security against millet production per season



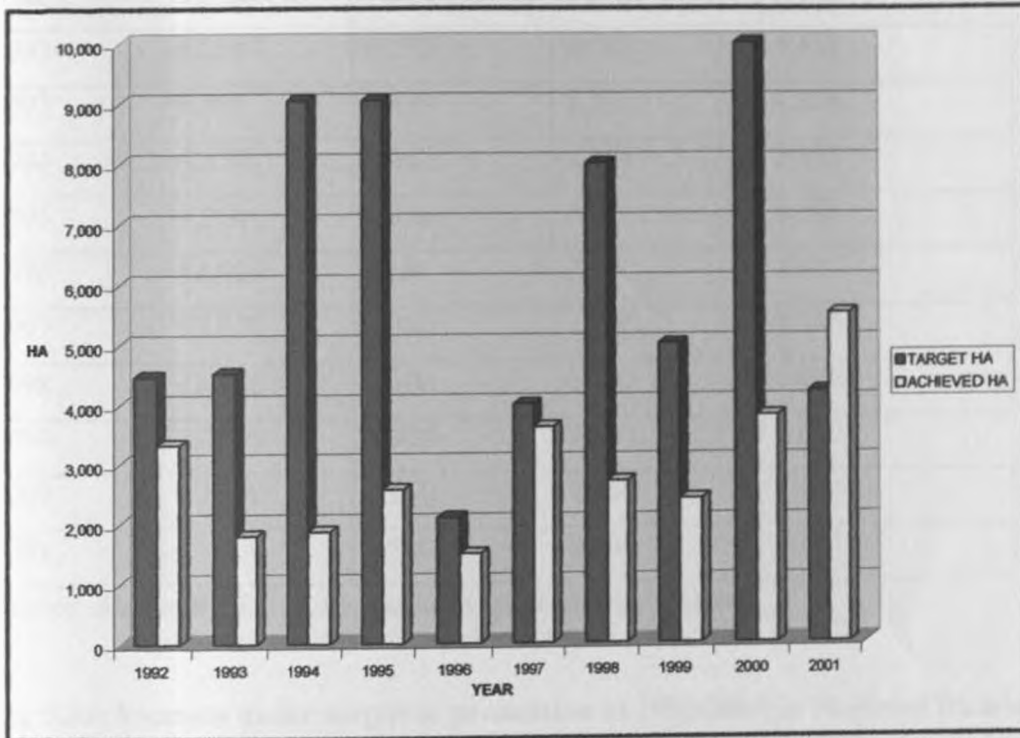
Source: Analysis of field survey data 2001 – 2006

Table 5.5: Millet production in tonnes ('000) and hectares 1992 – 2001

Year	Target Ha	Achieved Ha	Target tons	Achieved tons
1992	4,475	3,322	2,461	1,827
1993	4,525	1,810	2,714	845
1994	9,050	1,874	4,978	947
1995	9,050	2,569	4,978	2000
1996	2,100	1,500	6,000	1500
1997	4,000	3,623	1,980	1,221
1998	8,000	2,700	2,800	2,300
1999	5,000	2,400	3,000	3,320
2000	10,000	3,800	5,000	2,280
2001	4,200	5,500	5,4000	3,996

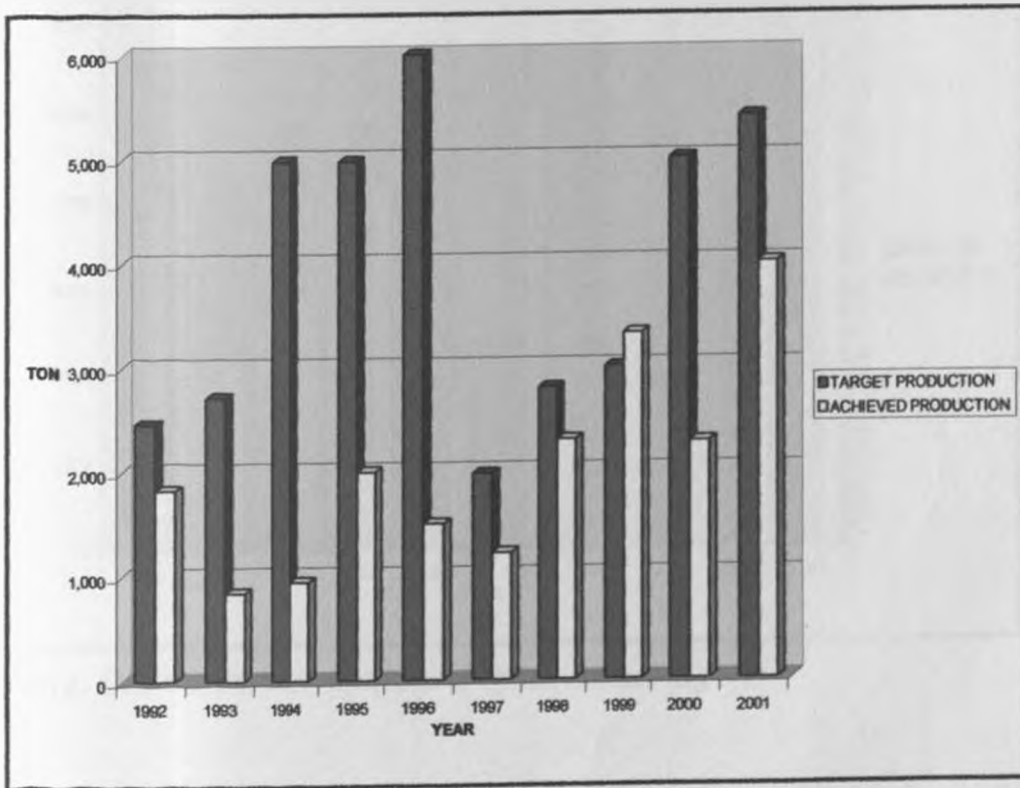
Source: Makueni District Agricultural Office, Annual Reports

Figure 5.7a: Hectares under millet production in 1992-2001



Source: Makueni District Agricultural Office, Annual Reports

Fig 5.7b: Millet production in tonnes in 1992-2001



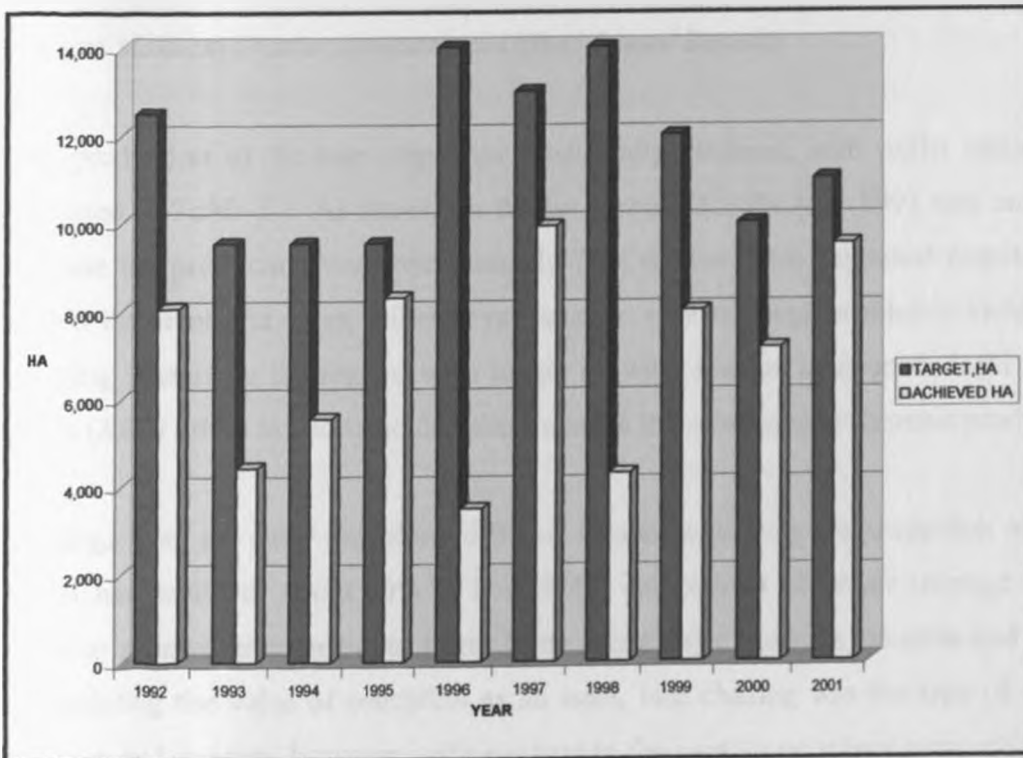
Source: Makueni District Agricultural Office, Annual Reports

Table 5.6 Sorghum production in tonnes ('000) and hectares in 1992 – 2001

Year	Target Ha	Achieved Ha	Target Tons	Achieved Tons
1992	12,500	8,070	8,000	4,438
1993	9,550	4,439	5,730	2,674
1994	9,550	5,562	4,775	2,503
1995	9,550	8,316	5,22	2,500
1996	14,000	3500	7,400	3200
1997	13,000	9,930	7,020	3,360
1998	14,000	4,300	6,300	6,075
1999	12,000	8,000	7,500	4,000
2000	10,000	7,150	9,000	4,940
2001	11,000	9,500	8,400	5,454

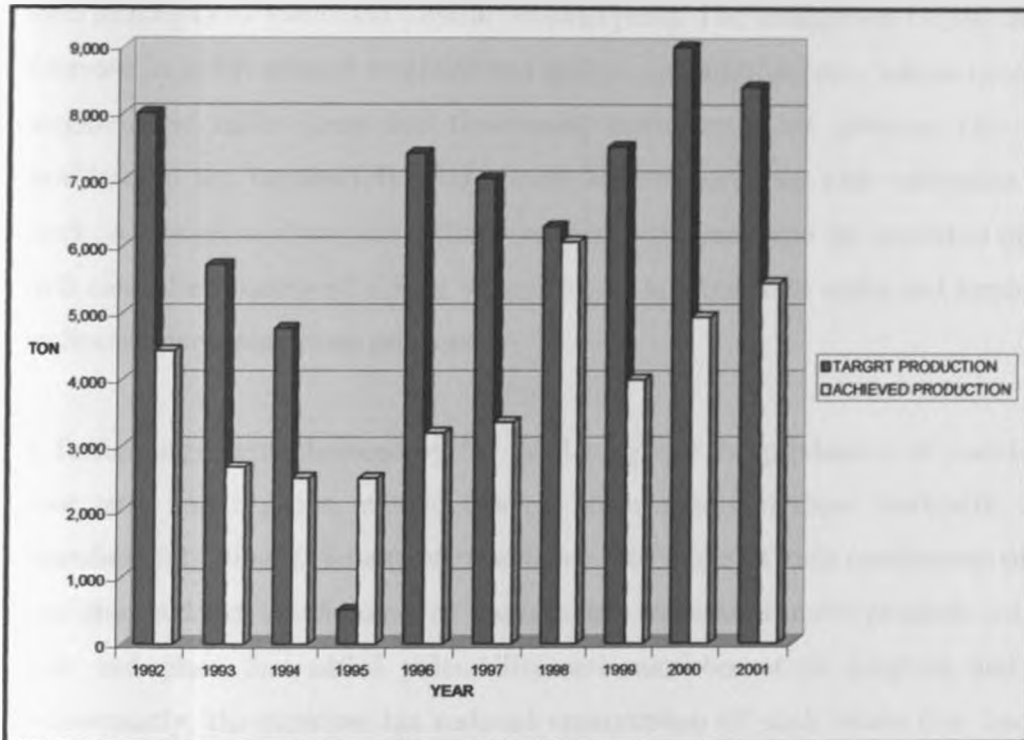
Source: Makueni District Agricultural office, Annual Reports

Fig 5.8a: hectares under sorghum production in 1992-2001 in Makueni District



Source: Makueni District Agricultural Office, Annual Reports

Fig 5.8b: Sorghum production in tonnes in 1992-2001 in Makueni District



Source: Makueni District Agricultural Office, Annual Reports

The production of the two crops has consistently declined, with millet taking the lead as indicated in *Table 5.5*. As shown on the bar graph 5.8a, the year 1993 was one of the worst because the production was approximately 75% decline. This happened despite the fact that within the semi-arid areas, millet is projected to give the highest relative yield for the short growing season. In the regions with longer growing season, sorghum is ideal under drought stress (*KARI 2003*) but households have not taken this advantage to increase production.

Findings from the study area show different reasons as to why the production of sorghum and millet has declined. About 40% of households complained of labour shortage to scare away birds as soon as grain begun to form. In the olden days when the Akamba had not yet begun appreciating the value of education as an asset, bird chasing was the type of work done by children and women. However, with increase in the number of school going children and drift of young men into urban centres, both men and women were forced to participate in birds scaring as expressed by one respondent named *Mzee Kiamba* of Kasikeu division. The situation has worsened with the advent of universal primary education and subsequently compulsory free

primary education. The highly affected areas are Kibwezi and Makindu divisions because of their proximity to Tsavo and Chyulu National parks. The disapproval of bird chasing led to the decrease in cultivation of sorghum and millet. In addition, more labour is required to grind sorghum and millet grain into flour using traditional stone grinders. This poses an extra workload to the women folk who already are overburdened with cultivation and household work. Although modern posh mills were been introduced into the market to perform this task with ease, the majority of elderly women prefer to grind their millet and sorghum flour in the traditional way using stone grinders.

A further argument advanced by households against the production of traditional crops was poor taste and negative attitude towards consumption of these foodstuffs. About 50% of household interviewed did not rate traditional food crops as main components of their meals. It was observed that deterioration of pastures and decrease in cattle products led to shortage of milk and ghee that added palatability and nourishment to sorghum and millet meals. Subsequently, the situation has reduced consumption of such meals thus leading to further decline in production of these traditional crops. The situation is worsened by the attitude created through provision of food relief that is almost exclusively in the form of maize and beans. The relief food does not include sorghum and millet.

This situation has contributed to the shift in consumption preferences towards foods that may not be suitable for growing in semi-arid areas of Makueni District. Sorghum and millet are perceived as food for the poor. Policy makers have also down graded the traditional cereal crops in comparison with crops such as maize thus promoting negative attitude towards promotion of traditional food crops. The situation has been worsened by low financial returns offered for these crops. About 30% of the households interviewed argued that there is no market for these crops because prices offered were too low to justify increment in production. The local hotels do not prepare meals from these traditional crops thus limiting their demand.

It is therefore clear from the study that traditional food crops are regarded as unpalatable, labour intensive and of low economic value when compared with maize. The perception that does not focus on the nutritional value of these crops as well as their suitability in such marginal lands has increased vulnerability of many households to food insecurity. The situation

is contrary to early years of 1950s to 1970s when traditional food crops had a great share in farmers' calendar and food insecurity was not as severe in the study area as today. It is no doubt the promotion of traditional food crops to achieve self-sufficiency at the household level is critical. The product promotion is needed by focusing on popularizing the existing traditional food products and producing attractive and palatable food products from traditional crops, acceptable to both urban and rural consumers.

One practical method of promoting sorghum and millet is to diversify cooking techniques and products with a view of improving palatability of the same to popularize their cultivation. The Department of home economics in the ministry of agriculture is well placed to do this job. This is important because tendency of continuing with the same methods of preparation throughout generations without introducing innovations and changing with social status lead to low investment in traditional crops. It is equally important to provide relief food if needed in the form of traditional foodstuff. This should also include provision of relief seeds of the same crops to encourage their production.

(e) Tubers/Roots

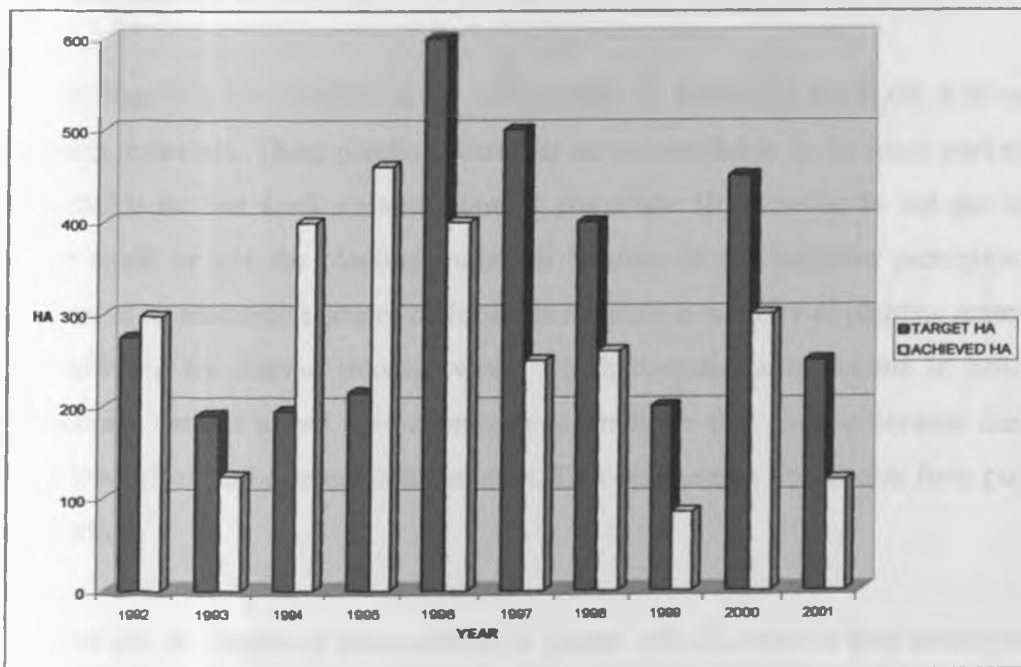
Tubers/root crops cannot be ignored in solving the problem of food security in the semi-arid lands. The common tubers/roots grown in Makueni District are cassava, sweet potatoes and arrowroots. Farm production of these crops has declined significantly. Cassava production has gone down by 30% while the hectareage has also decreased by 40% as shown below.

Table 5.7 Cassava yields variation in tonnes ('000) and hectares between 1992–2001

Year	Target ha	Achieved ha	Target tons	Achieved tons
1992	275	298	3,563	2,831
1993	190	124	1,900	1,116
1994	195	399	1,950	3,591
1995	215	460	2,150	4,000
1996	900	400	6,400	3,500
1997	500	2,33	50,000	6,000
1998	400	260	40,000	2,377
1999	200	85	10,000	1,000
2000	450	300	5,000	1,500
2001	250	120	3,000	2,100

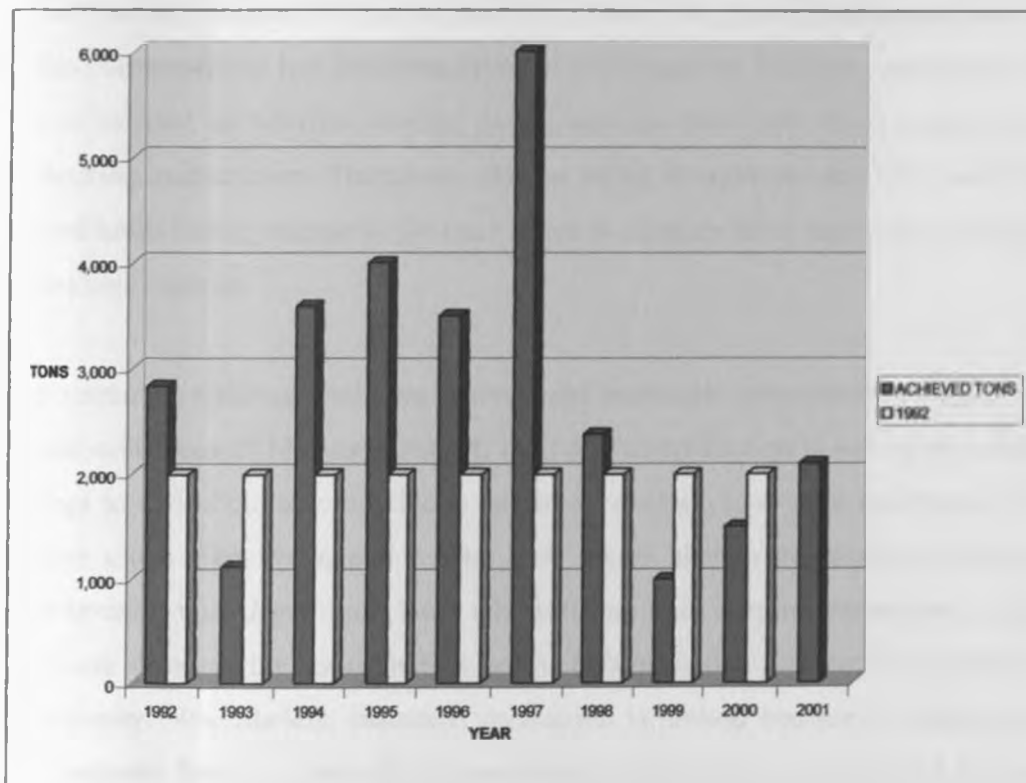
Source: Makueni District Agricultural office, Annual Reports

Fig 5.9a: Hectares under cassava production in 1992-2001, Makueni District



Source: Makueni District Agricultural Office, Annual Reports

Fig 5.9b: Cassava production in tonnes in 1992-2001, Makueni District



Source: Makueni District Agricultural Office, Annual Reports

The decline has been attributed to socio-economic factors in the study area such as lack of planting materials. These planting materials are not available in the local markets. Most of the households do not stock cassava-planting materials. Households do not put extra efforts to either stock or get the planting materials because of the negative perception attributed to cassava as an alternative source of food. In addition to scarcity of planting material, cassava is also affected by disease (mosaic virus) which contributes to decline in production. Many households cannot afford agro-chemicals to eradicate this disease because cassava products have low prices and demand in the market. This discourages households from pursuing cassava production.

Cassava can be consumed raw, cooked, or ground into flour that is then used to cook *ugali* and porridge. Cassava flour is mixed with sorghum and maize flour to form a nutritious meal. Despite this advantage offered by cassava, it is not considered a valuable food. Most of the household consider it as food for the poor despite its advantages in boosting food security. One

advantage of cassava is that it stores well up to three years in the ground providing for excellent food security against drought related crop failure by giving continuous harvest. Cassava has also comparatively low input requirement with regard to fertilizer, manure and agro-chemicals. It is tolerant to adverse weather conditions and plays role in environmental protection by checking soil erosion. Therefore, cassava being drought resistant crop with high production level holds better promise in the near future to alleviate food insecurity in the marginal areas of Makueni District

In summary, although traditional cereals and traditional tubers/roots are significant foods in the semi-arid areas of Makueni District, their rate of production is quite low. Admittedly, they do adapt to varied climatic conditions and have relatively low input requirements as compared to other crops like maize and beans. This means that with increased production, the rural community would get more food self-sufficient with surplus production, raising households' income through the local market sales. Subsequently, this creates pathways out of food insecurity. Nevertheless; increased production is limited because of maize popularity among households. Maize is planted in areas where productivity is marginal and households continue associating maize with food security at the expense of other crops.

5.1.2: Food security at household level

Findings from the field survey carried out in 2001-2003 at the selected divisions of Makueni district show that food security varied from household to household. Households were ranked according to food security status as shown in table 5.8 (supply versus demand).

Table 5.8: Household food security status

Status	Frequency	Percent
Low food secure(always)	70	35
Moderate food secure(occasionally)	117	58.3
High food secure	13	6.5
TOTAL	200	100

Source: Field survey data 2001-2006

These findings indicate that 35% of the households are low food secure throughout the year as witnessed from their consumption pattern, which is limited to at least one meal per day. Their consumption is less than 135 kg of assorted cereals and legumes per month for an average family of six members. These families have earnings that are below Ksh. 927 per person per month towards food consumption as recommended by FAO/World Bank (see details under household income in this chapter). Such households have limited food access from either farm production or market purchase and therefore, they are more concerned with food availability regardless of its nutritional value. Their survival is pegged on food relief and other social safety nets. Some of the common characteristics of households classified as high food insecure were the high levels of non-working population with limited sources of income, low education, large families and few assets to sell during food crisis.

The moderate food insecure group (58.3%) include families whose food stock fluctuated from average (135 kg of cereals) to below average. Occasionally these households experience food shortages although not throughout the year. They managed to have two meals per day regardless of nutritional value. However, some of them admitted having faced difficulties in accessing food due to inadequate income especially when farm stocks are low. The households were therefore forced to reduce their assets in order to sustain domestic food supply. Such households did not regard food relief as a major source of food compared to the first category.

The last category was the households classified as having low food insecure status (6.5%). Their food stock ranged between average (135 kg) and above through out the year. These households were more organized in their farm activities and income generating sources compared with the rest. They had more assets and steady income to rely on during food shortages. Such households had members with better educational standards and formal employment or reliable business. Consequently, they were able to continue supplying food from the market to their family members with ease. Often, these households participated in donating food to their disadvantaged relatives and neighbours as discussed in chapter six.

The food security situation was further analysed based on household sampled from the selected divisions in the study area as shown on *Table 5.9*.

Table 5.9: Household food situation at the selected divisions

division	total no. of HHS sampled	% of HHS buying food	% of HHS at food risk	% of HHS that may require food relief
Makindu	40	100	80	80
Kibwezi	40	80	80	80
Wote	40	75	60	55
Kasikeu	40	75	50	40
Kathonzweni	40	85	80	75
Average		83	70	65

Source: Field survey 2001-2006

These figures took into account food stock from the farm, market purchase and donations from friends and institutions. It comprises combinations of all edible foodstuffs available for the households. The situation of food insecurity appeared severe in Makindu, Kibwezi, and Kathonzweni divisions with 50% of the households at risk of being food insecure based on their production and purchase records. The divisions were 70% semi-arid; implying that rains were low and erratic thus leading to unreliable crop yields and subsequently great demand of food relief services. The situation was worsened by low purchasing power for most of the households. More than 83% of the households in the five divisions buy food annually with Makindu leading (100% HHs involved in food purchase). Generally, less than 25% of the households had an average of two bags of maize reserved from previous harvest (year 2001). Subsequently, the divisions benefited from relief services as shown below.

Table 5.10: Food relief distribution 2002

Division	Agency	Maize bags(50kg)	Metric tonnes
Makindu	AMREF-Kenya	16137	806
Kibwezi	AMREF-Kenya	23760	1189
Kathonzweni	World Vision	21090	1054.5
Wote	World Vision	10953	547.7
Kasikeu	AMREF-Kenya	3708	185.4
TOTAL		75,648	3782.6

Source: AMREF- Kenya, Makueni office 2003

The foregoing information shows the situation of household food security is a real problem. In some parts of Makueni District, hungry people are succumbing to diseases that have raised the mortality rate of the population as reported at Sultan Hamud, Kathonzweni and Kibwezi health centres. Food (let alone a balanced diet) is lacking most of the year in the lowland areas of the district. For many of the households, grain supplies run out as much as seven months prior to the next harvest. Most of the households seek casual employment thereby neglecting their own farms during the critical planting and weeding periods. This results into another poor harvest and continuation of the cycle.

Malnutrition adversely affects development in general within the district, as malnourished people are not actively involved in development activities of the district. Food poverty appeared to be the “catch” word as one moves from village to village amid the dry landscape dotted by drying acacia trees and shrubs. Parents and children living in utter desperation, not sure, when the next meal would be available characterized households. It was not unusual for families to go for up to three days without a proper meal in some areas of Kibwezi, Makindu and Kathonzweni. This was common in agro-ecological zones 4 to 5. Health officials confirmed that some of the infant mortality cases associated with certain illness was accelerated by problems associated with hunger, which weakens the victim to a point of not being able to resist attacks from diseases. Hence, the status of food insecurity in the study area is bad and needs attention. Some of the socio-economic factors attributed to this poor food status are discussed in the subsequent parts of this chapter.

5.2: SOCIAL CHARACTERISTICS OF HOUSEHOLDS AND THE EFFECT ON FOOD SECURITY

The household social characteristics affecting food security are discussed under this section according to the field survey results. These social characteristics include age of the household head, educational level and household size. These social aspects are discussed in line with objective three of the study, which deals with the socio-economic factors affecting food security in the semi-arid areas of Makueni District. The household heads acted as the respondents during the interviews.

5.2.1: Effect of the Age of Household Head on Food security

Findings from the study area show that most of the respondents (57%) were aged between 30 and 50 years old, while a few (12%) were below 30 years and only 31% were above 50 years (table 5.11). The age of the household head is important in determining food security as it influences his/her ability to manage farm activities and other income generating activities that can contribute towards enhancing food security

Table 5.11: Age of respondent and food status

Years	Frequency	Percent
Below 30	24	12.0
30-50	114	57
Over 50	62	31.0
Total	200	100.0

Source: Field Survey Data 2001-2006.

The results indicated that only a small number of households (12%) are classified as young families' newly married and inexperienced in farming and other non-farm activities. Some of the households under this category were rated food insecure because their members were not employed and continued to get help from their parents. They relied on their fathers' ancestral land and decision-making was hampered due to lack of independence in land ownership. Although some had inherited land from their fathers, they lacked autonomy because of being regarded as members of the larger family.

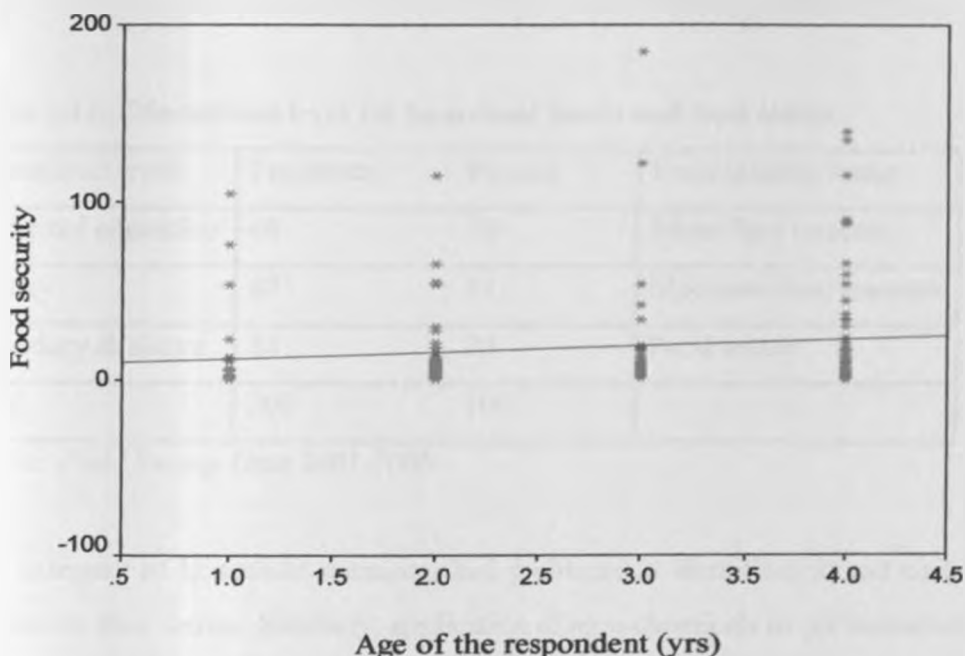
The second category was the middle aged group (30-50 yrs) who comprised 57% of the households classified as relatively food secure because they were able to meet their food needs in the current year without altering normal income activities or depleting savings. This group was critical in management of farm activities as well as engaging in off-farm income generating activities that can lead to food purchase during poor harvest. They were able to contribute positive ideas towards alleviation of food security problem. Most of them were receptive to change and were ready to take risk in farm investment and technology adoption

given the right and necessary assistance that was largely lacking. They were innovative, aggressive and more often than not willing to adopt modern forms of agriculture.

The third category of household heads comprised the age group (50 years and above) with 31% representation. This category of household heads were rated high food insecure and proved to be an obstacle to efforts towards increasing food security because they lacked innovative ideas towards yield improvement. Highly food insecure implied households that could not meet their food needs during the current year without reducing consumption or drawing down assets to such a degree that they compromised their future food security. They lacked the energy to diversify off-farm sources of income to procure food during periods of shortages. Such people were conservative and generally laggards. They preferred retaining the traditional methods of crop production that may not conform to the ecological challenges. This category of household heads were more pre-occupied with short term solutions to food insecurity such as famine relief food, reliance on social safety nets and disposing off family assets when confronted with food shortages. It required efforts to convince the aged group to use modern inputs like fertilizers, certified seeds and agro-chemicals and therefore acted as a bottleneck in efforts towards reducing food insecurity.

Bivariate statistical analysis of field survey data shows weak correlation between food security and age of the household head ($r = 0.162$). This implies that advancement in age does not automatically reflect decline in food security. The low correlation is because the data on age level was only collected from the household head who may not entirely command adequate food stock in the family. This relationship is further demonstrated by simple regression graph *Fig.5.10* that indicates that some aged households were able to produce slightly more food than the young and middle-aged generation due to long experience in weather prediction, positive attitude towards traditional food crops and having more relatives to depend on during periods of food shortages.

Fig. 5.10. Food security and household head age level



Source: Field Survey Data 2001 – 2006

It can be concluded that age was not be a significant factor in determining food security at household level because members of the family depend on different sources of food as opposed to farm production only. Age level also differ among the household members hence the age of the household head cannot be taken as the only yard stick to measure food security

5.2.2: Educational Background and Food security

Educational level of the household heads was an important determinant factor on food security. Results from the study area, shows that 30% of the household heads had not attended any formal education as indicated in table 5.12. Most of these illiterate household heads were also above 50 years of age. Their contribution to food insecurity was largely noticed in the low yields realized from farms and poor post-harvest grain storage thus leading to significant losses of food stock. This was aggravated by low income which could not enable them access food from market during periods of scarcity and therefore were classified as more food insecure meaning they had depleted their asset base to a degree that without immediate outside assistance, they would face famine. Lack of education is known to reduce people's ability to take advantage of the opportunities around them and has often been associated with increased

poverty. Lack of education shows loss of market exchange based entitlement according to Sen's model because household have no employment skills to generate income.

Table 5.12: Educational level for household heads and food status

Educational level	Frequency	Percent	Food security status
No formal education	60	30	More food insecure
primary	80	41	Moderate food insecure
Secondary & above	58	29	Food secure
Total	200	100	

Source: Field Survey Data 2001-2006

This category of household managers had problems in identification and control of pest and diseases in their farms. Similarly, application of agro-chemicals as per instructions given was a problem because such instructions are written in English. They faced problems in management of both on-farm and off-farm income which is important in sustaining food purchase. Embracing new technological ideas like use of fertilizers, certified seeds, and soil and water conservation techniques was largely a problem. The situation was worse because the same farmers have no access to informal education through Farmers Training Centres (FTCs), extension officers and agricultural shows. The nearest FTC at Machakos has not been actively involved in training farmers as it used to do before the implementation of Structural Adjustment Policies.

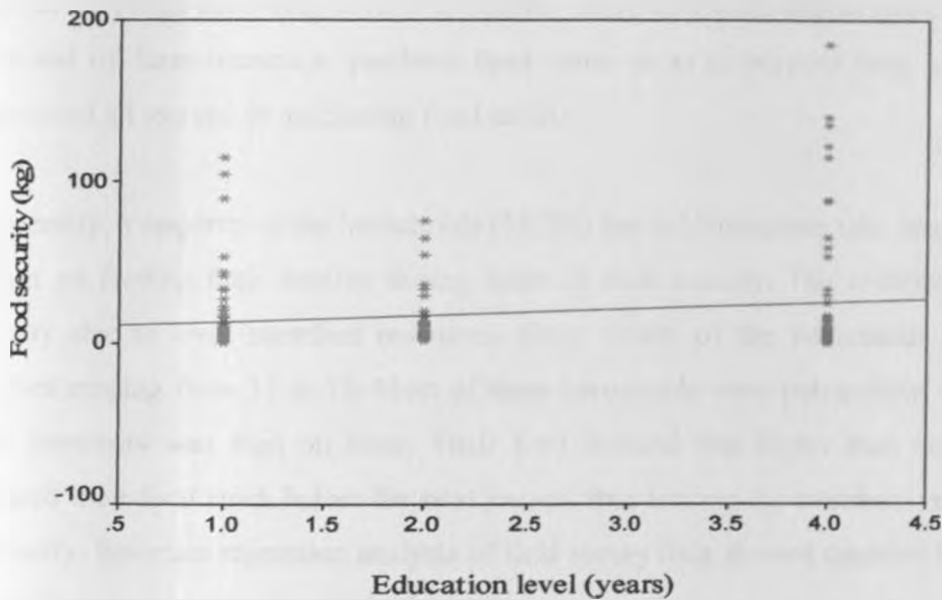
Consequently, there is an urgent need to increase formal and informal education by encouraging the illiterate persons to attend adult literacy classes to be more dynamic. There is also need to revitalize the functioning of Machakos FTC because educated farmers are dynamic. This would go a long way in making household heads more responsive to new technological ideas and broaden their awareness towards combating food insecurity through increased farm production and market purchase.

A majority of the household heads (40%) in the study area had primary level education. Although their food status was moderately insecure, it was not as serious as in the case of

household heads without formal education. This implies that such households could meet their food in the current year, but only by drawing down savings or relying on secondary income activities. Should market access or income from secondary activities be compromised, these households too might become highly food insecure in the current year. They were able to get casual employment and operated small-scale businesses thus earning cash to enable them to purchase food during periods of shortages. However, the income was not sufficient for their needs and therefore they faced difficulties in achieving food security.

The last group was those with secondary education and above (29 %). They displayed better management skills in their farms and proved more innovative in coping strategies during periods of food shortages. This group was rated moderately food secure because of better income and variety of assets to deal with food shortages compared to the illiterate and semi-illiterate household managers. They applied better agronomic practices, soil and water conservation methods and good post harvest management. No doubt, they had good ideas on how to minimize food insecurity but implementation process was difficult due to lack of sufficient resources. Regression results from field survey data indicated that higher educational level had positive strong correlation ($r = 0.718$) with food security. This implied that household heads with better education stood better chances of increasing food availability from the farm and the market and hence reduction in food security problem. These results are further indicated by the simple regression line graph in *Fig.5.11*, which indicates that an increase in education level leads to an increase in food security. This is because the options available for elite households to acquire food were more than the options available to illiterate households.

Fig. 5.11. Food security and educational level)



Source: Field Survey Data 2001 – 2006

5.2.3: Household size characteristics and status of food security

Family size is an important factor because it determines the availability of labour force, dependency ratio and the amount of household food consumption. Results from the study area revealed that family size ranged from 2-13 members (*Table 5.13*) with a mean of six members. A majority of the households (58.5 %) had 6-10 members, while few (11 %) had 11-15 members.

Table 5.13: Household size and food status

Range of family members	Frequency	percent	Food security status
1-5	61	30.5	Moderate food secure
6-10	117	58.5	Low food secure
11-15	22	11	High food insecure
Total	200	100	

Source: Field Survey Data 2001-2006

About 30.5% of the household interviewed had 2-5 members. Such households were easier to manage during food shortages because of few mouths to feed. They were able to provide their

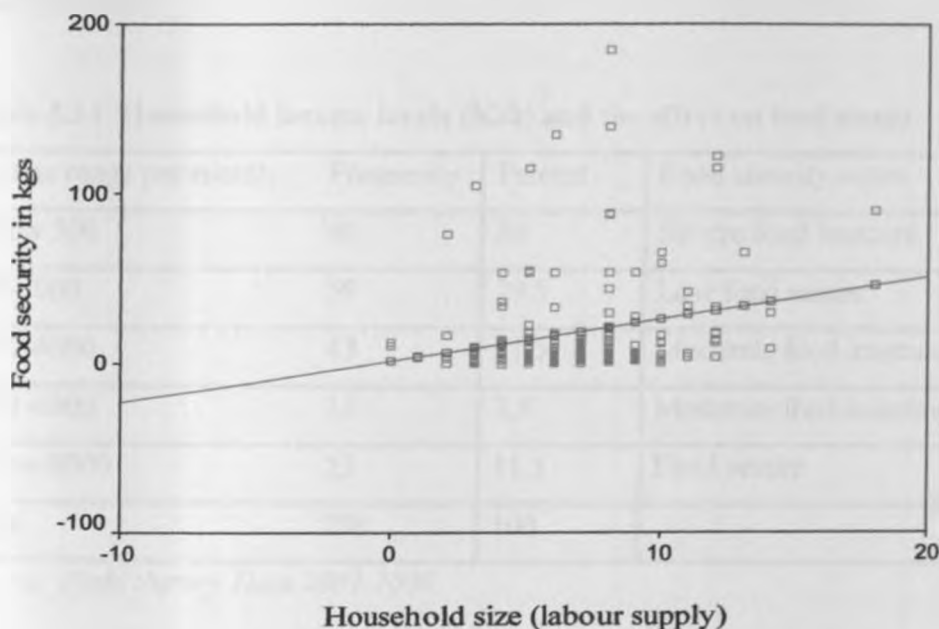
children with at least a meal thus making food security moderate. Their domestic expenditure was not very high according to rural standards hence they were able to spare some of their on-farm and off-farm income to purchase farm inputs so as to improve farm productivity rather than spend all income in purchasing food stuffs.

Conversely, a majority of the households (58.5%) had 6-10 members who spent nearly all their budget on feeding their families during times of food scarcity. This contributed to low food security due to over stretched resources. Only 11.0% of the households interviewed had families ranging from 11 to 15. Most of these households were polygamous and the effect of food insecurity was high on them. Their food demand was higher than supply hence they depleted their food stock before the next harvest thus leaving the members vulnerable to food insecurity. Bivariate regression analysis of field survey data showed negative correlation ($r = -0.244$) between family size and food security.

This implies that food security can decrease with increase in family size unless the household number is proportional to resources required in food accessibility. Ironically, such households were also highly affected by low incomes. Majority of the children were unemployed thus increasing chances of food insecurity because of depleting their food stock at a higher rate compared to households with fewer members. During periods of food shortages, the large households were hard pressed because they had to buy food in addition to other domestic requirements such as school fees, medication, and shelter among others. This shows that more money was required to purchase food at a time when funds were scarce. Subsequently, they were left in a state of poverty that further increased food security problem. They also faced problems of land fragmentation because of inheritance. This implies that the larger the family, the shorter the period under which food is stored because of high consumption rate.

Family size did however, influenced labour supply and subsequently contributed to food security as shown in the Simple Regression Plot *Figure 5.12*. The inference was that large families could increase food production by utilizing their labour force or boost food accessibility through market purchase where majority have income. Nevertheless, such situations were not common among most of the households interviewed.

Fig. 5.12. Food security against household size



Source: Field Survey Data 2001 – 2006

5.3: HOUSEHOLD INCOME AND THE EFFECT ON FOOD SECURITY

For all households to be food secure, each must have physical and economic access to adequate food. To achieve this goal, each household must always have the ability, the knowledge and the resources to either produce or purchase the required foodstuffs adequate for household consumption. It is assumed that those households that do not meet their food needs through cultivation can obtain additional supplies from the market. However, food markets may not be physically and economically accessible. This is largely unreliable especially for those households who may need to turn to purchasing on an instantaneous basis. However, it is also increasingly rare for household food needs to be met entirely by subsistence production.

5.3.1 Household income status

Results from the study area indicate that income varied from household to household as shown in *Table 5.14*. The variations in household income indicate differences found among household in terms of food insecurity. The figures shown below refer to monthly income that is available for all domestic requirements including food purchase. Descriptive statistics shows that the maximum income recorded was Ksh.12000 per month while the minimum represented those

without income at all. The mean average income was Ksh. 2107.75 and the standard deviation was Ksh.1465.

Table 5.14: Household income levels (Ksh) and the effect on food status

Income range per month	Frequency	Percent	Food security status
Below 500	60	30	Severe food insecure
500-2000	59	29.5	Low food secure
2001-4000	43	21.5	Moderate food insecure
4001-6000	15	7.5	Moderate food insecure
Above 6000	23	11.5	Food secure
Total	200	100	

Source: Field Survey Data 2001-2006

The Frequency Table shows that about 30 % of the households in the semi arid areas of Makueni District earned less than Ksh. 500 per month and were among the many living under severe food insecurity. These households were not engaged in any business activities and neither do they have employed members who can remit income. They relied on farm produce that often was not enough and whenever it is available, they sell part of it to finance family expenses. These households were also severely affected by hunger during periods of poor harvest and hence had to seek assistance from their relatives or food relief from institutional organizations. Their consumption was less than 60 kg of cereals per month that implies either skipping meals or cooking less food than required by the entire family.

Similarly, 58.5% of the households reported a monthly income within the range of Ksh.500-6000. Their income mainly came from casual labour and small scale trading activities. These categories of household are occasionally food insecure mainly during drought period when resources are more constrained. Most of them run small-scale businesses whose income is affected during famine because customers spend less money on non food commodities. Only a small percentage (6.5%) of households reported a monthly income above Ksh. 6000 per month. Household within this category represented members who either were in employment or engaged in stable business activities. Such households were food secure because they were able

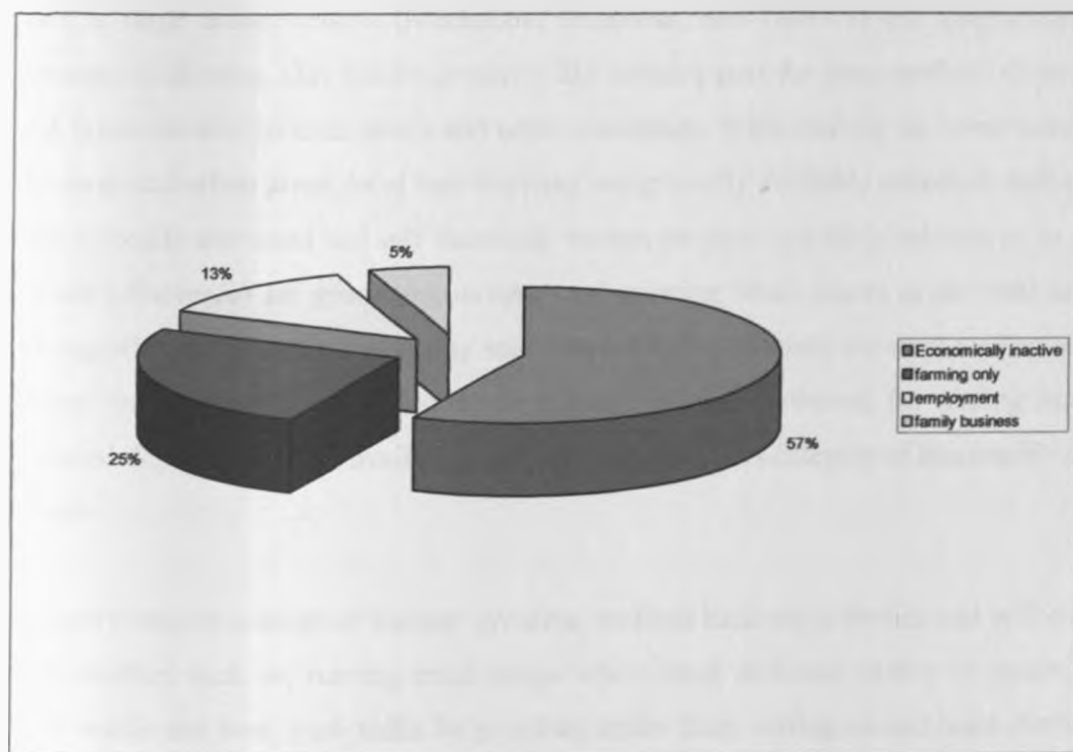
to afford foodstuff from the market. However, they occasionally complained lack of food in the market even when money was available. For instance during the 1984 famine referred to as *yua ya nikw'a ngwete*, households went hungry even with money available because there was no food at the market.

Analysis of income status in the study area shows that over 70% of the rural households are below food poverty line, which implies that people do not meet their minimum food requirement. Food poverty line has been set at 2250 calories per day per adult person in Kenya, a figure based on FAO/WHO recommendations for food consumptions for specific age groups. In monetary terms, that has been calculated as the equivalent of Ksh.927 per adult person per month in rural areas (FAO 2004). In the study area, these amounts to Ksh.927 multiply by six members of the household (average household number) equal to Ksh.5562. Those households who spend less than this amount on food are considered to be food insecure and represent 88.5% of the sample households.

5.3.2 Source of income

The latest population census of 1999 (*Republic of Kenya, 2000*) has put different categories of income groups in Makueni district as shown in *Figure 5.13*. About 57% of the entire population is classified as economically inactive with majority of the members in youth or aged group. This population lacks a source of income and depends on the income-earning group. Approximately 25% of the population relies from on-farm income that is not adequate due to weather vagaries in the semi-arid areas of the district. Only 13% of the population is in employment while 5% relies on family business activities. This analysis gives a general picture of the income situation in the district. The implication was that majority of the population relies on a few who are working and running business hence exerting a lot of pressure on the available resources. Subsequently, there was very little income left to take care of sufficient food purchases and invest in farm production. Results from the 200 household interviewed from the lowland areas of the district revealed a similar picture as analysed under the *National Census Report, 1999*.

Fig 5.13: income classification.



Source: Population Census, 1999

Table 5.15: Occupation of respondent

Occupation	frequency	Percentage	Cum
Off-farm employment			
• Small scale traders	10	5.0	5.0
• Medium business/self employment	26	13.0	18.0
• Public and private sector	20	10.0	28.0
On-farm employment			
• Peasant farmers	128	64.0	92.0
• Farm labourers	16	8.0	100.0
Total	200	100	

Source: Field survey data, 2001-2006

Analysis from the five divisions selected for an interview shows that, household relies on different sources of income to finance food purchase among other domestic requirements as

shown in *Table 5.15*. Category number one involves small scale traders (5.0%) dealing with the following commodities: handicraft products like sisal "*kiondos*", ropes and baskets which are sold in large urban centers (Machakos, Mombasa, and Nairobi) and International markets through middlemen, clay pottery products like cooking pots for local markets; charcoal burning and firewood sold in local hotels and other consumers, brick making for house construction in the rural and urban areas, local beer brewing using locally available materials; selling of honey that is locally extracted and self financing women projects popularly referred to as merry- go-rounds (*Nzangulo*) for generating income and running small kiosks in the rural areas. These among other small-scale commodity sales have benefited mainly the rural women who use the money to purchase food among other domestic needs. However, the trading activities are seasonal depending on the availability of commodities. This category of household is 40% food secure.

Category two of sources of income involves medium business activities and self employment opportunities such as; running retail shops which stock different variety of goods; operating local hotels and bars, posh mills for grinding maize flour, selling second hand clothes, buying and selling of livestock in different markets, carpentry and masonry services as well as tailoring and black smiths services. These businesses were considered stable sources of income in the study area although the sales were not very encouraging due to low purchasing power. Furthermore, optimum profit operations were seasonal. When the area is affected by food shortages, most of the business experience low sales because customers are more pre-occupied with food purchase than non-food commodities. This category of household is 50% food secure.

The third category source of income involves people in public and private sector employment who are few (10%) compared to the entire population. Most of these people were either teachers or government ministry employees. Only a few of them are employed in the private sector. This was the only group of people with regular salary. Households under this category were 75% food secure mainly through market purchase. Because of steady income, they were allowed to access foodstuff from local shops on credit payable at the end of month. However, other domestic expenses such as school fees heavily burdened their income, medical care among others.

The fourth category involved the peasant farmers whose income was farm based. This group comprises majority (64%) of the rural population. They relied on sales of farm produce such as cereal and legumes. A few of them grew horticultural crops under irrigation for local market (mainly Makindu and Kibwezi). Others sold fruits such as mangoes, oranges and bananas only during season for such products. This group is largely under food security problem because of low and erratic income that cannot guarantee food purchase (70% food insecure)

The last category involved people employed as farm labourers (both casual and monthly) in their neighbour's farms. They comprised 8% of the population. Their income was not reliable because farm activities are seasonal. In times of drought, the workers were temporary retrenched only to be rehired later during the rainy season. This left the households vulnerable to food insecurity (65% food insecure during dry season). The study area did not have reliable sources of income that could support large percentage of the households in terms of food supplies when harvests were poor. Subsequently, over 70% of the households were left food insecure during unfavourable cropping season caused by low and erratic rainfall.

5.3.3 Relationship between income and food security

Household income is the key determinant of food security status whether through farm production or market purchase. The underlying assumption is that those households that do not meet their food needs through cultivation can obtain additional supplies on the market. However, as observed from this study, the food purchase is largely unreliable, especially for those households whose earnings are low. Household income determines whether the family members can afford to purchase foods during periods of scarcity to meet their consumption demands. This is supposed to be achieved without depleting family assets. Income also influences the ability of a household to adopt modern agricultural practices and methods in farm management aimed at increasing farm production. A farmer cannot invest in certified seeds, fertilizers or manure, agro-chemical, and farm technologies when the income is insufficient.

Observations from the study area showed that there were marked differences between farms managed by well to do household heads and those managed by households faced by cash

problems. This difference was experienced further in the intensity of food insecurity situation at household level whereby the low income earners are more food insecure compared to those household with sufficient income. Income empowers households to access required food from the market without shortage of supply. Although some households had small farms, because of their stable income, they were able to sustain continuous food supply from market purchases. Nevertheless, the results from the study area revealed that poverty was prevalent among the majority of the households. This implied low purchasing power and subsequently high food insecurity situation due to loss of income as entitlement. Consequently, constant food shortages will be found among the households below food poverty line and that is related to lack of income, since it occurs even when there is plenty of food for those who can afford it.

Since many households had inadequate sources of income, they often disposed off their basic assets to purchase food when the need arose. This involved selling off, particularly when the demand was low and prices were depressed. For instance, the price of a mature goat of 15kg could drop from Ksh.2500 to Ksh.500, while that of a cow would depreciate from Ksh.10,000 to Ksh.3,000 during dry periods. This would often be accompanied by chronic food shortages as witnessed during the 2005/2006 drought when livestock was starved of pasture.

Due to lack of alternative source of income, poor households were forced to sell their livestock at throwaway prices to purchase food stuffs. Unfortunately, this was done when food prices were already too high. Hence, households ended up not solving the problem of food security because the money earned from livestock sales among others was sufficient to purchase adequate food at the prevailing prices to last the household for a longer period. Some of the households had even sold the drought animals used for farm ploughing and weeding. Consequently, when rainy season started, they were unable to plant in good time due to lack of oxen and hence, ended up with poor yields. The most affected divisions were Makindu and Kibwezi. Traders dealing with buying and selling of livestock made huge profit during dry season because they purchased the animals at low prices that they then sold to slaughter house dealers at high prices. The slaughterhouse dealers in towns such as Makindu, Simba, Emali and Sultan Hamud transport the meat to Nairobi for sale. This leaves the household with neither livestock nor adequate income to purchase food and food insecurity continues to persist.

Due to persistent low incomes, most households (80%) sold cereals and legumes immediately after harvest to earn money for other domestic expenses. When bivariate regression analysis was performed on field survey data, the results indicated negative correlation between food security and the amount of food sold before the next harvest ($R=-0.404$). This implies that families that sold their food early were more exposed to food insecurity than those that left some food in their granaries. About 60% of the households acknowledged that they sale their cereals and legumes without leaving sufficient stock for household consumption. Only 13% confirmed putting aside enough food stock for consumption after selling.

The quick disposal of food stocks was prevalent because of lack of cash crops to generate income. What was disturbing is the fact that these foodstuffs were sold when prices were extremely low, since supply exceeds demand. Furthermore, the same households were forced to purchase such foodstuffs later when prices were too high as demand exceeds supply. For instance, the cost of maize per kilogram retails at Ksh. 25 during high demand when farm yields are low. This price could drop down to Ksh.5 per kilogram during low demand when bumper harvests were realized.

Hence, households are engaged in selling their food stock immediately after harvest without leaving adequate stock to take them to the next harvest. This practice had exposed households to unnecessary food insecurity especially prior to the main harvest since by then stocks from the previous harvest have fallen to their lowest level. Subsequently, this has created a vicious cycle of food insecurity because of lack of alternative sources of income. Field results showed several households (67 %) who did not have enough to eat, in spite of experiencing good harvest simply because of engaging in selling at depressed prices what was obviously not surplus.

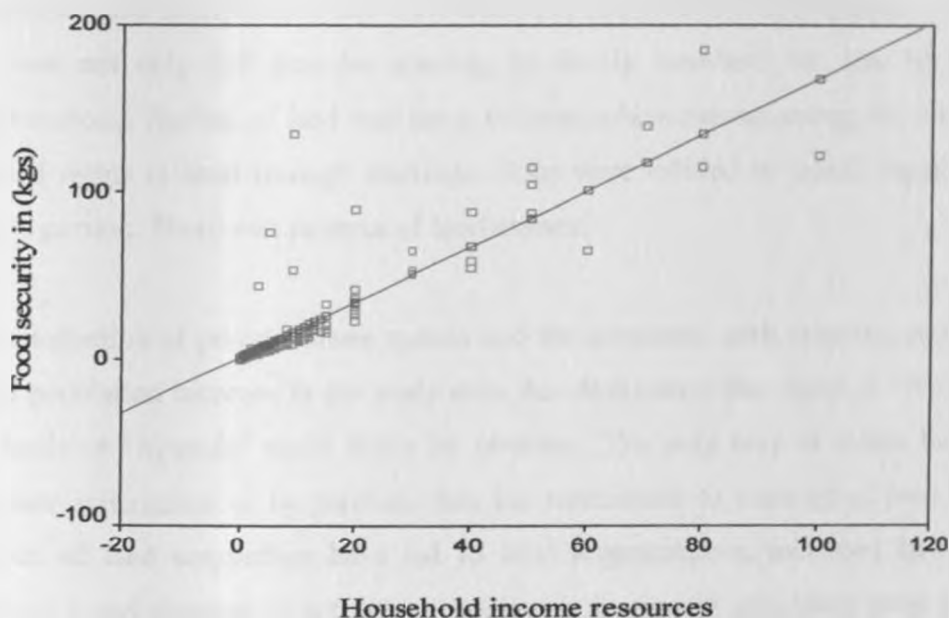
Opinions were divided as to why some households sold their produce early, thereby reverting to food insecurity. Households that sold what they themselves needed were perceived by their neighbours to be irresponsible, ignorant of market conditions and poor planners. Although this verdict appears too harsh, it was assumed that unplanned sales of food stock were bound to enhance household food insecurity and subsequently render such households village beggars. However, a few of the households (13 %) showed compassion to households that sold their

food stock because they were regarded as poor persons in need of money for school fees, medication, domestic expenses among other unforeseen problems. In other words, these houses had no choice but forced to sell their cereals to meet their basic needs. Lack of adequate storage facilities also pushed households to sell their post-harvest grain.

The Bivariate Regression Analysis from field survey data shows strong correlation between household income and food security as indicated by $r = 0.890$. Increase of income leads to increase in food security and vice versa. Households with adequate income enjoy food security even during droughts because they can purchase the needed food from the market. Low income contributes to high rural poverty that is associated to food insecurity at household level. *Fig 5.14* shows simple linear relationship between income and food security, which indicates that household food security (dependent variable), increases with increase in household income (independent variable). This implied that household income is very critical in solving the problem of food security in the study area. Income determines both availability and accessibility to food at household level. People suffered from hunger not because there was no food in their country or area, but because they simply could not afford it and have no other means of access. Similarly, households experience low yields not because of poor rains but due to poor farming because of lack of income to purchase the necessary farm requirements.

Accordingly, there is need to provide a permanent solution for the poor to help themselves through multi-dimensional policies, with income earning opportunities, access credit and the provision of affordable basic services. Many of the people living below the poverty line were self-employed or combined smallholder farming with part-time trading and seasonal migratory employment. It is in this sense that the lower groups usually had 'livelihoods' rather than regular 'employment' and were in various stages of permanent and temporary poverty as their livelihoods prosper or undermined by natural calamities or changes in economic markets. They were also prone to falling ill or out of favour with important social contacts. This was likely to lead to the loss of purchasing entitlement as envisaged by Amartya Sen.

Fig. 5.14. Food security against income resources



Source: Field Survey Data, 2001 – 2006

5.4: LAND FACTORS AND THE EFFECT ON FOOD SECURITY

The opportunities and limitations that households face in their search for food, and in particular, as growers of their own food largely centre on land. Land is also the source of income, employment and economic security for most rural people. Subsequently, access to land has remained central to rural livelihoods and efforts aimed at obtaining land have sometimes been characterized by great emotion and acrimony. Endowment of agricultural land is assessed based on size of cultivated land and in terms of its suitability for the use to which it is put, the level of its fertility and the degree of its consolidation or conversely fragmentation. This is crucial in understanding the search for food within the farm management landscape.

5.4.1: Land tenure system and its effect on food security

Land ownership is perhaps the most critical entitlement to preventing a household from food insecurity in rural areas. Access to land can safeguard against household hunger in situation where food supply is limited by non-environmental factors such as changes in food prices brought about by trade policy. For the Kamba community, land was perceived to be a free resource and could be secured by the establishment of a homestead consisting of an arable area (“*Muunda*”) and a pastureland (“*Kisesi*”). The Kamba distinguished between unsettled land

('Weu') which was available for communal grazing or for the establishment of new farms and land, which had been cleared and cultivated, popularly known as 'Ngundu'. The communal land was not only left free for grazing by family members but also by people in the neighbourhood. Selling of land was not a common phenomenon among the Akamba. Women acquired rights to land through marriage. Sons were entitled to inherit equal share in their father's portion. There was no issue of landlessness.

The introduction of private tenure system and the associated cash cropping economy, coupled with a population increase in the study area, has diminished the extent of "Weu" from which new lands or "Ngundu" could freely be obtained. The only way to obtain land today is by patrilineal inheritance or by purchase that has contributed to shortage of land. These current methods of land acquisition have led to land fragmentation, increased land disputes and tenancies. Land shortage is not only a problem in increasing area under crop production, but also expanding livestock numbers. Uncultivated land served as an area for the hunting of wild animals to supplement household food. Households could also collect honey and wild berries from such thicket vegetation. However, the uncultivated land is no longer available because of population growth and expansion of agricultural land. Subsequently sources of livelihoods have been limited hence opening way to food insecurity.

Table 5.16: Land ownership

Ownership	Frequency	percentage	Cumulative
Private	188	94	94
Communal	12	6	100
Total	200	100	

Source: Field survey data 2001-2006

According to *Table 5.16*, the majority of households (94%) in the study area are private landowners contrary to the expectation of communal land ownership in the semi-arid areas. Such households may experience food security problem because of low farm investment in terms of manure, fertilizer, seeds and soil and water management. This investment is constrained by low income as earlier discussed. Only 6% of households owned land communally a fact attributed to lack of land adjudication or the on going process of

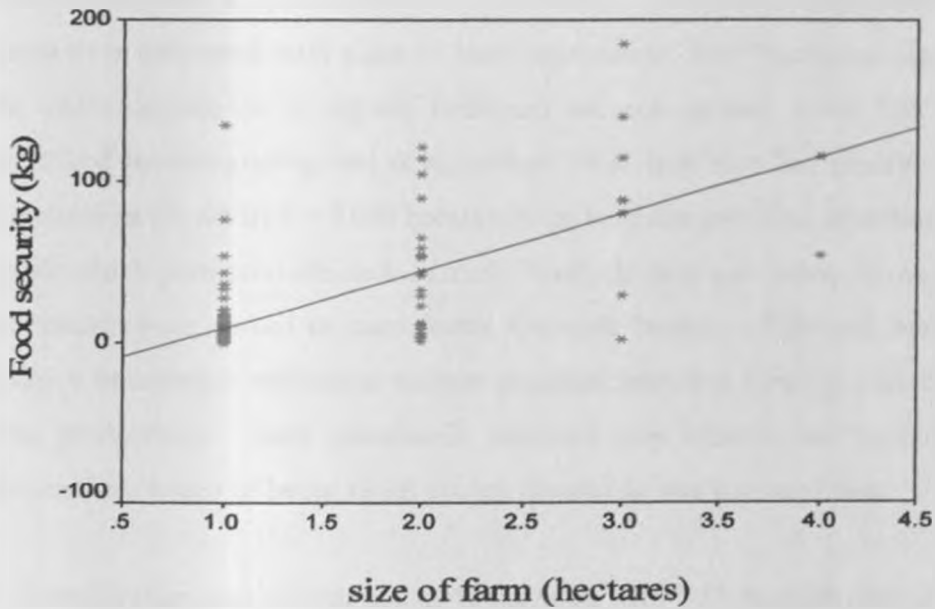
adjudicating land was carried out as a block belonging to a certain clan. Such cases are found in areas where families are not able to agree on how to divide land among them. This was the case in *Kathonzweni*, *Makindu* and *Kihwezi* divisions. The only problem that emerged even from the privately owned land was lack of title deeds, which denies them access to credit and loan facilities. Landowners have complained that the procedure of land adjudication is long and is occasionally slowed down by disputes. Processing of title deeds is long, corrupt and complicated for most of the rural people. Most of them are no longer interested in making follow up of title deed processing because of the long bureaucratic and often corruption-ridden process.

In areas where land was communally owned, farms were characterized by high soil erosion, devegetation, overgrazing among other factors that contribute to land denudation. This farm management amounts to low farm produce and ultimately contributes to food security problem even during successful rainy season. Land is regarded as common property where it is communally owned and therefore households were not ready to invest in modern methods of farming such as using manure and fertilizer. Furthermore, such households have no chances of securing credit facilities because of lack of ownership documents. Consequently, the prevailing land tenure among certain households has been regarded as a barrier to implementation of modern methods of farming which aims at reducing household food insecurity

5.4.2: Farm size and the effect on food security

Descriptive statistics from field survey data shows that the maximum cultivated farm size was 20 ha while the minimum was 0.25 ha. Mean average was 4.6 ha and the standard deviation was 3.01049 ha. Bivariate regression analysis from the same data indicates that total cultivated farm size in ha has strong correlation with food security problem ($r = 0.854$). For instant, large farms offer advantage in crop and livestock diversification, land lease in exchange of cash to purchase food hence high returns in food security. This argument is demonstrated in the Simple Regression Graph *Figure 5.15*, which indicates increase in food security (dependent variable) as farm size increases. However, many households were faced by problem of small farm sizes which indicates loss of production based entitlement according to Sen's model

Fig.5.15. Food security and farm size in hectares



Source: Field Survey Data 2001 – 2006

Table 5.17: Farm sizes in lowland areas of Makueni District.

Hectare	Frequency	Percentage	Cumulative percent
1-5	80	40	40
5-15	70	35	75
15-30	30	15	85
Above 30	20	10	100
	200	100	

Source: Field Survey Data 2001-2006

About 40% of the farmers' owned 1 to 5 hectares of land a fact attributed to population pressure and lack of money to expand farm size as indicated in *Table 5.17*. A majority of these cases were private landowners mainly in agro-ecological Zone 3 of *Kasikeu* division. Farmers owning the small farms do not effectively apply crop rotation, fertilizers, manure, better seeds and other farm inputs to boost crop yields. Although Boserup (1974) found a strong relationship between land size and farm intensification, the principle may not be applied in the study area because of lack of working capital. This limitation is caused by low income that

could not allow effective soil productivity methods, water management techniques and agronomic practices as prerequisite for successful land intensive use. Some of the farms appeared over cultivated with signs of land degradation. Such farms are associated with low yields where organic or inorganic fertilizers are not applied. Areas left uncultivated are characterized by overgrazing and devegetation. Total land size had positive correlation with food security as shown by $r = 0.686$ because large land size provided opportunity to keep cattle and goats which gave products such as milk, beef/goat meat and hides. However, the majority of households were forced to keep fewer livestock because of limited land size. Only the progressive households with some income practiced intensive farming without compromising on land productivity. Such households practiced crop rotation and intercropping, thereby improving the chances of better yields during favourable weather conditions.

Farm diversification was evident among households with 5-15 hectares. About 35% were able to diversify crop yields and keep slightly more livestock. Such households were moderately food secure. The number of crops intercropped depends on the region and the individual farmers' preferences for particular crops. Three main cropping systems were identified as maize/bean cropping system predominant in areas above 1300m covering agro-ecological zones 3-4; maize/pigeon peas/cowpeas cropping system predominant in areas between 900 and 1300m covering agro-ecological Zones 4-5; and maize/sorghum/millet system predominant in areas below 900m found in agro-ecological Zone 5-6. Only a few households (10%) had over 30 hectares of land size in *Kathonzweni*, *Makindu* and *Kibwezi* where land potential is low. Such households kept large herds of livestock or have leased part of their land to neighbours for grazing purposes. Nevertheless, the productivity of these large farms was low and households lacked resources to increase soil fertility and implement water and soil conservation techniques.

Farm fragmentation was also identified as a significant factor affecting food security. Although farm fragmentation is not very severe in the study area compared to the high potential areas, it does exist and affects farm production. Results from the study area shows farm fragmentation is caused by geographical dispersion or scattering of farms purchased at different locations. This leads to non-continuous blocks of small farms ranging from 3 to 4 pieces of land which are small and disconnected. This results from household buying pieces of farms from different owners who are not necessarily neighbours. The other form of fragmentation was caused by

subdivision of the ancestral land into several pieces according to the number of sons in the family. This was attributed to high population growth rate compared to low productivity of the area. The situation was worse in the polygamous families where subdivisions were going down to less than one hectare. After subdivision of the family land, members with income were able to buy land elsewhere to ease land pressure in the ancestral land. This process led to one person owning many scattered farms located from 3 to 4 km apart and therefore, proper development and management of such farms is a problem leading to low yields.

The findings of the investigation revealed that the buying and selling of land as well as the subdivision of ancestral land have contributed to the process of fragmentation. Fragmentation leads to uneconomical land use in terms of application of modern methods of farming, ineffective management and lack of adequate time to work in all the pieces of land that may be highly dispersed. This leads to waste of time as people walk to different holdings. In cases where the plots are 2 km away, the owner cannot plant in good time; application of manure is a problem and harvesting is tedious. In *Kasikeu* division, the average distance between different farms owned by the same person was 4 kilometres.

Consequently, households cannot realize the full potential of the land because either due to over-utilization or under-utilization of the farms because of distance, size and lack of necessary capital to employ labour and buy farm inputs. This ultimately leads to low production and subsequent food insecurity as witnessed in the study area. Households cannot practice crop rotation because of farm fragmentation. Multi cropping and intercropping have become common but poorly applied practices. This leads to poor yields and subsequent food insecurity.

5.5: LABOUR INPUT AND THE EFFECT ON FOOD SECURITY

Results from the field survey shows that 98.5% of the households rely on family labour. Only 5% are able to employ farm labour either on permanent or casual basis. Out of 5% of farm labour force employed, 2.2% are permanent farm workers while 2.8% are casual workers hired during peak seasons of planting, weeding and harvesting. As expected, labour was a key constraint at weeding, ploughing and harvesting because many households cannot afford to hire sufficient labourers.

Despite a high rate of unemployment in the rural areas largely caused by high population growth versus low economic growth, family labour supply was not readily available contrary to the popular view that there is surplus labour in the rural area. About 81.5% confirmed that labour was a constraint in farm production activities among other household duties. Agricultural labour requirements are seasonal, reaching peak during rainy season. This is the time when labour scarcity is most experienced, a problem attributed to the following factors:

- (i) Male migration to urban areas left the already over-burdened women to manage the agricultural sector. Women are often engaged in fetching water, collecting firewood, nursing the young ones, livestock grazing and community women group activities among other domestic responsibilities.
- (ii) The majority of youth have a negative attitude and perception towards agricultural activities. They often prefer part-time off-farm employment in the village and nearby markets in exchange for quick income as compared to directing their efforts on-farm employment.
- (iii) A significant number of men are addicted to heavy consumption of alcohol that leaves them distracted from any productive occupation. Some of these people leave their houses early morning and return drunken late evening on daily basis.
- (iv) Free primary education has affected family labour in the sense that its congested curriculum leads to a heavy workload for children thereby pre-occupying them to an extent that they have no free time to assist their parents on the farms.

Family labour was therefore not sufficient despite households registering reasonably large population. Subsequently, this contributed to food shortages and hence food insecurity. Many households had large population to feed but few members who were productive in either farm activities or non-farm income generating activities.

Labour provisions were also affected by low income among most of the household. Monthly hired labour cost 2000 – 3000 Ksh on half-day basis while casual labour cost 150 - 200 Ksh per day depending on the nature of the job performed. These rates are quite high for a majority of the households who seemed to be cash strapped by living on less than one dollar per day. Therefore, majority of the household preferred engaging the casual workers only when their services were required specifically during farm preparation, planting, weeding and harvesting.

This observation is further confirmed by bivariate regression analysis which indicates that there is relationship between cost of labour and food security $r = 0.244$. Sometime the workers were not even available especially during season proceeded by bumper harvest when nobody was hungry. In the absence of sufficient manpower to handle essential farm activities, most of the farms exhibited poor weeding, lack of soil conservation, decreased hecterage, late planting, and poor agro -nomic practices among others. These inadequacies contributed to a decline in production and subsequent food insecurity in several households even when rains were sufficient.

5.6: EFFECTS OF FARM TECHNOLOGIES ON THE FOOD SECURITY PROBLEM

Farm preparation, planting and weeding in the study area is commonly done using a hoe (*jembe*), oxen plough or tractor. The *jembe* has traditionally being a popular implement with 90% of the households using them during weeding. Nearly every household has a hoe, commonly referred to as a *jembe*. However, use of the *jembe* is declining due to being cumbersome and counter productive. Use of oxen plough is a common practice in the study area with 90% of households using it. The least used technology is tractor services with only 11% of household population. Those using tractors are farmers with large farms above five acres and only hire one during preparation and planting. However, tractor hire services are limited because of cost involved and the nature of the farm size that are small and uneconomical. One ha is ploughed at Ksh. 1500 while the same can be ploughed using oxen plough at Ksh.800. Although tractor is faster, a majority of farmers prefer oxen plough.

The use of the oxen plough is the most dominantly used technology in Makueni district. Its use in Ukambani originates back to 1910 (Perberdy 1958). It started with small holders in Kangundo in Machakos District by 1920s. By 1933, this technology was widespread in the entire Ukambani region to a level, that the colonial administrators feared that the Akamba would plough more land than they could properly manage, resulting in lower yields and soil erosion (Kenya, DOA 1935). Subsequently, the ministry of agriculture by then did not promote ox-plough technology because of these misgivings. By 1970s, use of oxen-plough was now highly adopted in Ukambani. Currently, over 70% of the households in the lowlands of Makueni District use oxen plough. Despite high demand for oxen plough, those households who own a plough are about 52%. Some of the households possess only a plough without the

drought animals or vice versa. Others have neither plough nor oxen and cannot afford to hire the same. Lack of oxen-plough contributed to food insecurity as indicated by bivariate statistical analysis from field survey data $r = -0.366$. The implication is that lack of oxen plough has negative correlation with food security because it contributes to late planting and weeding hence poor yields. Households that own oxen and plough have the advantage of early farm preparation that is critical in semi-arid areas where rains are erratic. A delay of one week is crucial in semi-arid land where crops compete for moisture.

Households also use their oxen plough to generate income by working on their neighbours' farm for pay. The same animals are used to transport farm produce from the fields to the households at a fee. Therefore owning oxen is an advantage to households because of several benefits offered to the owners. Generally, the study area has inadequate implements for developing agriculture that is likely to enhance food security problem in different ways.

5.6.1 Advantages and disadvantages of using oxen plough technology

Advantages

- i. The technology is cheaper and more available than using tractors. A plough cost Ksh 3,500 to 4,500 to purchase depending on the quality and can be utilized for over 10 years. On the other hand, two oxen will cost Ksh 12,000 to 24,000 to purchase. Therefore, a total of Ksh 16,000 to 28,000 will enable a farmer to own a complete set of oxen plough as opposed to Ksh 500,000 required in purchasing a tractor. However, this amount is still not within the reach of many farmers in the study area.
- ii. Oxen plough saves labour and time. A pair of oxen can plough three hectares a day using only three labourers. The same work will take 8 days to be completed by three people using jembe.
- iii. The technology requires little skill as the case of tractor services; people need little training to handle oxen plough.
- iv. A plough digs just deep enough to allow for quick germination of seeds. Few seeds fail to germinate as compared to a situation where planting is done using a tractor. It also retains soil fertility by burying and mixing manure, remnants of maize stacks and any other trash in the farm.

- v. A suitable technology for most topography and poorly cleared farms that cannot be ploughed using a jembe. Some of the topography is unsuitable for a tractor but a plough will perform well.

Disadvantages

- i. This technology is slow and requires more labour than a tractor.
- ii. Bulls are susceptible to cattle disease, theft and shortage of pasture during farm preparation.
- iii. It involves extra hand weeding between the sowing lines.

However, the advantages outweigh the disadvantages hence oxen ploughing remains the key solution to improvement in farming within the lowland areas of Makueni District. Households need financial empowerment to enable them purchase drought animals and plough. Once a family is self sufficient in terms of oxen plough and *jembes*, it becomes easier to improve farm production and subsequent reduce food insecurity. Such implements can also be loaned at a fee to those who do not have. This becomes a source of income to purchase foodstuff.

5.7: GENDER FACTOR IN FOOD SECURITY PROBLEM

While there are significant variations in different countries, overall women in Africa play a major part in agricultural sector through sowing, weeding, application of fertilizers/manure, harvesting, threshing, food processing and transportation. Men are mainly responsible for clearing and preparation of the fields. The women therefore end up overburdened since in addition to their usual farm chores, they are involved in tending small livestock, gathering firewood, fetching water, preparing meals and taking care of their children. This leaves them with inadequate time to devote to off-farm income generating activities that can provide cash to purchase foodstuffs and reduce food insecurity. This informal division of labour is already gender biased because women are over-loaded compared to males.

Results from the study area showed that 60% of the households were jointly managed by females and males (FMHH), 30% were male (MHH) managed (MHH or *de facto*) and 10% were female (FHH) managed (FHH or *de jure*) as shown below.

Table 5.18: Gender management in Household farm activities

Household farm management	Frequency	Percent
Female/male joint management	120	60
Male (de facto)	60	30
Female (de jure)	20	10
Total	200	100

Source: Field Survey Data, 2001 – 2006

The category of household jointly managed appeared to be the majority. Although management was referred to as jointly done, the bulk of farm activities (70%) were performed by women despite the fact that they make limited decision without consulting their husbands. This situation was witnessed during interviews whereby some women did not want to appear as managers of the farm activities in the absence of their husbands. They preferred giving the name of their husband as the respondent although their husbands were not available.

However, some of the females (20%) had full mandate to make decision on farm activities in the absence of their husbands who were working in town or absent because of other reasons. This category of households was more food secure contrary to the perception that women leadership is weak. Despite being over burdened with several domestic duties, women performed better than men as far as household food security management are concerned. They performed well due to financial support received from their husbands as compared to their counterparts who lacked authority to transact farm activities without husband's presence.

Men managed the second categories of household only. These involved cases where the men were in charge of the farm operations. However, they acted as administrators but the women did implementation of farm decisions made. When the men were interviewed, they appeared not knowledgeable on certain farm production activities. It is unfortunate men make decisions for situations that they are not engaged in hence leading to low farm performance and subsequent food insecurity.

The third category was predominantly female managed households. This group comprised of single mothers who are either widows or unmarried mothers. Such households faced problem of finances especially where the female head did not have a stable source of income. Their farm yields were characterized by fluctuations that occasioned food shortages. The few who were financially stable proved to be good managers, and their households were not highly affected by food insecurity. They were also good in finance management as compared to the households that were predominantly male managed which tended to be very extravagant in their management of resources.

Generally, the results points out that over 80% of the agricultural activities in Makeni District are performed by women. Conversely, only 13.3% of the women had full control over their farms to a level of being able to make vital management decisions. This percentage is low compared to men who controlled 61.5% of the farm activities. The implication is that women have little say in the management of farms despite the fact that they dominate most of the farm activities. Though the women-folk in the study area provide labour and manage development activities, they do not have control of the productive assets such as land and capital. Over 87% of the respondent indicated that women are not supposed to inherit land or have land title deeds under their names.

In many cases, property (land) is registered in the name of males, who consist either of the husband or the first-born son. Subsequently, this tradition locks out women from accessing credit facilities due to lack of collateral. This acts as bottleneck to land development because women are not free to invest in land development without their husbands consent. They have little access to credit facilities because this is seen as a male dominated area. They lack access to agricultural inputs, technology, training and extension services that are important in fighting food insecurity.

Women are also marginalized in employment opportunities. Most of the rural off-farms and on-farm employment opportunities favour males as opposed to females. For example, there are few women employed in the extension advisory service that is critical in improving food security. One of the factor-limiting women in employment sector is low education level and

over commitments to domestic and community duties. Subsequently, low education limits women to sources of income and hence higher chances of household food insecurity.

Despite the marginalization and overburden in the semi-arid areas of Makueni, the households headed by women proved to be more food secure than those headed by males. This is contrary to the popular belief that women led households are more food insecure than their male counterparts. The study findings show that although women have low earnings than men, they are better financial managers and better planners in food security issues. They have diversified their sources of income and all their money is committed to promoting household welfare. None of their income goes to luxury or unbudgeted expenditure as compared to their husbands who spend a bigger percentage of their income in matters outside family needs such as buying alcohol, cigarettes and status consumer goods and spending it on female companionship. A Bivariate Analysis from survey data indicates there is relationship between women access to farm production resources and food security $r = 0.364$. Therefore, empowering women financially is a sure way of eliminating food insecurity at household level.

In the majority of cases, women did not participate in decision – making. For instance, women were not supposed to sell livestock without the authority of the husband. They were allowed the freedom to sell the cheaper commodities like chicken, limited cereals and pulses. Property ownership is still biased in favour of males than females in Ukambani. Even for the single widowed women, they often had to consult their uncles and in -laws when they wanted to transact a major business involving development.

Given the necessary support in decision-making and implementation, women can make a significant impact in creating pathways from food insecurity at household level. However, they do need to have accessibility to resources, production inputs and support services in order to increase production. This move is possible through institutional intervention. Women also need to be empowered in property ownership and expansion of sources of livelihoods. When men leave to seek employment during critical period of food shortage, it is the women who tend to bear the burden of a starving family hence need for such empowerment in household management. Furthermore, it will be necessary to break the social – cultural and economic constraints that confront women performance to solve the problem of household food insecurity

in Makeni District. This will go a long way in acknowledging that reducing gender disparities promotes agricultural growth, allow women access to better income resulting in better food and nutrition for the entire household.

5.8: PRE-HARVEST, HARVEST AND POST-HARVEST FOOD LOSSES

Food losses or waste refers to any changes in the availability, edibility, wholesomeness or quality of the food that prevents it from being consumed by people. This includes both qualitative and quantitative losses. Such losses are experienced during pre- harvest, harvest and post-harvest stages. This study looks at food losses from economic point of view and not from agronomic perspective. Food losses is a common phenomenon all the time, so much that one tends to take it for granted and at times it is allowed to go on virtually unchecked.

5.8.1 Pre-harvest losses and their effect on food insecurity

At pre- harvest stage, high losses of food occur through infestation by pests and diseases at farm level, further losses is incurred through grain consumption by birds (such as quela quela, sparrows, starlings, pigeons, doves among others), monkeys, rodents and other small wild animals. It is estimated that farmers in East Africa lose about 40% of their crops to field pests and animals (Ngugi, 1989). According to field survey data from the study area, the most affected farms are at Kibwezi and Makindu divisions because of their proximity to Tsavo and Chyulu National parks. There are a lot of movement of wild animals (elephants, monkeys, antelopes, rabbits, and wild pigs among others) and birds (weaver, quela queal, sparrows among others) from the conservation areas to the settled lands where farming activities are being carried out.

A further cause of food losses at farm level was associated with damage by domestic animals (goats, cattle, sheep, donkeys and chicken) owned by neighbours and themselves. Most of the grain was eaten before reaching maturity. The estimated losses at pre-harvest stage were indicated as follows; about 40% of the households gave an average loss of one third of their farm produce before harvest stage while 44% of them experienced small losses. Only 15% of the sampled households did not experience field losses. The pre-harvest losses were based on average statistics because of lack of measurement techniques as per the scope of this study.

5.8.2 Harvest losses and their effect on food insecurity

Harvest losses occur between the onset and completion of harvest process. This is mechanical losses resulting from shattered mature grain during removal from the farm. Evidence of such losses was displayed as pre-mature germination immediately after rains. Delayed harvest because of labour shortage and exposure to wet weather conditions aggravates losses. This kind of loss was not pronounced to many households and therefore difficult to estimate.

A second type of loss experienced after harvest was excess cooking and consumption at household level. The study observed that households tended to increase ratio of food cooked during bumper harvest regardless of the number of members in the family. This leads to many food remains that goes into waste. At this particular time, families do not realize this kind of waste because food appears to be in plenty especially when maize and bean are gotten right from the farm. However, it was not easy to quantify this kind of waste because 90% of the households start consuming their crop produce right at the farm due to food scarcity. The situation is aggravated by the so-called "African socialism" or generosity where households give food donations to friends, neighbours and visitors before the harvest is done. By the time harvest is completed, a lot of food has been eaten, wasted and donated to friends. This gives a picture of a situation where households lack good management of crop yields to last them to the next harvest hence leading to food insecurity immediately after bumper harvest is realized.

5.8.3 Post-harvest losses and their effect on food insecurity

The biggest problem in the study area was post – harvest losses. To determine this kind of loss, household were asked to give details on the amount harvested and stored in their granaries. Households were also asked to account for the grain that was discarded as spoiled during the storage process. This amount was easily detected when grain was removed from the granary for sun drying. They use a sieve to remove the spoiled cereals and pulses. Other households weigh their bags of grain when storing and when removing for use. The spoiled grain had weevils, beetles and moths and had visibly been damaged by the insects. Field observation was also carried to corroborate information given by household. *Table 4.20* shows contribution of post harvest losses to food security problem in the study area.

Table 5.19: Quantity of food losses at post-harvest storage

Average quantity lost	Frequency	Percentage	Food security status
Over 50%	17	8.5	High food insecure
25%	110	55.0	Moderate food insecure
Below 25%	51	25.5	Food secure
Not sure	22	11.0	Moderate food secure
Total	200	100.0	

Source: Field Survey Data, 2001-2006

About 8.5% of the households experienced heavy post-harvest losses amounting to over 50% of the total harvest and subsequently classified as high food insecure. These households complained of having been duped into using fake pesticides bearing trademarks of established manufactures. Such household incurred huge losses as reported at *Kasikeu* where a number of farmers complained of throwing away approximately 100 bags of 90 kg of maize per household in 1999. A majority of the households (55%) argued that they normally have about 25% of their post-harvest grain going into waste because of poor storage facilities and inadequate application of chemicals due to lack of money. Such households were moderately food insecure. Only 25.5% of the household seemed not to be seriously affected by post-harvest grain losses. These households had good post-harvest management strategies that kept their grain whole for a longer period. Hence, they were less affected by the food security problem.

The percentages outlined in *Table 5.19* accounts for what was stored and removed from storage in good condition. The amount that was discarded by household as unfit for human consumption formed the percentage referred to as losses. This type of loss was noticed when cereals and legumes were removed from store for consumption, flour milling, and sale. Each bag of grain stored without proper treatment with pesticide was found containing infested grain whose status was beyond human consumption. Such infested grains were sieved out as waste. The field results were corroborated with statistics in the district agricultural offices and the results had similarities. Officers from Ministry of Agriculture and Amref-Kenya in Makueni District have also carried a similar survey on post-harvest losses and their findings indicate 40% of grain is lost to pest during storage (unpublished research, district office Makueni).

Therefore, post harvest food storage losses are quite significant for such a district as Makueni, which is frequently hit by dry spells and subsequent famine. Any loss, however small it might be is very significant in solving the problem of food security in semi-arid areas.

5.8.4 Storage Facilities and their effect on food security

Most of the households (45%) used the traditional thatched granaries that are vulnerable to attack by termites, rodents and pests. The traditional granaries used for storing cereals and pulses consist of igloo-shaped, grass-thatched weavers nest like containers known as “*ikumbi*”. These granaries are small, with large spaces that allow rats to reach the stored grain. Rats are dangerous because one can eat 11 kilograms of grain per year and spoil and contaminate 3 times as much according to FAO (1969). Few of the household (10%) had modern roofed granaries with good ventilation as shown in *Table 5.20*.

Table 5.20: Types of storage facilities

Types of granaries	Frequency	Percent
Traditional thatched granary	90	45
Modern thatched granary	60	30
Modern roofed granary	20	10
Inbuilt house store	23	11.5
No place for storage	7	3.5
Total	200	100

Source: Field Survey Data, 2001-2006

Households without granaries have resulted into converting one of the rooms in their house as a store. This group of households who comprised 11.5% argued that their produce is not sufficient to warrant construction of a granary. Their sentiments were shared by 3.5% of the households who did not have any storage facility. The households with poor storage facilities resulted in selling foodstuff immediately after harvest thus contributing to poor post-harvest food management. It was expected that because of the regularity with which crop fail in semi-arid areas, many households would pay adequate attention to having appropriate granaries but this was not the case.

Lack of appropriate storage facilities has significantly contributed to food insecurity because households have a tendency of disposing off their produce for fear that it will be damaged by the great grain borer. This trend left families without adequate stock to last them to the next season and therefore become vulnerable to food insecurity. Households also store grain before proper drying. This led to grain damage by mould. Mould grows on grain, which is stored with moisture or allowed to be wet during storage or left in contact with the floor/unsheltered walls of a food store. These are some of the storage conditions found among the households in the study area. Grain affected by mould cannot be eaten because it contains aflatoxin chemical that is poisonous. The district had cases of people having died while others had been hospitalized and having lost their eyesight because of consuming maize with aflatoxin compounds. However, most of this maize was found to have been transported to Makueni district from other sources. Therefore, improper grain storage only adds to waste and higher chances of food insecurity.

Findings from the study area show that 90.2% of households cannot afford the required pesticides to protect post-harvest grain storage. Most of the grain was subjected to weevil attack because either the farmers did not use any pesticide or they applied the wrong ratios because of inadequacy. Households also complained of buying fake pesticides from unscrupulous chemical dealers. Such chemicals are well packed and labelled such that the common peasant farmer cannot be able to tell the difference. The worst case was witnessed in 1998 *El Nino* episode when household harvested huge yields which would have lasted long. Unfortunately, unscrupulous chemical dealers supplied fake pesticide supposed to have been manufactured by an established company. Households were quick to purchase the same because the prices were fair. They treated their stored grain with fake pesticide that turned out to be a concoction of harmless powder. This contributed to huge waste because weevil to a point of being unfit for human consumption attacked the stored grain. The study area also experienced another blow from a strange invasion of unusual weevil in 2000-2002. This particular weevil destroyed most of the stored maize grain in Ukambani area. It was nicknamed "OSAMA" because of being resistant to pesticides and posing disastrous grain damage. The study area was rendered a food shortage zone at a time when bumper harvest had been realized.

The problem of post-harvest waste is further aggravated by the fact that households no longer practice some of the traditional preservation methods. Traditionally farmers poured ash on the stored grain in a bag, gourd or pot. Ash kills insects by suffocation i.e. insects are unable to breath when coated in ash. One bucket full of ash is recommended for a 90kg bag of cereals and pulses. Ash costs nothing and remains effective against insects for many years. It is easily removed from grain by winnowing and washing and does not have side effects to foodstuffs. The traditional method of preservation was also applied in planting seeds. The best maize cobs were selected and hanged along poles in the kitchen. The idea was for the maize cobs to develop soot coat that could not be attacked by pests. Such grain could last long without being damaged by weevils.

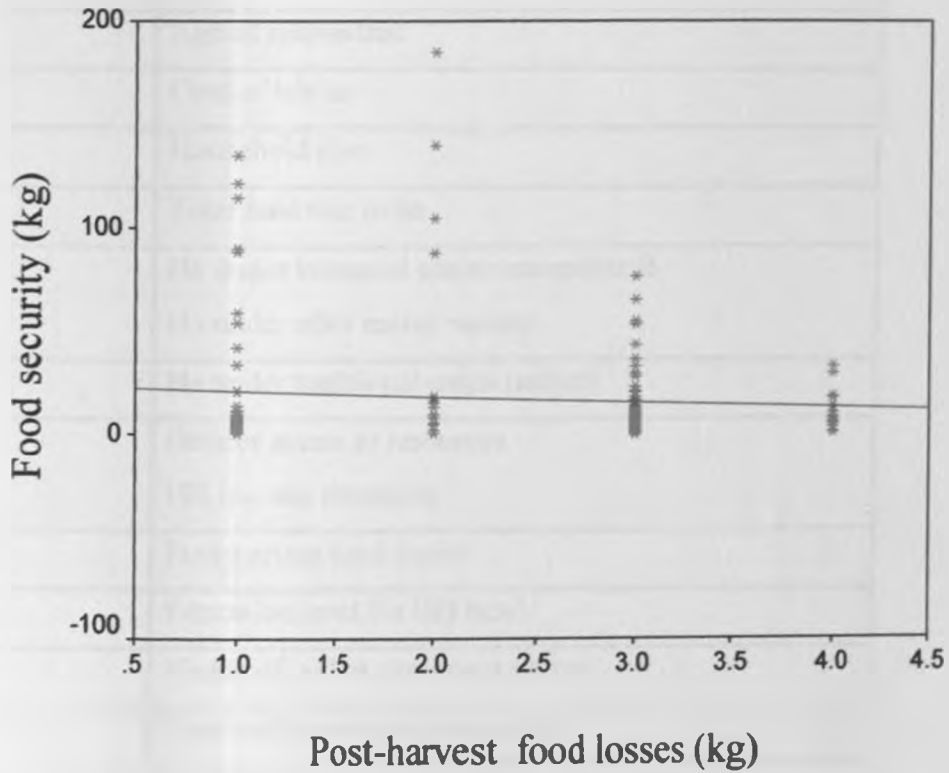
Other methods applied involved use of certain herbs which acted as repellent to pests. The grain was mixed with herbs and sealed in a big guard-using cow dug. Such methods apart from preserving the grain from pest attack also guarded the selected seeds from temptation of cooking. Once treated traditionally, households regarded such grain as unfit for human consumption but useful during planting season. Unfortunately, households are not using these traditional methods anymore, a trend which needs to be reversed.

The reasons why such methods are not in use are simply households embracing modern methods. For example, ash is seen as archaic and tedious to apply. Some households argued that it is not easy to get adequate ash to treat many bags because most of the fireplaces used by the grand fathers as warming and advisory centers are not in existence. Shortage of wood does not allow continuous burning without cooking. Similarly, preservation of planting seeds is no longer done as explained because household lack the kind of traditional thatched kitchen, which ailows accumulation of soot. Soot is today referred as dirt. However, the bottom line concerning lack of traditional preservation is absence of old men and women who were conversant with these processes. Such technology has not been successfully passed from one generation to another. The researcher holds the view that if the traditional methods of preservation were in use, probably it may stem down grain waste and thus promote food security.

Traditional preservation was not applied on cereals and pulses only but extended to other foodstuffs. For example, cowpea's greens were sun dried, crashed and stored in gourds. This ensured continuous supply of vegetable stew during times of scarcity. The Akamba people had also mastered skills of smoking and drying meat to make it last many days. This enabled families to use only the portions sufficient for a daily meal. Similarly, milk was treated with herbs and stored in gourds to last for almost 5 days. They extracted ghee from milk that was used as cooking fat. The concept of proper storage and preservation was therefore highly mastered in Kamba community and subsequently severe cases of food insecurity were not common. However, with modern lifestyle, such preservation methods are regarded as unhygienic and not conforming with modern technology that is expensive and out of reach for majority of the households.

A Statistical Analysis from field survey data on post-harvest losses show that there is significant negative correlation between post-harvest food losses and food security in the study area as indicated by $r = -0.698$. This observation is reflected by simple regression line graph *figure 5.16*, which indicates that, high post-harvest losses lead to quick depletion of grain stock, and subsequently reduces food insecurity. The graph shows that as more food goes in to waste, chances of food security are reduced. This occurs even during bumper harvest when stock is reduced or rendered unfit for human consumption within a short time. Prevention of food losses and waste can result to more household food availability and subsequent minimal food insecurity. It is a pointless waste for a household to allow foods to be spoilt during storage when they can easily ensure that it keeps in excellent condition. This calls for more awareness and financial assistances to put in place the right storage facilities and apply effective preservation methods.

Fig. 5.16. Food security and post-harvest losses



Source: Field Survey Data, 2001 -2006

5.9 STEPWISE MULTIPLE REGRESSION ANALYSIS OF SOCIO-ECONOMIC FACTORS AND TEST OF HYPOTHESES

In order to establish the major socio-economic factors that influence spatial variation of household food security in Makueni District, the following variables were subjected to stepwise regression analysis using SPSS computer programme. The independent variables (Socio-economic factors) were regressed against the dependent variable (food security) to measure the influence of the independent variable.

Table 5.21 Variables subjected to stepwise multiple regression analysis

Variable	Variable Label
V ₁	Age of respondent
V ₂	Cost of labour
V ₃	Household size
V ₄	Total land size in ha
V ₅	Ha under katumani maize composite B
V ₆	Ha under other maize variety
V ₇	Ha under traditional crops (millet)
V ₈	Gender access to resources
V ₉	HH income resources
V ₁₀	Post-harvest food losses
V ₁₁	Education level for HH head
V ₁₂	Yields of millet per season in kgs
V ₁₃	Total cultivated farm size in ha
V ₁₄	% of HHs growing katumani maize variety

Source: Field Survey Sample Data, 2001 – 2006

The Stepwise Regression Analysis ranked the above 14 variables according to the R value of the partial correlation coefficient or strength in determining the variation of the food stock in the study area. The stepwise multiple regression models used has the following components =

$$\beta_0 + \beta_1 + X_1 + \beta_2 + X_2 + \beta_3 + X_3 \dots \dots \dots \beta_{10} + X_{10} + E$$

Where:

- \hat{Y} = Observed food security in kilograms per year
- β_0 = Constant term
- $\beta_1 \beta_2 \beta_3 \dots \beta_{14}$ = Multiple regression coefficients of $X_1 X_2 X_3 \dots X_{14}$
- $X_1 X_2 X_3 \dots 14$ = independent variables as listed above.
- E = Error term

The results obtained from the analysis were as follows:

Variable entered and selected in step one of the stepwise regression analysis holding the other constant was **Households' income in Ksh. per month - V9** with the following computed results.

Multiple R	=	0.886
R Squared	=	0.785
Adjusted R	=	0.782
Standard error of the estimate	=	15.69986
F calculated (statistic)	=	713.566
F Critical at 0.01 significance level	=	6.76
Degree of freedom	=	1,198

From the foregoing analysis, it is noted that household's monthly income from on- farm and off-farm activities had the highest contribution amongst the socio-economic factors in explaining the spatial variation of food security at household level in the study area. When the household's income was correlated with food security, the variable produced a multiple correlation coefficient (R) of 0.886. This statistical figure shows a strong positive relationship between food security and the financial stability of the household. The coefficient of multiple determinations (R^2) was 0.785. This indicates that farmers' income amongst the socio-economic factors accounted for 78.5% of the variation in food security availability and accessibility in the study area. The remaining socio-economic factors accounted for 21.5% of the variation in food security observed. The observed F statistics or computed (713.566) was greater than critical F statistic (6.76) at a significance level of 0.01. This implies that the multiple regressions R (0.886) were found to be significant at 0.01 significant levels.

Statistical interpretation of these results indicates that farmers with income are relatively able to buy farm inputs, employ labour and apply sustainable farm management technologies leading to better yields or purchase foodstuffs during periods of food shortages. Those without income cannot improve food production due to lack of necessary farm inputs (certified seeds, fertilizers, manure, pesticides among others) nor can they access food through purchase. Subsequently, they experience food insecurity because social safety nets are not reliable. Poverty is rampant among the rural farmers within the study area due to limited sources of income. Food insecurity is therefore highly determined by household income, which is a central

factor in improving food security. With less income, household results into disposing off the available food stock at throw away prices. This is followed by selling the family assets hence reducing the entire household into food insecurity status. Therefore, the solution to food insecurity lies with improvement in financial status of the rural households.

The variable entered in step two of the stepwise regression analysis was **production of traditional food crops i.e. millet - V2**. The following results were computed.

Multiple R	=	0.955
R Squared	=	0.912
Adjusted R	=	0.911
Standard Error of the estimate	=	10.06043
F Calculated (Statistic)	=	282.326
F Critical at 0.01 significance level	=	4.71
Degree of freedom	=	2,195

Millet production had second highest contribution towards variation of food security in the study area amongst the socio-economic factors. The multiple R increased from 0.866 on variable entered in step one to 0.955 on variable entered in step two. This implies that there is a strong relationship between traditional food crops such as millet and food security. The coefficient of multiple determinations (R^2) increased from 0.785 to 0.912. This indicates that approximately 91.2% of the variations in the food security among the households in the study area are explained by two variables (Household's income and the production of traditional foodstuffs such as millet) amongst the socio-economic factors. The coefficient of multiple determination (R^2) change shows that millet alone explained 12.7% of the total variation in food security in the study area.

The observed F statistic or computed (282.326) was greater than the critical F statistic (4.71) at 0.01 levels of significance. This implies that traditional food crops such as millet production has significant relationship with food security because the crop is resistant to weather vagaries and subsequently, households which grow millet have higher chances of harvesting better yields compared to those relying on maize only.

The variable entered in step number three was **post-harvest food losses - V₁₀**. The stepwise regression analysis showed the following results.

Multiple R	=	0.976
R Squared	=	0.953
Adjusted R Squared	=	0.953
Standard error of the estimate	=	7.34527
F Calculated (Statistical)	=	171.807
F Critical at 0.01 significant level	=	3.88
Degrees of freedom	=	3,194

The post-harvest losses increased the multiple R from 0.955 to 0.976. Similarly, the coefficient of multiple determinations (R²) increased from 0.912 to 0.955. This implies that post-harvest losses accounts for 4.1% of food insecurity in the study area.

The observed F Statistic or computed (171.807) was greater than the F critical (3.88) at 0.01 significance level. This shows negative relationship between post-harvest losses and food security in the study area. As post-harvest losses increased, food stock decreased thus creating food insecurity. Farmers are exposed to famine not necessarily because of poor harvest, but due to poor storage and preservation methods that depletes their stock such that by the next season, they cannot have grain for consumption.

The variable entered in step number four was **total cultivated farm size - V₁₃**. Stepwise regression analysis showed the following results:

Multiple R	=	0.983
R Squared	=	0.965
Adjusted R ²	=	0.965
Standard error of the estimate	=	6.34563
F Calculated (Statistical)	=	66.936
F Critical at 0.01 significance level	=	3.41
Degrees of freedom	=	4.193

This implies that cultivated farm size has significant relationship with food security. House holds with large farms (12 ha and above) have an advantage of higher yields, because of crop

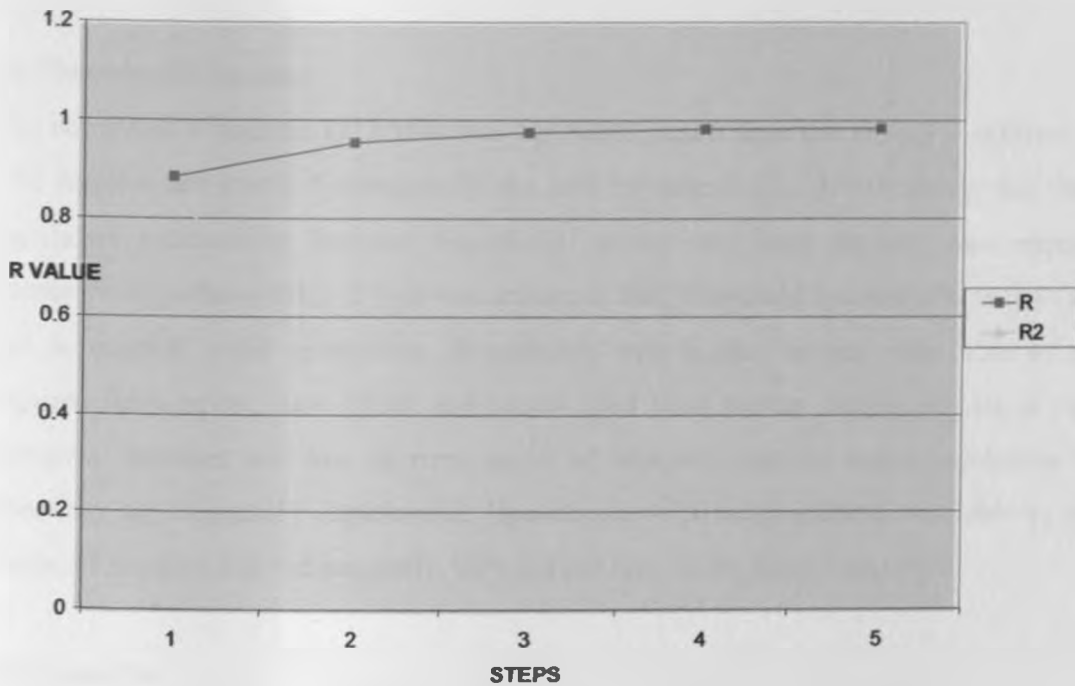
diversification and use of land for other income generating activities. Farm size increased the multiple R from 0.976 to 0.984. The coefficient of multiple determinations (R²) also increased from 0.953 to 0.965. Farm size accounted for 1.2 % of food crop yields and food availability. Subsequently, there is relationship between farm size and food security. The observed F statistic (66.936), was greater than the F critical (3.41) at 0.01 significant level.

The variable entered in step five was **education level of the household head - V₇**

Multiple R	=	0.984
R Square	=	0.967
Adjusted R ²	=	0.967
Standard error	=	6.16134
F Calculated (statistic)	=	12.719
F Critical at 0.01	=	3.11
Degree of freedom	=	5,192

Household education level increased the multiple R from 0.983 to 0.984. The coefficient of multiple determinations (R²) also increased from 0.965 to 0.967. This information is indicated in *Fig 5.17*, which displays only the five significant variables. Education level showed relationship with food insecurity through production and market access. Households with educated heads had managed their farms well and stood better chances of employment or business success compared to the illiterate members. These results indicates that 96.7% of food security problem in the study area is contributed by socio - economic factors namely; house hold income, production of traditional food crops such as millet, post harvest food management, farm size under crop production and level of education of the household head. The remaining nine socio- economic variables subjected to stepwise regression analysis contributed only 3.3% to food security problem in the study area.

FIG: 5.17 R VALUES OF SOCIO ECONOMIC FACTORS



Source: Analysis of Field Survey Data, 2001 – 2006

5.9.1 Test of Hypothesis on Socio-economic factors

First Hypothesis in chapter one stated in null form ($H_0: \beta=0$) assumes that there is no significant difference in food security between households of different socio-economic status, (farmers educational level, household income, farm size and post-harvest food losses). Statistically, if the observed F ratio (computed) equals or exceeds the critical F value, the null hypothesis ($H_0: \beta = 0$) is rejected and the alternative one ($H_1: \beta \neq 0$) is accepted. The stepwise regression analysis for the components of the socio-economic hypothesis was as follows:

(i) Farmers' Educational Level

The computed F statistic (12.719) was greater than the critical F statistic (3.11) at 0.01 level of probability (confidence level). Therefore, the null hypothesis ($H_0: \beta = 0$) was rejected, which indicates that the farmers' education level has relationship with the yields realized from the farm and its management as well as household food purchasing power. Education influences farmers' ability to adjust to new farming technological innovation. The farms run by literate farmers were better managed than those managed by their illiterate counterparts. Similarly,

households with better-educated members had great chances of employment opportunities to improve purchasing power.

(ii) Household's Income

The computed F statistic (713.566) was far much greater than the critical F statistic (6.76) at 0.01 significance levels. Subsequently, the null hypothesis ($H_0: \beta = 0$) stating that there is no significant relationship between household income and food security was rejected. The alternative hypothesis ($H_1: \beta \neq 0$) was accepted; that, household income affects farm activities and subsequent yield production. Households with higher income were able to purchase required farm inputs, hire labour and access food from market during periods of shortages. However, incomes are low in rural areas of Makueni District hence incidences of food insecurity are frequently experienced. Households with better income were able to purchase foodstuff required and subsequently, they did not face severe food insecurity.

(iii) Farm Size

The observed F statistic or computed (66.936) was greater than the critical F statistic (3.41) at 0.01 level of probability. The null hypothesis ($H_0: \beta = 0$) was rejected and the alternative ($H_1: \beta \neq 0$) was accepted. Therefore, farm size has significant relationship with spatial variation of food security in the study area. In areas where farm sizes were small, the household had limited option in crop diversification. The small farms were over cultivated leading to low yields due to nutrient depletion. Conversely, areas where farms were large i.e. Kathonzweni, Makindu and Kibwezi, households managed to harvest good yields during favourable weather conditions. Livestock keeping was more pronounced among households with large farms and subsequently helped to reduce food insecurity risks.

(iv) Post-harvest food management

The computed F statistic (171.807) was greater than the critical F statistic (3.88) at 0.01 significance levels. Subsequently, the null hypothesis was rejected and the alternative was accepted. Post-harvest food management has strong relationship with food security. Many food losses were incurred during storage thus contributing to food insecurity in the study area. Poor storage facilities and preservation methods has contributed to grain losses. Therefore, the null hypothesis ($H_0: \beta = 0$) based on socio-economic factors was entirely rejected and the

alternative one ($H_1: \beta = 0$) was accepted. This implies that socio-economic characteristic of the households has strong a relationship with food security problem in the study area. Household cannot make certain important decisions aimed at increasing food security simply because of lack of money, low education and lack of adequate land. Subsequently, there is need of improving socio-economic conditions of households to enable them produce and purchase adequate foodstuffs.

Table 5.22: Summary results of stepwise regression analysis on socio-economic factors

Variables no	Variable label	Multiple R	R square	R ² change	Simple R	Standard error of the estimate	Beta	Computed F	D.F	Critical F at 0.01 significance level
9	HH income resources	0.886	0.785	0.785	0.886	15.699986	0.886	713.566	1,196	6.81
12	Yield of millet per season in kg	0.955	0.912	0.127	0.781	10.06043	0.426	282.326	2,195	4.75
10	Post-harvest food management	0.976	0.953	0.041	0.696	7.34527	0.244	171.807	3,19	3.91
13	Farm size	0.983	0.965	0.012	0.839	6.34563	0.183	66.93	4,193	3.44
11	Education level	0.984	0.967	0.002	0.708	6.16134	0.149	12.719	5,192	3.14

Source: Analysis of Field Sample Survey Data, 2001 -2006.

5.10 CONCLUDING REMARKS.

Our research findings concur that food security is a significant problem within the study area. Farm production cannot meet household demands. Production of traditional food crops have substantially declined because of negative perception and attitude due to lack of extension advisory services. The majority of households cannot afford to purchase adequate food from the market due to low income and limited sources of income. Low income among households has negatively affected farm size, labour and farm technologies. Social characteristics of the households have also affected post-harvest food management and hence contributed to food insecurity. A high percentage of post-harvest losses have contributed to food shortages

immediately after bumper harvest. Subsequently, socio-economic factors are significant to food security problem in semi-arid areas of Makueni District

CHAPTER SIX

ANALYSIS OF THE IMPACTS OF THE INSTITUTIONAL FACTORS ON FOOD SECURITY PROBLEM IN SEMI ARID MAKUENI DISTRICT

6.0 INTRODUCTION

This chapter examined food security through government and non-government intervention in food production, purchase and distribution in the study area. It analysed the effects of institutional intervention on food production support services such as farm inputs, extension services and credit facilities. The chapter has also examined government and non-governmental intervention on food relief supply, distribution and their effectiveness in addressing food security problems. Finally, the chapter assessed the status of road transport in the study area and how it affects accessibility and distribution of food, farm inputs and food price fluctuations in the study areas. Accessibility to water facilities has been examined along side the infrastructural facilities to determine man-hours spent in search of water and how it affects food security. The field survey results were presented in qualitative and quantitative analysis. Simple regression analysis was concurrently used with qualitative approach to present the findings. Thereafter, the Stepwise Multiple Regression technique was applied in order to provide an in-depth analysis and testing of the hypothesis on institutional factors. Finally, stepwise multiple regression and principal component analysis were applied to analyze socio-economic and institutional factors combined.

6.1 KENYA'S NATIONAL FOOD POLICY: ACHIEVEMENTS AND FAILURES.

Efforts to implement food policies in the sessional papers discussed in chapter one, were affected by external forces in the name of Structural Adjustment Policies (SAPS) which pushed for a liberalized economy. These changes led to further complication in the national food policy and food security. The international financial community insisted that governments adjust their spending and restructure public enterprises. This led to a number of measures being taken such as the cutting of social welfare spending, removal of government subsidies on agricultural and livestock services, readjustment of exchange rates downwards, and more emphasis on investment in export crops. Subsequently, the Government was put in a dilemma because as it

emphasized on self-sufficiency, it also focused on increasing cash crops that are confined into specific areas. In this state of dilemma, Kenya Government embraced policies that were more biased towards cash crops production in the arable areas as compared to food crop production in semi-arid areas. This led to more production resources being channelled to the productive areas while the less productive areas continued to slide into food shortages

6.1.1 Effects of Structural Adjustment Policies on food security

The policy instrument for achieving food security used to be tight government control of maize marketing under the auspices of National Cereals and Produce Board (NCPB). NCPB had the monopoly over all grain and as such only two bags of maize could be transported within the country without authorization until 1992. Prices were also fixed by the Government to control fluctuations within and between regions.

By 1993, the marketing of maize among other grains was decontrolled. The liberalization of agricultural markets and the commercialization of NCPB forced the government to rethink its food security policy, not primarily, because the objectives had lost their relevance, but because the instruments for implementing the maize market control policy were no longer available. The solution chosen was to encourage the development of the private sector to play the major role in all aspects of maize marketing. The idea was to ensure that the liberalized market could and would operate smoothly, whilst at the same time providing food security safety-net measures through government bodies and NCPB. The NCPB was given the task of ensuring maintenance of strategic maize reserve of up to three million 90kg bags.

The general impact of grain marketing liberalization on producers and consumers in Makueni District has been mixed. On the one hand, liberalization has been a blessing to the semi-arid areas because many players in grain marketing have emerged thus creating competition and subsequent fair prices. We have inter-regional movement of maize from areas with surpluses to areas with demand. A case in point is that maize grain is transported from Rift Valley to Makueni District. Other sources of maize grain are Tanzania via Taveta and Loitoktok. According to information collected from households in the study area, many households acknowledge that there is more maize supply in the market than it used to be when the market was controlled by NCPB. On the other hand, households were quick to point out that

liberalization has not solved the problem of food security because sellers have been inflating prices under the pretext of high transport costs. The principle of market forces shows that, whenever demand of main grain is high, the price goes up to the disadvantage of the poor rural households. Instead of competition pushing prices down, the maize traders have formed cartels to ensure prices are high to maximize their profits.

Farmers are quick to dispose their grain immediately after harvest when prices are depressed due to need of money for domestic expenses. At this particular time, the demand is low because nearly all households have some reasonable harvest to keep them food secure. However, the same households selling food stock at throwaway prices are later forced to purchase the maize grain after 3-4 months, at high prices when their stock is depleted as earlier discussed in chapter five. In the pre-liberalization period, chiefs had authority to discourage the sale of maize by small-scale households immediately after harvest. Area chiefs would inspect local market centers to deter such sales using the chief's Act. The idea was to force households to store their grain for a longer time to ensure adequate consumption. This policy was rendered null and void with liberalization of the grain market.

Households are now free to dispose off their stock as they wish. When the harvest is good, traders come from different parts of the country to purchase grain in large quantities at low prices for markets in the major urban areas thus leaving households with little stock for domestic consumption as discussed earlier in chapter five. Subsequently, households revert to a food shortage position within a short period after harvest. By the time the next harvest is realized, most of the families are already food insecure, not because of low yields or failure of rainfall, but simply because of poor post-harvest management of food stocks.

SAPs have also affected livestock production by privatization of veterinary services and cattle dips. Livestock are used as an alternative source of food because households in the semi-arid areas of Makueni district draw their livelihood from agro-livestock economy. Consequently, the removal of government subsidies on veterinary services such as disease management and ticks control increased the risk of livestock mortality. The small-scale farmers who are unable or unwilling to pay the market prices for these services that were previously given free of charge or subsidised, were most highly affected by being left under the mercy of veterinary

officers and other incompetent unscrupulous people who want to take advantage of the uncontrolled service delivery. Because livestock operate like a savings account that buffers many households against the effect of drought and crop failure, high mortality rates of livestock have further endangered households' livelihood. This has subsequently, reduced household's options to control food insecurity through sales of livestock and their products. There is need to revert to government management of cattle dips and other veterinary services so as to prevent farmers from being exploited and offer the needed services. The government should also be careful not to embrace all policy changes emanating from developed world as seen with SAPs. Such policies may not work in Kenyan situation as already witnessed by failure of SAPs

6.2 INSTITUTIONAL INTERVENTION ON FARM INPUT SUPPLY AND THE EFFECT ON FOOD SECURITY

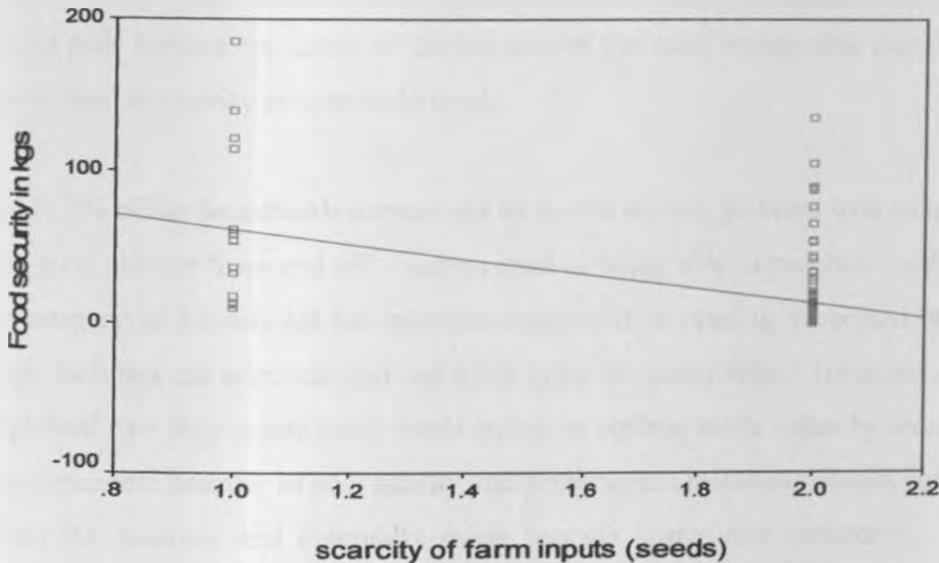
6.2.1 Certified seeds and the effects on food security problem

Households in Makueni District have been faced with shortage of certified seeds especially Katumani maize variety and beans due to financial limitation and lack of credit facilities. Bivariate analysis of field survey data showed lack of seeds had negative correlation with food security ($r = -0.332$), implying that many households did not plant at the right time; or used poor seeds, hence low yields as indicated in *Figure 6.1*. Findings from the study area shows that many households have abandoned the traditional methods of seed preservation from their farms that used to guarantee seeds during planting as discussed in Chapter Five. Currently, seeds are available in the market but the cost is too high for a majority of the farming households. For instance, certified maize seeds cost ksh.350 – 500 per 2 kg packet while bean seeds cost ksh.400 – 500 per 2 kg packet in the local agro-chemical shops. These prices are too high for the majority of the rural households whose income is low and government intervention in seed price control is no longer applicable.

Other planting materials that are scarce are cassava, sweet potatoes, pumpkins, sorghum and millet. Such crops are not popular with farmers hence their seeds are rarely available, even within the agro-chemical shops. Institutional intervention is viewed from management in supply and distribution of seeds at affordable prices. For instance, the International Fund for Agriculture and Development (IFAD) has been involved in the promotion of traditional food

crops by providing seeds, but adoption rate has been low due to negative attitude and perception by farmers. This problem is attributed to poor extension advisory services as discussed in later parts of this chapter.

Fig. 6.1. Food security against farm inputs



Source: Analysis of Field Survey Data, 2001 – 2006

The problem of effective use of certified seeds partly started with privatization of seed production and marketing. Prior to the decontrolling of the seed industry in 1996, the government regulated the production and distribution of certified seeds by granting the Kenya seed company monopoly status over marketing. With privatization, many other players have appeared in the seed industry and price determination is now the responsibility of the seed market / industry. The assumption of privatization was to remove monopoly by allowing many players to join the seed industry but the situation appears different because prices have been fluctuating upwards especially during planting season when demand is high. The situation is worsened by emergence of unscrupulous seed dealers who are selling and distributing fake certified seeds which do not germinate or if they do, their yield characteristics are poor contrary to information given about their performance. Therefore, households realize low yields because of using poor seeds hence perpetuating a state of food shortage.

By the time rains start, many households (78.5%) have no seeds to plant because of lack of money to purchase them. Sometimes there is shortage of seeds in the nearby markets. The

problem is most acute after dry spell is experienced followed by scarcity of food. Households are forced to consume the preserved seed stock because of famine thus leaving insufficient seeds for planting. Similarly, the household finances are diverted to food purchase and little is left to purchase seeds. This leads to household not being able to plant at the right time or their failing to plant certain crops especially beans because they cannot afford to. Subsequently, this leads to poor harvest regardless of the success of the rainy season and subsequently a vicious cycle of food insecurity at household level.

Only 21.2% of the households seemed not to have a serious problem with planting seeds due to either good storage from end off – season seed or being able to purchase seeds when required. This category of households has members employed or running successful businesses. Their storage facilities are adequate and can keep grain for many days. However, such households complained that they waste many seeds trying to replace seeds eaten by rodents. Other seeds fail to germinate because of poor quality and preservation methods. Hence, constant re-seeding reduces the reserves and eventually seeds become scarce and expensive. Ultimately, this affects farm produce leading to food shortages.

Families that cannot afford to purchase seeds have been relying on donations from government, NGOs, churches and well-wishers. Some of the NGOs who have contributed significantly towards distribution of seeds and recovery process are World vision, German Technical Aid Agency (GTZ), German Afro-Action (GAA), Danish International Development Agency (DANIDA), Africa Medical Research Foundation (AMREF), International Fund for Agriculture and Development (IFAD) and CARE- Kenya among others. Table 6.1 show the distribution of seeds during 1995-1997 when farm production was low.

Table 6.1 Seed Distribution to farmers in Makueni District by donor organization 1995 – 97 in Makueni district

Type of seed	Year/donor in metric tonnes ('000)					
	1995		1996		1997	
	W.V	KFC/GAA	KFC/GAA	W.V	KFC/GAA	DANIDA
Maize	20	30	30.4	18	30	11.2
Beans	13	7	30.4	7	30.6	0

Source: Makueni District Agricultural Office, Annual Reports

KEY: KFC - Kenya Freedom from Hunger Council. GAA – German Agro-Action
WV -World Vision. DANIDA – Danish International Development Agency

Table 6.2 Seed distribution to farmers by GOK under drought recovery programme 1992 – 97 in Makueni district

Seed type	Amount distributed in metric tonnes('000)					
	1992	1993	1994	1995	1996	1997
Maize	52.3	5.0	105.0	63.5	120	35
Beans	4.8	226.0	21.0	15.0	80	30
Cowpeas	12.7	3.0	4.5	3.0	10.0	5.0
Sorghum	2.2	10.0	12.8	5.0	5.0	5.0
Millet	5.5	0	7.0	5.0	0	2.0

Source: Makueni District Agricultural Office, Annual Reports

The table reveals some efforts made to enable household access seed through donations. However, this system has not been effective because of malpractices perpetuated by the provincial administration charged with the responsibility of seed distribution. Farmers complained that seeds do not reach the deserving households because of being diverted for commercial gain. Secondly, the types of seeds given to the households do not conform to the environmental conditions. In addition, more emphasis is given towards distribution of maize seeds at the expense of the traditional crop seeds i.e. sorghum and millet. There is need to reverse the trend and supply more seeds for traditional crops to encourage and promote their production in the study area. Government and non-governmental officials at district level

charged with responsibilities of drought recovery strategies supported this view. These officials felt that distribution of free seeds of sorghum, millet and cassava would encourage more household to grow them. The seed aid operations involved many institutions that were often uncoordinated and lacked expertise in local and national seed and crop systems. Consequently, this approach has remained ineffective in addressing the real constraints affecting the seed systems of resource-poor farmers in the study area. This was evident in 2001 when 15200 households in the district were in need of seeds and only 4600 (30%) were supplied with seeds (*Republic of Kenya, 2002-2008*). Assuring a strategic and reliable source of appropriate seeds should be part of the Government's food security strategy. This is one of the possible strategies towards improvements on food security at farm level.

In the case of dry land crops such as traditional food crops, farm households in the study area obtain their seeds from local sources, especially own-saved seeds, social networks (relatives and other neighbouring farm households) and local traders (shopkeepers and open-air market grain traders). Local traders also play a key role in rural communities by purchasing grain at harvest; storing it and selling it back later to the same farm households either as food or as seed at planting time. These already existing local seed institutions are critical to the livelihoods of the marginalized and poor households in the supply of food and seed grain. The desire by humanitarian agencies to assist vulnerable households in response to disaster can undermine these institutions and interfere with the coping mechanisms and livelihoods of the people in the community.

6.2.2 Institutional interventions in fertilizer and manure supply and their effect on food security

Fertilizer and manure are part of farm inputs that are important in improving crop productivity. Institutional intervention in the provision of fertilizer and manure is viewed, as a way of enabling farmers to have access to such farm inputs and obtain the necessary education on their utilization. Results from the study area indicate that use of fertilizer is very low due to the poor resource base and lack of information flow on importance of fertilizers in the district. Only 12% of households interviewed use fertilizers. These were mainly found in Kasikeu and some parts of Wote divisions. About 88.0% admitted that they had never applied fertilizers in their

farms partly because of lack of money to purchase the same or lack of information from the extension officers on importance of fertilizers. It is too expensive to invest in fertilizer utilization within semi-arid areas where farm productivity may be constrained by unfavourable weather conditions. In the absence of agricultural education and advice by the extension officers, households regarded fertilizers as input reducing soil productivity instead of increasing the same.

Nevertheless, an overwhelming majority (81.5%) of households prefer using manure instead of fertilizers because they are more familiar to manure application. It is also economical to use manure in areas where rainfall is unreliable. Manure improves the structure of the soil, minimizing damage from water splash and improving water retention hence farmers who had applied sufficient manure realized better yields (50% improvement). This improvement was reflected in bivariate statistical analysis from field survey data which showed positive correlation ($r = 0.310$) between manure utilization and crop yields. The only problem faced is shortage of farm manure caused by decreasing number of livestock holdings because of lack of grazing land.

Smaller farms and shortage of grazing pastures have further contributed to fewer people keeping draft oxen because they have no adequate areas to graze. To get manure, households go to purchase from the pastoral Maasai community in the neighbouring Kajiado District. However, only few households can afford transport cost of manure from such sources. Transportation of manure from the supply point to the farms is also limited by the poor rural access roads. Government intervention in improving road network is poor in the study area as later discussed under this chapter.

In the absence of inorganic fertilizers and manure, households practiced traditional soil fertility management strategies including crop residues, cereal/legume rotation and inter-cropping. Fallowing which is a traditional soil fertility maintenance practice, is not practiced due to continuous increase in both human and livestock population putting pressure on the land available. Some International agencies like DANIDA have tried to fund projects like the Makueni Agricultural Project (MAP), which has tried to assist farm households in preparation

of composite manure to boost soil productivity. However, low educational level among households has been a hindrance towards embracing such technologies.

The best strategy for food security and sustainable agriculture is a strategy of augmenting traditional soil-enrichment practices with moderate amounts of inorganic fertilizer. There is no doubt that lack of proper use of either inorganic and organic fertilizers has significantly led to low yields and subsequently, food security problem in the study area which is already facing soil degradation problem.

6.3: INSTITUTIONAL INTERVENTION ON CREDIT / LOAN FACILITIES AND THEIR EFFECTS ON FOOD SECURITY

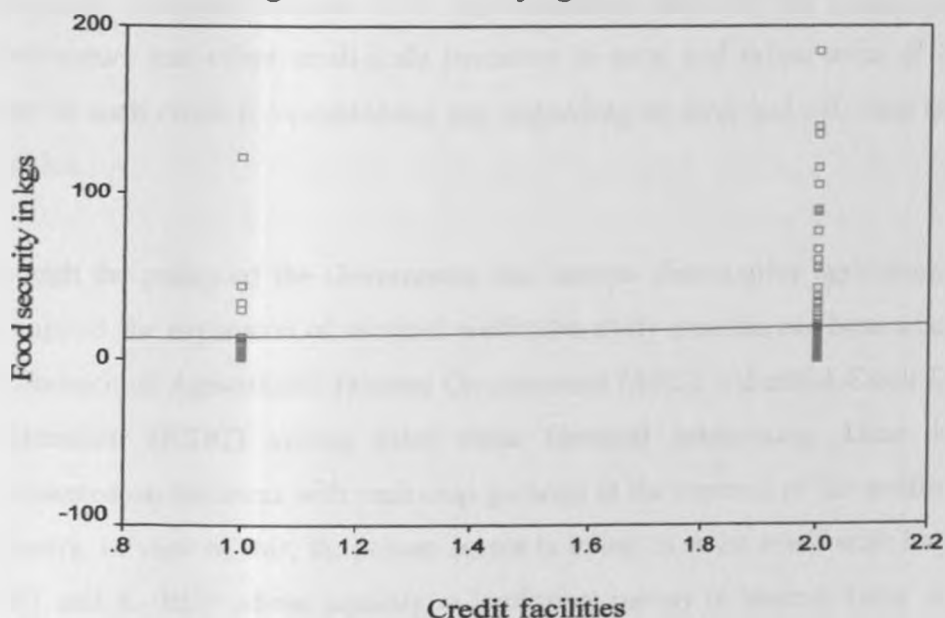
Effective use of farm inputs requires access to adequate financial resources through seasonal and long-term credit programmes. Therefore, the role of public and private institutions is important in provision of credit facilities. Unfortunately, for the last three decades, rural credit has been left to the private sector in a system where liberalization and the creation and enforcement of banking act in the financial sector, has left farmers and the rural sector starved of both credit and financial services. This is created by lack of government support on credit facilities to small-scale farmers despite the poverty level experienced in rural semi-arid areas of Makueni District.

Results from the survey conducted in the study area shows that about 94% of the households have never received farm input on credit or at subsidized pricing. Similarly, 99% of the households have never received agricultural loan facilities or any other form of finance from the government. This inaccessibility to loans and credit facilities was attributed to lack of information on where to get such financial assistance as well as lack of collateral security due to lack of title deeds. Some of the households expressed fear of getting loans because of the marginal productivity of the area that cannot guarantee repayments.

However, 75.8% of the households agreed that, given credit facilities in terms of farm inputs or loan would improve food crop production and increase investments in other sources of income in the study area. This is clearly shown by regression analysis where credit facilities indicated positive correlation with food security as $r = 0.304$. Similarly, the regression line shown in

Figure 6.2 gives a clear indication that increase in credit facilities towards food production leads to improvement in food security at household level. Provision of capital can lead to improving farm activities, engaging in soil and water conservation, promoting small-scale business aimed at increasing income and promoting “Jua Kali” sector. All these activities will increase household income that can be used in food crop production and food purchase from market hence reduce food insecurity at household level.

Fig. 6.2. Food security against credit facilities



Source: Analysis of Field Survey, Data, 2001 – 2006

Credit facilities were scarce in the district and this contributed immensely to low investment capacity of the people. There are only a few finance institutions in the district (i.e. Kenya commercial banks, equity bank and Kenya Rural Enterprises) that cannot adequately help small-scale farmers with loans due to stringent regulations in lending. Although banks appear to be relaxing their lending conditions, the interest rates are still high for the common person in the rural areas. This has been a draw back to investment growth in the district because mobilizing savings for income generating projects is difficult in the rural semi- arid areas.

In view of this constraint, Kenya Women Finance Trust (KWFT) has now established an office in the study area, which is giving small loans to women entrepreneurs through organized

women groups at reasonable rates. Kenya Rural Enterprises (K-Rep) micro finance has also established two rural banks that support small-scale business enterprises aimed at creating and increasing rural income. Kenya Industrial Estate (KIE) is the only government financial institution that used to finance small-scale business people but its services collapsed because of mismanagement. However, these facilities though very integral in alleviating food insecurity, they only tend to serve a very small population of the district households because of high interest rates. A majority of households in the rural areas have not yet familiarized themselves with the concept of borrowing funds to invest in agriculture. Lack of information about availability of these facilities is a big bottleneck hence it has denied potential farmers, entrepreneurs and other small-scale investors in rural and urban areas of Makueni district, access to such credit for establishing and expanding on-farm and off- farm income generating activities.

Although the policy of the Government has been to decentralize agricultural finance system and support the expansion of informal credit, the study area has not been a beneficiary. There is no branch of Agricultural Finance Co-operation (AFC), Industrial Credit Development and Co-operation (ICDC) among other state financial institutions. These institutions have concentrated on the areas with cash crop growers at the expense of the small-scale subsistence producers. In view of this, the private sector is trying to assist small-scale households through KWFT and K- REP whose capacity to lend more money is limited. Other organizations like NGOs have come up to assist small scale rural households by creating village credit associations which provide small loans to individuals who have organized themselves as mutual guarantee groups (solidarity groups). Fellow committee members give members the small loans under guarantee. Donors normally provide the seed money. Makindu Division is one of the beneficiaries under NGO'S sponsorship such as Pride Africa. Women are the target and are registered in groups of around 15 members.

Each village credit association accumulates and invests its own funds derived from fees, savings and interests paid by members. Credit from the village credit association is extended to individuals after approval by the individual's solidarity group peers and the entire membership of the association and is based on their assessment of the applicant's ability to carry out the undertaking and pay back the loan. It has worked in several countries such as Zimbabwe, India

and Malawi where women are empowered to generate income to fight food insecurity. Farmers are able to invest in bench terracing, cut-off drains among other methods of soil and water conservation aimed at increasing productivity. Therefore, food insecurity will be minimized if households have access to credit facilities that will boost farm production as well as improve other sources of income to empower households economically.

6.4: INSTITUTIONAL INTERVENTION IN EXTENSION SERVICES AND THE EFFECTS ON FOOD SECURITY

Field survey results show that an extension officer has never visited 89.0% of the households in their lifetime. About 4.5% of sampled households have been visited once and 4% visited twice a year. Only 2.5% of the households have managed to access extension services four times a year after personally making effort to transport them from their offices to farms (see table 6.3). These categories of farmers are mainly food and horticultural producers. Their farms are doing relatively well as compared to those where extension services are lacking. Statistical analysis from field survey data shows that extension advisory service work has positive strong correlation with food security as indicated by $r = 0.396$. This observation is further supported by regression graph *Figure 6.3* which shows that increase in extension advisory services will lead to boosting food security

Table 6.3 Frequency of visit by extension officers

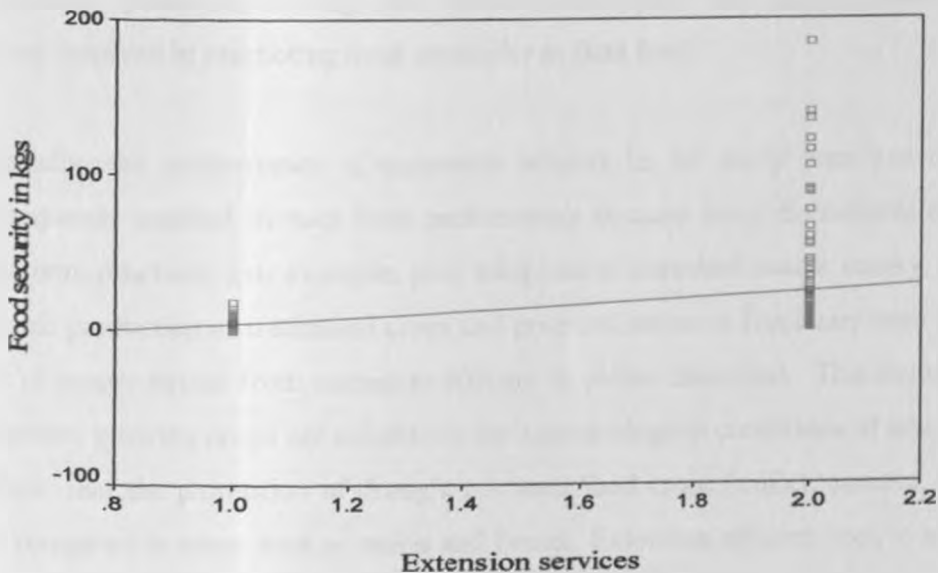
Frequency per year	respondents	percent	Cumulative percentage
Never visited	178	89.0	89.0
Once	9	4.5	93.5
Twice	8	4.0	97.5
Four times	4	2.5	100.0
Total	200	100	

Source: Field Survey Data. 2001- 2006

Agricultural extension is important in the dissemination of relevant and up to date technologies to farmers. Extension service providers enlighten farmers' in the best way of utilizing farm inputs. Similarly, farmers are advised on viable decision making on credit facilities, market produce and consumer prices. It is the responsibility of extension officers to create awareness

of new ideas and their practices. After becoming aware, an individual becomes interested in the new technology i.e. how it will help them and how it will work. Therefore, from their awareness, farmers become interested and stimulated to seek more information. Transfer of information will not occur if the person decides not to adopt the technology. Subsequently, the extension has the function and responsibility to provide sufficient information so that the farmer can make a knowledgeable decision. Unfortunately, the activities carried by most of the extension service providers often do not consider the priority demands of the farmers. Although KSPFS has emphasized empowering farm households to identify their priorities and make demands on services they need to solve their problems, the extension service providers do not work in collaborative manner to respond to the farmer's demands. Demand from the farmers fall under different categories such as information, new technologies, credit, and value addition to produce and marketing system.

Fig. 6.3. Food security against extension services



Source: Analysis of Field Survey Data, 2001 – 2006

Consequently, the performance of extension officers is poor in the study area and government intervention is lacking. The situation was complicated by the fact that 93.3% of the household heads had no agricultural training, despite government emphasis on informal farmers' training at Farmers' Training Centers (FTCs). In the absence of informal education, 83.3% of the households in the study area rely on their neighbours' skills while 64.5% operate on trial and

error methods and only 34% have learned through radio programmes, knowledgeable farmers and chiefs barazas. Makueni Agricultural Project (MAP) funded by DANIDA has tried to assist farmers with extension services through Community Based Organizations (CBOS) in selected areas of the district. MAP has managed to train groups of farmers so as to pass the same information to the rest. This approach has worked but those trained lacked capacity to hold field demonstration to their fellow farmers. The best method is farmers' tours to areas where solutions to their demands have succeeded because they learn faster from other succeeding farmers than extension providers.

Information gathered from the household heads indicated that most extension officers no longer visited farmers, but operate from divisional offices. Lack of supervision from the District Agricultural Office (DAO) has enhanced laxity among officers on the ground. Households manifested anger and despair because they claimed that unless the extension officers are bribed, they are not willing to offer services as per their job description. The officers are lacking well-formulated system of reaching rural farmers, identifying their problems and enlightening the factors involved in promoting food insecurity at farm level.

Generally, the performance of extension officers in the study area was discouraging and subsequently resulted in poor farm performance because many households did not apply the right farm practices. For example, poor adoption of katumani maize variety, negative attitude towards production of traditional crops and poor utilization of fertilizers were partly because of lack of proper advice from extension officers as earlier discussed. This has really contributed to farmers growing crops not suitable to the agro-ecological conditions of semi-arid areas. It is pathetic that the promotion of drought resistant food crops (millet, cassava, sorghum etc.) is low compared to crops such as maize and beans. Extension officers need to advise farmers on better methods of processing and storing traditional foods to increase their appeal to consumers. It will require food preparation trials and introduction of different dishes to consumers with a view to changing food-eating habits to enhance food security. This can be achieved with efficient extension advisory services, which includes the role of nutritionists in the ministry of agriculture.

However, when asked about their appalling performance, the extension officers gave their version of the story. They argue that their operations are constrained by inadequate financial resources since introduction of the Structural Adjustment Policies in Kenya. The SAPs have led to reduced donor funding and national budget allocation has gone down leading to most of the field vehicles being grounded. The extension officers complained of poor roads and lack of accessibility to some areas of the district. Their numbers have also declined following government policy on freezing civil service recruitment. This has led to poor staff-farmer ratio that currently stands at 1:1479 (Table 6.4) thus making it impossible to serve farming population in the study area effectively.

Table 6.4 Extension officers' statistics in the study area

Division	Estimated area sq. km	Estimated population	Estimated no. of farm families	Staff-farmer ratio
Wote	2183	163,000	20,380	1:1451
Kibwezi	2241	148,000	18,500	1:1542
Makindu	1159	40,000	5,000	1:1259
Kasikeu	1200	122,000	15,250	1:1386
Kathonzweni	2400	120,000	16,300	1:1631
Total	9183	593,000	75,430	1:1454

Source: Annual District Agricultural Report 2002

There is serious understaffing in the field of agricultural extension despite the fact that, the key to increased agricultural production lies with nation's ability to disseminate relevant information to the farming community. Accordingly, there is need to have a strong extension service to constantly update the farmers on new development in the fields of pests and disease control to reduce crop damage, agro-chemical application, use of better seed varieties, weed control, soil fertility management, farm organization and management, post harvest management among others. Proper management of these problems will definitely lead to reduction in food insecurity. Extension services can also help households to prepare production and financial plans for their farms, then recommend to credit and financial institutions to issue loans to individual farmers based on these farm plans. Once the loans have been given to

farmers, extension workers can help farmers to utilize effectively the loans for the purpose intended.

Therefore, it can be noted that, the key to a successful extension service lies in its ability to facilitate communication between the officers and the farmers. Hence, it is necessary to speed up mobility for these extension officers through provision of motorbikes where roads are not good. Vehicles should be made available to enable the officers to move as a team. Training and employing large number of women as extension workers will assist greatly in solving the problem of food insecurity at household level, because women workers are likely to assist their fellow women in rural areas to promote farming. Agricultural curricular extension programmes needs to be re- oriented to reflect the reality of the roles of men and women farmers in the agricultural sector.

6.5: INSTITUTIONAL INTERVENTION IN FOOD RELIEF SERVICES AND THE EFFECT ON FOOD SECURITY

Food relief services is coordinated by the Government of Kenya (GOK) office of the president (OP) through Famine Relief and Rehabilitation Programme (FRRP), Drought Preparedness Intervention and Recovery Programme (DPIRP), Famine Early Warning Systems (FEWS), Famine Relief Committee (FRC), Food Security and Drought Monitoring Secretariat (FSDMS). International organizations such World Food Organization (WFO) and Food and Agricultural Organization, Non- governmental organizations and religious organizations have also played key role in food relief distribution. For example, the government (55.7%), churches (11%) and NGOs (5%) supply food relief in Makueni District among other donors (Unpublished Reports, Makueni District Agricultural Office). These percentages only represents what is documented otherwise several other donors have been involved in food relief distribution without coming into public. All these bodies aim at assisting victims of drought and other hazards that may need food relief and other rehabilitation measures. The organizations under OP have coordinating committees right from location to national level to monitor situations of food shortages.

However, despite having elaborated system on how to monitor development of food insecurity, things have not worked positively because intervention measures are normally carried out

when cases of food insecurity are highlighted through electronic and print media. Often, authorities have been seen moving to distribute food in a haphazard manner yet there is a system to monitor changes leading to food shortages. The subsequent results are use of huge resources but little accomplishment in solving food security problem because households receive food relief when it is too late after undergoing suffering from food shortages.

Several requests for food relief have been made from public and private institutions, though without clear baseline information to quantify the levels of food needed at household level. The framework to monitor food deficits from one division to another or one household to another in the same district is weak. For example, the organs dealing with food insecurity should be on alert when environmental indicators show unusual fluctuations outside expected seasonal ranges. This occurs within the entire district or within localized parts of the marginal areas of the district. This also happens when assets levels of households are still too low to provide an adequate subsistence level and vulnerability to food insecurity is still high. The situation is alarming especially when environmental and agricultural livestock indicators fluctuate outside expected seasonal ranges affecting the local economy of households. Such conditions are common in the lowland areas of Makueni district and threaten the food security of households who consequently require assistance in food supply. The situation may deteriorate to emergency levels when all indicators fluctuate outside normal ranges. In such a situation, local production systems have collapsed as well as the dominant sources of livelihoods within the affected areas.

Consequently, the situation affects the assets status and purchasing power of the households to an extent that their welfare levels have been seriously worsened resulting in famine threat. Subsequently, the situation calls for immediate food relief services to minimize hunger. Droughts are not abnormal in semi -arid areas but what are lacking are effective methods of monitoring food security and recommending appropriate actions in time.

6.5.1 Monitoring and Early Warning Systems.

The early warning programme is based on the assumption that food insecurity occurs from a lack of information that would bring about early intervention. Some of the information that is considered important relates to signals that could result in either shortages or excess supply of

major food commodities. This is obtained from data on input availability, use and distribution difficulties, land preparation and planting; germination and growth, monthly weather and crop performance; progress of harvesting, storage, marketing and stock accumulation; and local supply as relates to farm – gate and market prices of the main food crop. The government has no active system on the ground to sensitize farmers on these issues that are important in preparation. Monitoring and Early warning was emphasized in 1994 – 1996 National Development Plan as key element in food security strategy. Emphasis was to facilitate the gathering and analysis of data dissemination of information on expected weather trends and their possible effects on food production and livestock management. This policy is still a paper work which has not been translated into action hence it has not been of any use to farmers within the study area. Results from the study area shows that there is no coordination among the institutions charged with responsibilities of passing information from the grassroots to the top organs of the Government. The interventions of both the Government and other non – governmental organizations in food insecurity management when the situation is out of control has not solved the problem of food security inspite of spending huge sum of money

6.5.2 Impacts of food relief services on food security problem

Makueni District just like other districts under semi-arid conditions has been relying on food relief for decades. The GOK has spent considerable resources on relief food but with relatively little impact in addressing the compounding problem of food insecurity. What has not been adequately addressed is how effective is food relief services in eradicating food insecurity. Results from this study shows that 56% of households mainly from Makindu, Kibwezi and Kathonzwani acknowledged having benefited from food relief supplies in form of maize, beans and some time cooking oil. The supplies are erratic mostly being brought in once per month and do not have adequate nutritional requirements. The ratio given is also small ranging from 2 kgs to 10 kgs of cereals per household per month depending on family size.

Although food relief is meant for needy cases, the distribution criteria is not transparent and therefore, households who deserve food relief either receive small quantities or are denied supply due to inefficient system used to distribute food. However, food supply to these households was temporary as long as supplies last. The moment supplies stopped coming, the households found themselves in more food insecurity situation. This category of households

account for those classified as extremely food insecure as discussed under household income in chapter five. They comprise households that have depleted their assets base to such a degree that without immediate outside assistance, they will face famine. It includes also the highly food insecure households who cannot meet their food needs during the current year without reducing consumption or drawing down assets to such a degree that they compromise their future food security.

About 43.6% of households expressed that they had not benefited from food relief services despite the fact that they needed the same. This particular group comprised of the moderately food insecure who can meet their food needs in the current year but only by drawing down savings or relying on secondary income activities. They argued that they might become highly food insecure when market access or income from secondary activities is compromised.

The issue of food relief has been open to political lobbying and media pressure. Politicians have capitalized on food relief services to win political support. This is done by selectively providing food relief services to the loyalists (pro-establishment) and denying the same to those in opposition (anti-establishment). Consequently, people who do not deserve food relief end up getting huge ration while deserving cases are denied the same. Politicians use the carrot and stick method by using this food during the election campaign to woo voters. This defeats the aim of food relief and subsequently very little is realized in fighting food insecurity. The Bivariate Regression Analysis from field survey data showed negative weak correlation between food relief and food security ($r = -0.221$). This implies that households who depend on food relief have not improved their food security status but instead they have developed dependency syndrome that leaves them more food insecure. Food relief is therefore a stop gap measure to food shortage and should be used as the last option.

The system of food relief services has also been abused by provincial administration who provide food stuffs to their cronies and kin regardless of whether they deserve it or not. The system of distribution is marred with corruption, lack of transparency and inefficiency that makes it difficult to help in reducing food insecurity. Extreme cases have been reported in the district where food relief is sold by the chief and District officers. Bales of flour and bags of maize bearing GOK mark have been found in private shops being sold to the same people who

would have got it free. The years 2005 and 2006 were reported as the worst where a lot of food and cooking oil donations were sold as many children went hungry and starved. Because of mismanagement and deliberate poor distribution of food relief, 96.2% of households interviewed were categorical that they could survive without relief food due to such frustrations. Only 3.3% of households interviewed felt they could not survive to the next yield season without food relief support. This category of households consisted of the poor old folks who relied on dependants. About 43.1% of household acknowledged that relief food is important if the system is void of malpractices and corruption. They felt that such food should be given to the needy families at appropriate time before they succumb to food insecurity.

However, 56.4% never acknowledged the importance of relief food. They argued that relief food perpetuates a culture of dependency that contributes to higher chances of food insecurity at household level. It is a temporary measure but not a solution to food insecurity. Moreover, it is a time consuming exercise because people spent a lot of time at the centers waiting for food rations that are insufficient even for two days rations. These results were contrary to the popular view that food relief plays important role in reducing food insecurity in semi-arid areas. There is need to change approach in the way this food is viewed and how it is administered.

No clear baseline information exists to quantify the level of needs. Without a good understanding of how households in semi-arid function, it will be difficult to analyse the constraints such households face in pursuant of food security. The present complicated structures in food relief services allow politicians, development planners, disaster mitigators and rapid response units to influence the livelihoods of the affected communities. All of these have their own agendas as to how best to utilize the limited resources available.

Food relief promotes an undesirable shift in consumption patterns away from staple foods in favour of foodstuffs such as rice and wheat that are not grown locally. The common foodstuff given as relief is maize that contributes to households moving away from growing traditional food crops. Households complained that the government does not give them food relief in form of traditional food stuff namely sorghum, millet, pigeon peas, cow peas among others. By giving such foodstuffs to households, the government will help the campaign to promote the

production of these crops in the study area. The same should be reflected in distribution of seeds for the mentioned drought resistant crops that are capable of improving household food security.

Relying on food relief as means of food security carries with it a specific socio-economic and political implication that does not help in solving food security problem; it serves the priorities and interests of the donor, which may be out of tune with the interests and objectives of the recipient country. In particular, food aid may be given only if the recipient country accepts certain conditions in domestic policies and programmes in such areas as agricultural pricing and marketing which may not be favourable in promoting food security. More so, the availability of food aid declines as the stock of excess supplies of food on the international market decline, so food aid may be least available when needed most.

Consequently, the receiving country will accept what is offered, which may not meet local taste preference or the preferred form of nutrition. A case in point was 2005 when a New Zealand donor proposed to donate dog food to starving children in Kenya. This is an abuse of the highest order to the government and should serve as a wake up call to strengthen our resolve towards elimination of food insecurity. Similarly, the study area has been exposed to consumption of relief food in form of maize deemed unfit due to aflatoxin poisoning caused by moulds. This has led to loss of lives of people in the last three years while others have been left handicapped after losing sight. Aflatoxin leads to decreased blood calcium and bone strength. These shows what kind of food is sometimes given in form of relief to families.

6.6: INSTITUTIONAL INTERVENTION ON INFRASTRUCTURAL FACILITIES AND THE EFFECTS ON FOOD SECURITY

The Government is charged with the responsibility of ensuring presence of good infrastructural facilities. This is because infrastructural facilities play an important role in food security. Rural infrastructure is a very loose concept however, sometimes conceived narrowly to include only roads. For the purpose of this study, infrastructure has been used to refer to roads and rural water supply. These facilities have been examined because food security cannot be achieved in isolation from infrastructural development. Furthermore, adequate infrastructural facilities cannot be achieved without public and private institutional intervention.

6.6.1: Transport Infrastructure and the effect on food security

Rural transport remains a big handicap in improving food security in Makueni District. It is now recognized that modern and well-maintained transport infrastructure is the key catalyst to economic growth and poverty reduction that assist towards increasing food security. This issue came strongly during Makueni poverty reduction strategy consultative forum where stakeholders emphasized improvement in transport infrastructure as a means of fighting poverty and subsequent reduction in food insecurity within the district. A survey in the study area shows that the district whose total area is 6767 square kilometres (km²) has a total of 1,623 kilometres (km) of classified and unclassified roads out of which 285.4 km is of bitumen, 548.4 km is gravelled and 789.4 km is of earth surface (*District Public Works Office, Annual Report 2002*). The only international trunk road cutting through the district is the Nairobi – Mombasa Road, with a total length of 220.4 km. *Table 6.5* shows total kilometres of different types of roads in the district compared with the total area covering the entire district. This shows a lot of disparity in road network within the study area that leads to low connectivity. Similarly, *Table 6.6* shows road length of classified roads according to surface type based on who do maintenance work.

Table 6.5 Total kilometres of road network per division in comparison to the total district area.

Division	Bitumen	Gravel	Earth	Total	Area (Km ²)
*Wote	10	11.0	58.3	79.3	362.7
Tulimani	6.0	41.6	33.5	81.1	126.0
Kisau	-	25.2	51.6	76.8	301.2
*Kathonzweni	-	40.0	88.3	128.3	880.7
Kalawa	-	40.0	44.6	84.6	330.0
Mtito Andei	50.0	65.5	58.6	174.1	931.2
*Makindu	30.0	-	19.9	49.9	880.2
*Kibwezi	73.0	32.0	15.3	120.3	944.8
*Kasikeu	-	40.0	73.7	113.7	270.9
Mbitini	32.0	24.0	25.0	81.0	229.9
Kilome	36.0	45.2	15.0	96.6	359.4
Kilungu	3.0	29.1	49.0	81.1	178.3
Nguu	15.0	-	137.4	152.4	350.3
Matiliku	-	39.0	11.7	50.7	240.6
Mbooni	-	40.0	66.6	106.6	141.6
Kaiti	30	75.8	40.9	116.7	239.8
TOTAL	285.4	548.4	789.4	1583.2	6767.4

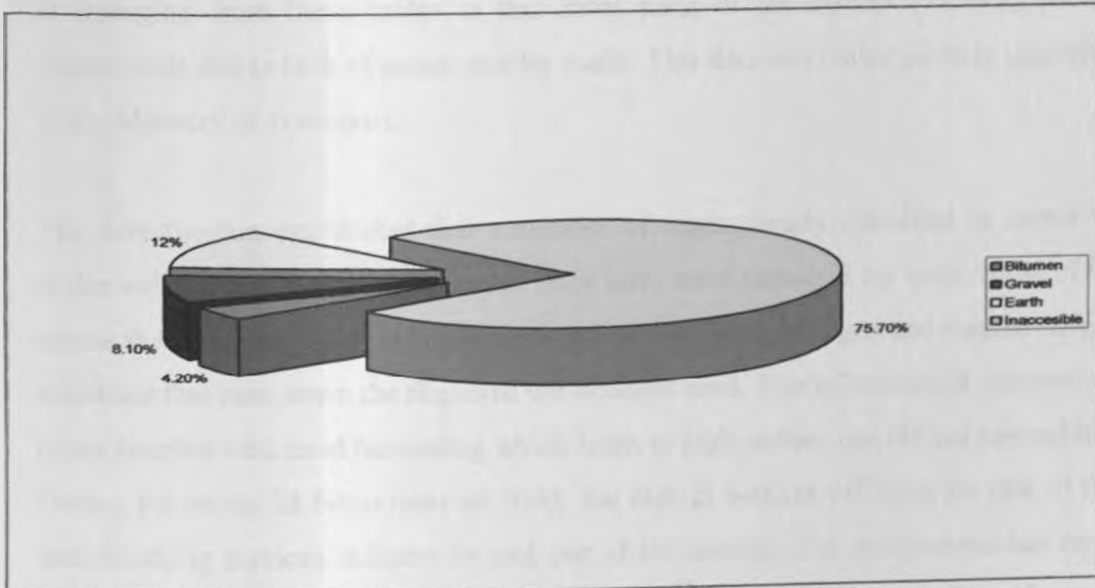
Source: District Public Works Office, Annual Report 2002

*Divisions sampled for study.

It is evident from *Table 6.5* that the road network (1583.2 km) in the district is too low as compared to the district total area surface (6767 km²) which gives network density of 4.3 square kilometres. This is an indication of poor network that is contrary to the government policy on making rural areas accessible through increased roads as articulated in National and District development plans. Among the five divisions sampled for this study; Kathonzweni, Makindu, and Kibwezi are the most affected in terms of accessibility due to large surface area. Kathonzweni has 128.3 Km road length against 880.7 km² surface areas, Makindu has 49.9 Km road length compared to 880.2 Km² service areas and *Kibwezi* has 120.3 Km road length compared to 944 Km² service areas. This gives a total area of 3338.8 sq. km covered by 491.5

km of road length. The road density for the 5 divisions is 6.8 sq. km which is rated quite low for effective transportation of goods and services.

Fig 6.4: Percentage covered by road network in the study area



Source: Makueni District Public Works Office, Annual Report 2002

Table 6.6: length of classified roads in Makueni District

Class of roads	Bitumen	Gravel	Earth	Total km	Maintaining agent
-International Truck Roads	220.4	-	-	220.4	Public works
-National Truck Roads	3.0	24.8	-	27.8	Public works
-Primary Roads	-	152.9	-	152.9	Public works
-Secondary Roads	87.6	85.5	47.5	180.6	Public works
-Minor Roads + SPR + E+	-	184.7	826.6	1,011.3	Admin./beneficiaries/NGOs
TOTAL	311.0	447.9	874.1	1,633.0	

SPR – Special Purpose Roads

E+ - Class E and above

- None

Source: Makueni District works office, Annual Report 2002

Table 6.6 shows the roadwork in Makueni District indicating surface type and classification according to maintenance. What appears as Bitumen road classified in Makindu, Kibwezi and Mtito Andei only passes along the outskirts of the district thus leaving the interior part of the district without Bitumen road except Salama – Nunguni and Muumandu – Wote (46 km). What is emerging from these tables is that most parts of the district (75.70%) are completely inaccessible due to lack of motor worthy roads. This data was collected from secondary sources in the Ministry of Transport.

The investigation established that a number of roads already classified as motor worthy are under utilized due to their poor state. They have been damaged by rains. Most of the bridges across the rivers are either old or dilapidated or have been damaged and washed downstream by rainwater that runs down the slopes of the denuded land. This is because of destruction of forest cover coupled with sand harvesting which leads to high surface run off and low infiltration rate. During the recent El Nino rains of 2000, the district was cut off from the rest of the country thus blocking services delivery in and out of the district. The government has been slow in putting the right infrastructure on the ground to facilitate movement of goods and services. CBOs have tried to repair some of the rural access roads but the impact is minimal because of the terrain.

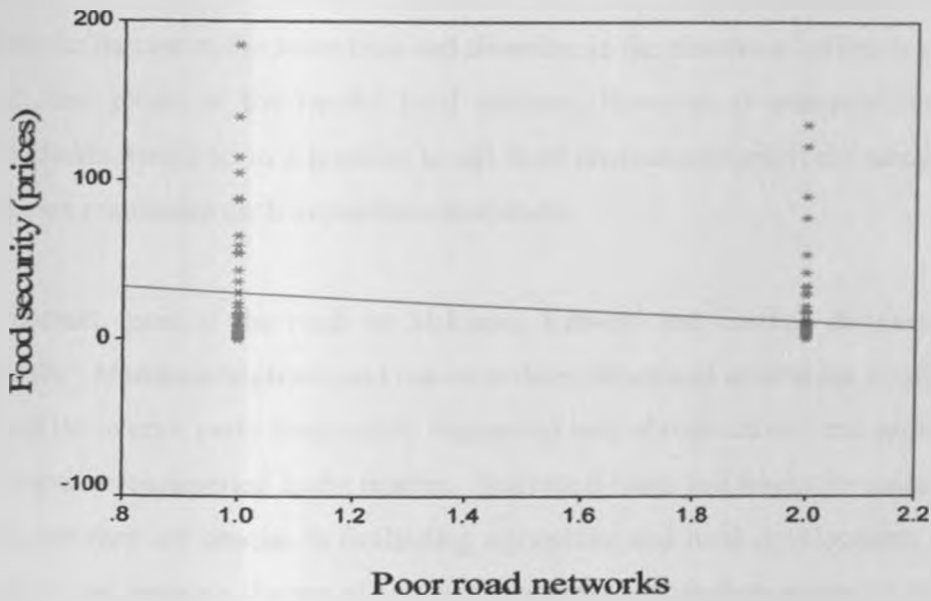
6.6.2 Implications of road network on food insecurity in the study area

The poor state of roads in the study area hinders transportation of goods and services within and outside the district. Spatial interaction between areas of deficit and surplus is hampered by lack of efficient and sufficient road networks. This occurs due to lack of transferability between such areas. For example, movement of grain from other parts of the country such as the Rift Valley region, where there is surplus to Makueni District, where there is deficit, is inefficient and costly. Hence, the maize surplus in Rift valley will not benefit farmers in deficit areas such as Makueni District unless the two areas are well connected and accessible all year round. Once grain is transported to the major urban areas in the district such as Sultan Hamud, Emali, Makindu, Kibwezi, and Wote, distribution to other rural towns and market centers in the district is slow and expensive. Therefore, the consumer price is too high for most of the rural households who are characterized by low income.

Bivariate regression shows linear relationship between food prices and the condition of the roads as indicated in figure 6.5. Prices of foodstuff increase with increase in poor condition of roads because transporters charge more on transport cost incurred which is passed to the consumers. For example, an additional Ksh 5 per kg of maize was charged within a distance of 10 kilometres to offset transport expenses due to poor status of the roads. Sometimes sufficient food is available in the district's major towns but does not reach the remotely situated rural households due to poor transport facilities. This increases food insecurity as the majority of the households cannot access food due to lack of transport and high prices.

Regression Analysis from field survey data indicates that there is negative correlation between poor roads and food security ($r = -0.400$). Areas affected by poor roads experience higher prices because of increased transport cost hence they are more vulnerable to food insecurity. Evidence was noted in maize prices where 1 kg cost Ksh 15 in Sultan Hamud, Emali and Wote urban areas that are accessible while the same produce sold at Ksh 20 in the interior of the study area. This relationship is clearly indicated by regression line *Figure 6.5* that shows that poor road status leads to high chances of food insecurity due to price increase of cereals and grain. The grain merchants are free to adjust their prices according to demand and supply as well as overhead expenses. The main complain is tear and wear of vehicles because of poor roads. Areas where vehicles cannot reach, bicycles, donkeys and oxen carts are used to transport grain to the nearest market centers. This inconveniences further increases price to the consumer.

Fig 6.5. Food security and status of road networks



Source: Analysis of Field Survey Data, 2001 – 2006

The conditions of the roads have also affected the timeliness and quantities of agricultural inputs such as certified seeds, manure, fertilizers and agro-chemicals. Similarly, it also affects movement of output from the farm to storage. Easy accessibility to market, timely and reliable availability of extension services and farm inputs reduces production costs and minimizes returns thus realizing more funds for investment. Unfortunately, majority of households in the study area do not enjoy such services. Inputs are expensive and unavailable when highly needed due to poor transport facilities. This leads to delay in planting or failure to plant and hence high chances of food insecurity among the rural households. Extension officers are not able to serve farmers effectively partly because of poor transport facilities as discussed earlier.

Poor roads have also affected transport of horticultural produce from the study area to local and national markets. The most affected are small-scale horticultural schemes using irrigation technology at Kibwezi and Makindu. These schemes produce Asian and local vegetables for domestic and foreign market. Unfortunately, high volume of horticultural produce goes to waste due to poor roads and lack of markets. Kasikeu Division, which is a major producer of mangoes, is affected by poor network. Production of mangoes is seasonal hence due to poor transport and high rate of perishability when the fruit are ripe; households dispose their produce

at throwaway price as the rest goes into waste. A sack of mangoes for example, goes for Ksh 50 at farm level while the same can fetch Ksh. 2,000 at market centers. Mangoes mature and ready for harvest at the same time and therefore in the absence of efficient road transport, they fetch low prices at the nearby local markets. However, if transport facilities were good households would be in a position to sell their produce competitively outside the local market and earn reasonable cash to purchase foodstuffs.

At present, most of the roads in Makindu, Kibwezi and Kasikeu divisions branch from the Nairobi – Mombasa highway and run for a short distance of an average length of 4-5 Km. This leaves the interior parts inaccessible because of lack of connectivity and subsequently few farm products are transported to the market. Both rural roads and tracks for animal-drawn carts are poor, yet they are crucial in facilitating agriculture and rural development. There is need to improve and promote the use of locally appropriate intermediate means of transport, especially animal-drawn and off-road transport. Improvement in off-road transport is essential for rural people's well-being and productivity. This is important because inefficiency in the movement of agricultural inputs and outputs to and from motor worthy roads acts as a powerful brake on agricultural productivity and food distribution. The effect of this poor transport is high consumer prices and hence household food insecurity in the study area.

Improvements in transport and marketing networks can serve to move grain more efficiently from areas of surplus to areas with food shortfalls at affordable prices. With improved market opportunities for food crops, horticultural crops and dairy products, peasant farmers will produce more food for domestic consumption and sale. Therefore, complementary policies, designed to prevent or offset food entitlement collapse at the local level, will be necessary to draw full advantage from improvement in physical infrastructure within Makueni District.

Although the issue of physical infrastructure has been raised severally in the five-year district development plans, few of the target projects have been accomplished. For instance, Makueni District development plan 1997 – 2001 had proposed 8 public works project but only 2 were implemented. This is a result of poor government policy on implementation during budgetary allocations that does not match with needs assessment. There is lack of coordination in management of road network maintenance. Therefore, there is need to involve local community

in planning, construction and maintenance of roads especially rural access roads. This will succeed by forming community based road committee that can work closely with public works, NGOs and other stakeholders. There is also need for proper coordination of road maintenance programmes between public works and local authorities. Funds should be solicited for rehabilitation of gravel roads and make all roads motor able by constructing bridges in the affected areas. This will contribute enormously in reducing food security problem in the study area.

6.6.3: Water facilities and their effect on food insecurity

Access to water for human consumption and livestock use is a major problem in rural areas of the study area. Prolonged drought, coupled with the siltation of the water pans and dams, has resulted in earlier than usual drying up of water resources. Water supply has diminished over the years to a point where demand cannot be sustained with current systems because of population growth and therefore, time devoted to food security is compromised. Makueni District reported scarcity of safe water at rates in excess of 80 % during poverty report carried out by the Ministry of Finance and Planning in 2000. The other districts under semi-arid conditions and at par with Makueni in terms of water problem are Kitui and Homa Bay. *Table 6.7* show different sources of water in the semi-arid areas of Makueni District where households draw water. This data was collected from primary sources in the study area.

Table 6.7 Sources of water for domestic and livestock use.

Source	Consumer	%
Rivers	70	35
Dams	35	17.5
Water pans	20	10
Springs	35	17.5
Roof catchments	15	7.5
Boreholes	20	10
Piped water	5	2.5
Total	200	100

Source: Field Survey, 2001 – 2006

A majority of the households (35%) draw water directly from rivers while 55% get their water from different sources such as dams, boreholes, water pans and springs as shown in *Table 6.7*. About 7.5% of the households harvest water from roof catchments during rains. However, the harvested water does not run for many days due to lack of adequate storage tanks. Only small percentage (2.2%) of the households has access to piped water. These sources of water are unevenly distributed across the divisions and located quite a distance. Majority of the households in the lowland divisions of the district travel from 5-15 km to gain access to drinking water. Similarly, people trek long distances to water their cattle. Subsequently, little time is left to engage in potential income generating activities that can be used to reduce food insecurity. In addition, the overuse of few existing water sources increases the likelihood of water contamination, thus posing the danger of diseases outbreak. The worst hit divisions are Kathonzweni, Kibwezi, and Makindu.

Households spend a lot of time looking for domestic and livestock water. Women are the most affected because they spend more time fetching, transporting, boiling and storing water for consumption, cooking and laundry services. Findings from the study shows that on average a family of 6 persons requires a minimum of 80 litres of water daily for domestic use. This amount of water requires four people to draw the same and subsequently farm work is reduced. Because of distances involved and congestion at the source point, 5 – 8 hours are spent for a return trip. This translates to almost a full day devoted to the search for water. Water collection involves labour and therefore it affects their priorities for the search for food. When combined with other domestic chores, women are left with inadequate time to attend to their farms as well as other income generating activities that can be used to improve food security.

Due to the problem of accessing safer water for domestic use, people have taken to the business of selling water as witnessed by significant number of people transporting water on bicycles, oxen carts and donkeys for sale at various destinations. The price of water has increased from the normal Ksh. 2 per 20-litre container to Ksh. 20 for the same as the demand has far outstripped its supply. Few households are able to afford these facilities of transporting water. Households are forced to buy water not because they have money but due to dire need of safe water. This arises because of direct link between safe potable water and the reduction of infant mortality. Water borne and water related pathogens are major causes of seasonality or permanently

debilitating diseases that severely affect agricultural labour productivity. Therefore, development of water harvesting techniques and exploitation of ground water resources are important steps towards food security. The following *Table 6.8* shows the distribution of self-help and institution supported water facilities in the study area. The table also indicates the status of the water source in view of establishing whether it is over utilized or under utilized. This data was collected from secondary sources.

Table 6.8: Distribution of self-help/institutional water facilities in the 5 divisions sampled

Division	No. of water facilities	Purpose	Maintenance	Status
Wote	4	Domestic/livestock	Community/ institutional	Over utilized
Kibwezi	3	Domestic/livestock	Community/ institutional	Underutilized
Makindu	3	Domestic/livestock	Community	Underutilized
Kathonzweni	3	Domestic/livestock	Community	Over utilized
Kasikeu	2	Domestic/livestock	Community	Over utilized
Total	15			

Source: Makueni District Water Office Annual, Report 2002

The reflected water facilities shown in the table refers to boreholes and protected springs. Wote division has two major boreholes maintained by the government and county council (Mwaani and Malivani boreholes) while the other two are maintained by the community. The boreholes are over utilized because of serving Wote town which is the District headquarters and whose population has increased tremendously since 1992 when the district was created. The boreholes are too old and require rehabilitation. Kibwezi has one main spring originating from underground river system. The supply is adequate but does not reach the majority of the rural areas of the division due to long distances. The ministry of water maintains the spring while the community maintains two boreholes. The other divisions rely on boreholes in addition to dams and sand river wells. These sources are under utilized due to lack of maintenance and poor

management. Consequently, accessibility to safe water is an issue that needs urgent attention in order to help in improving food security by saving man-hours lost in search of water. This will be achieved by strengthening local institutions including user group to manage community based water resources.

The Government, NGO's and other organizations have an obligation to continue supporting local community in exploitation of ground water resource. Danida, AMREF and Catholic Church are some of the organization who have done commendable job in water provision in Makueni District. They have assisted in construction of community water tanks managed by CBOs. The investigation established that there is a strong involvement of NGOs in the community self – help water supply schemes. Evaluations done on community based water projects have shown that fee collection rates are high. Despite this observation, there is no mechanism for exempting the poor from user charges. Therefore, most households either continue to spend more time in search of water or spend more money to purchase water hence compromise their goals to improve food security.

6.7: HOUSEHOLD FOOD INSECURITY COPING STRATEGIES DURING SHORTAGES

With reference to the fifth objective of this investigation,, household food security self-sufficiency and coping strategies are discussed in this section. Findings from this study indicate that households employ a variety of strategies to attain sufficient food and cope with food insecurity. Some of the strategies applied are farm cultivation, social safety nets, purchases, change of feeding habits and exchange of commodities as shown in *Table 6.11*. Households were asked to enumerate various techniques that they have used over time to obtain staple food. A majority of the households (40%) obtain their food through market purchases and exchange of commodities when farm production is low. A further 22.5 % supplement cultivation by seeking assistance in form of social safety net when in need. About 31 % of the households continue to pursue cultivation as food self-sufficiency strategy to meet their food needs. This group of households is highly affected when confronted by poor weather conditions and the only option available is institutional food relief service as earlier discussed. A few (5%) cope with food shortages by changing feeding habits while only 1.5% relies on other survival strategies (table 6.11). This categorization was because the households had, at one time or

another utilized a specific strategy towards meeting their food needs. It is not a permanent condition since it keeps on changing. *Table 6.9* analyses each of these categories.

Table 6.9: Food security Strategies adapted by households during famine

Source of food	No. of households	percentage
Cultivation only	62	31
Social safety nets(seeking assistance)	45	22.5
Purchase and exchange of goods	80	40
Change in feeding habits	10	5
Others	3	1.5
TOTAL	200	100

Source: Field Survey Data, 2001 – 2006

6.7.1 Pursuing food self- sufficiency through cultivation

Among the Kamba community, reliance on cultivation for food commences upon marriage. This is the time when members of the household access factors of production such as land and labour. Moreover, it is also the time when one can have their own kitchen, a granary and subsequently, allocation of cultivation site. This applies to households that depend on cultivation as the main source of food. However, this process takes time and varies among households. For instance, some families take between 3 to 4 years before they are allocated cultivation site or independent kitchen. This implies that they continue operating under management of their parents and as such, one cannot clearly comment on their self – sufficiency in food supplies.

Pursuing food security through cultivation therefore depends on household socio-economic characteristics. As already indicated in *Table 6.9*, out of 200 households interviewed, 62 of them (31%) rely on cultivation as their sole means of food security and the only other option pursued was institutional food relief services as mentioned earlier. A majority of these households do not have their members in the formal employment to provide income to purchase extra food from the market. If one is not employed and lacks other sources of income to acquire food, the only choice left is to rely on cultivation to get food. A significant number

of them were found in Kathonzweni, Kibwezi and Makindu divisions. The strategy applied by these households is mixed cropping. Households argued that mixed cropping ensures security of harvest in the marginal areas where rains are unpredictable. This is realized by mixing a short growing season crop variety (which usually has mediocre yields) with a slower growing but better yielding variety. Household practicing this mode of mixed cropping achieved some yields because the farmer was assured a bit of harvest if rains are poor, while the latter maximizes crop yields if there are good rains. However, due to limitations in the use of fertilizer/manure and poor agronomic practices, the harvest could not guarantee food security for more than four months. These households have been using traditional methods of food preservation as a strategy to keep grain for a longer period as discussed in chapter five. However, this process is no longer upheld because of changes brought by modern methods of preservation using agro-chemicals, which few farmers can afford.

Only the more affluent households have been able to adopt improved farming practices such as manuring, fertilizing, soil and water conservation to increase yields in the face of frequent dry spells. Therefore, reliance on cultivation only has not been an effective strategy to solve the problem of food insecurity in the study area due to physical and socio-economic constraints. Whereas cultivating one's own food is a way of life in rural areas, making cultivation a dependable source of food arises from resources available, life expectations, societal expectation and institutional intervention support services.

6.7.2. Reliance on social safety nets/seeking assistance as a source of food

Over the years, there have been traditional mechanisms to cope with food insecurity. These include intra- household while others were inter - household exchange networks. Such exchanges aimed at making food available in the face of either a shortfall or when a given social occasion was too demanding for a single household to handle e.g. marriage and burial ceremonies, in-laws visiting amongst other reasons. This involved giving assistance to households facing food shortfall at harvest especially in the event of drought or famine. Subsequently households were cushioned against severe food shortages. After borrowing food from neighbours, one was expected to refund the same when the situation improved. These exchanges were reciprocated instantly at a specified period or sometime when in future a similar need arose. While this was considered a kind of debt, it may or may not be paid back

upon attaining self – sufficiency. Instead, the beneficiary remains indebted until such a time as the benefactor too is in need. Households whose stocks run out could seek assistance in the form of grain or flour from relatives.

Generally, the Kamba community are social and generous in matters concerning social obligation. They had obligation to give a portion from their food stock to the relatives and neighbours in need. Although this exchange and assistance is supposed to be mutual where each party reciprocate, findings from the study area showed that the practice has become permanently one way today. We have households who have the habit of borrowing food throughout the year without refunding. Often, they request for small portions that donors tend to forget. Households have also developed habits of releasing their children to go and feed at their neighbours' houses. Others release their children to go and stay with relatives in exchange of food assistance. Food seekers normally focus, on the wealthier families, kin, in laws, their children and any family or individual accessible to them. Hence, to benefit from social safety nets one has to nurture kin relations and good neighbourliness. Households with many in-laws find it advantageous because it is seen as a source of help during needy conditions. It is regarded as investment by the parents of the girl.

However, the study established that only 22.2% of the households interviewed continue to rely on traditional socio-cultural mechanisms of food sharing because the system has been undermined by modernization. This is because of introduction of monetary exchange whereby food has taken an economic perspective as opposed to a social one. While there are limitations, regarding giving things for free, generosity is culturally respected among the Akamba while stinginess is shunned. The composition of social security networks is now being narrowed to close kin (Parents and siblings) as opposed to the wider kinship network. Therefore, many households slide into food security problem due to lack of assistance from their neighbours during periods of scarcity. Individualism, cost of living and reduced proximity have also contributed to reduced social safety nets. Relatives have now moved to far places where land is bought hence cutting links with their people. Others have become too mean to help because of being over burdened by many responsibilities. It is also worsened by breakdown of family solidarity over certain aspects of life.

The Kamba community also had elaborate social system involving loaning of cattle to relatives and friends as a way of coping with food insecurity. This system was based on the probability that all livestock would be lost during severe drought. It required the herd to be split up and a proportion of the animals be moved to other ecologically favourable zones where relatives and friends would care for the stock. In exchange for this facility, relatives and friends were allowed to use dairy produce (milk and manure) but eventually, they must return the herd and offspring to the rightful owner. This social system enabled the owner of the animals to sell at times of food scarcity as well as the keeper enjoying benefits of the livestock products. However, this system of loaning cattle to relatives and neighbours is currently not highly practiced because of limited land size. Similarly, lack of trust has limited such help only to the close relatives because the wider society abused the arrangement by selling livestock loaned to them without owners consent.

6.7.3 Food purchase and exchange of commodities as a coping strategy.

About 40% of the sample households reported that they relied on markets for food during drought or any other calamity. They explained that they purchased food from the nearby and sometimes distant market. Ordinarily they purchased little amounts (e.g. 20kg) to last a few days depending on availability of funds. Households who relied on purchase of food during shortages were mainly those who had working members able to remit earnings to their families. Several young, energetic people opted to seek wage labour in neighbouring districts and urban areas. Unfortunately, it was not automatic to enjoy the benefit of remittance because there are cases where a family had working sons, daughters and husbands who did not remit earning to their rural families in good time and therefore resulting into food shortages. Families falling under this category fared no better than the families without any employed person.

An additional source of income for food purchase came from families involved in trading activities within the local markets (see Chapter 5). A Majority were in small and medium business transactions like kiosks, sales of livestock, horticultural produce, making artisan products, second hand clothes, selling local brew and burning charcoal among others (details of sources of income are discussed in chapter five). Women were involved in barter trade where food was exchanged with commodities like chicken, pottery products, goats, and honey among others. This was common in markets serving the lowland semi- arid areas and the high

productive hill masses. People from the relatively productive areas such as Mbooni and Kilungu hills bring arrowroots, sugarcane, sweet potatoes and bananas to exchange with cassava, animals, gourds, sisal ropes and traditional cereals from the lowland semi-arid areas during periodic markets such as Matiliku, Kasikeu, Kilala, Nunguni and Makindu among others. This principle of commodity exchange operates within the spatial and ecological design of traditional Akamba life that provides a symbiosis relationship between the hills and lowlands. However, this coping mechanism is weakening because of money economy and scarcity of exchange commodities.

Women have formed investment groups for savings called '*merry go round*' as a coping mechanisms to generate their own funds. They contribute money to each other in turns and the earnings are useful in purchasing food and other domestic needs. Families who had no assets to sale or exchange resulted into offering casual labour in exchange for food or money. Unfortunately, casual labour services are normally scarce when farm operations are minimal. Others denied themselves medical treatment to finance food purchase. Relying on market purchase is unreliable because there are times when food becomes scarce in the market because of poor transport facilities thus forcing households to go hungry even when money is available.

6.7.4 Changing feeding habits during food shortage periods.

About 5% of sample households revealed that they either eat foods that are less preferred e.g. porridge during lunch and supper or consume limited quantity of the meals to ensure something is left for other days. This strategy was used by a small percentage of the household as shown in table 6.11. Some households had devised a method of skipping a meal preferably lunch so that once they did eat, they would be satisfied (these meals are largely carbohydrates). Women and children were more affected by these coping strategies. For example, mothers were forced to limit their own intake in order to ensure that children especially weaned toddlers get enough to eat. Few households indicated that they rely on wild fruits and vegetables. Specific cases were noted in Makindu and Kibwezi where people resorted to eating baobab fruits that are stirred with water into a thin consumable paste, fig fruits, tamarind fruits, cactus fruits among other wild fruits. They also consumed a wide variety of wild vegetables, wild groundnuts (*Ngaatu*) wild mushroom, among others which are available only during rainy season. Immature pawpaws and mangoes were also consumed. Occasionally hunting was carried out

among the communities bordering the wildlife conservation parks as well as other sparsely settled areas. These changes in feeding habits were implemented as austerity measures to ensure household had something to feed on when the situation was extremely bad and in order to avoid starvation

6.7.5 Other food coping strategies.

Extreme cases were often reported where some individuals resorted to stealing food or other commodities for sale to purchase food. Assets highly targeted were chicken, goats and grain stored in granaries. Women got involved in prostitution and bar attendants in market centers to earn a living. Some of the mothers confessed that their daughters work in urban town but could not specify what kind of job they were doing. What was important was that their daughters brought money home to assist them. The vulnerable groups were the girl school dropouts who got involved in pre-marital sexual activities in exchange of monetary gains. However, such cases only represented 1.5% of sample households. The health officials in the few selected health clinics visited indicated that the reduced purchasing capacity of households has resulted in sick members of households opting not to seek medical attention but instead used the available amount of money to purchase food. Subsequently, households have relatively traded health care for cereals.

In conclusion, households adopt a variety of coping mechanisms and strategies that may not necessarily be efficient or effective due to lack of resources, inadequate institutional support and other factors to offset the impact of production shortfalls and market uncertainties. Food security strategies, as applied at the rural household level, criss-cross one another and in the process they shape and are shaped by rural livelihoods. Evidently, the food security strategies that are employed by rural households are individual decisions but taken in the context of the composition and functioning of the households and networks within and beyond which such strategies are performed.

6.8: STEPWISE MULTIPLE REGRESSION RESULTS BASED ON INSTITUTIONAL FACTORS AND THE TEST OF HYPOTHESES

To find out the major institutional factors affecting food security problem in the study area, the following independent variables were subjected to the Stepwise Multiple Regression Analysis against the dependent variable (food security). These variables were analyzed based on the way institutional interventions affecting food security through such variables

Table 6.10: Variables subjected to Stepwise Multiple Regression Analysis.

Variable	Variable label
V ₁₅	Credit facilities
V ₁₆	Food relief services
V ₁₇	Extension services
V ₁₈	Water accessibility
V ₁₉	Road infrastructural facilities
V ₂₀	Seed supply
V ₂₁	Loan facilities
V ₂₂	Manure supply
V ₂₃	Market structure/ food prices
V ₂₄	Cost of fertilizer

Source: Field Survey, 2001-2006

Stepwise regression analysis ranked the above ten variables according to the R-value of the partial correlation coefficient or strength in determining the variation of food security in the study area. The results obtained from the analysis were as follows;

Variable selected and entered in step one of the stepwise multiple regression analysis was **institutional intervention on cost of seeds and supply.....V₂₃**

Multiple R	=0.491
R square	=0.241
Adjusted R ²	=0.237
Standard error of the estimated	=29.27488

F calculated (statistics)	=62.271
F critical at 0.01 significance level	=6.81
Degrees of freedom	=1,196

This analysis showed that use of certified seeds had the highest contribution amongst the institutional factors in explaining the problem of food security in the study area. Multiple correlation coefficients (R) were 0.491 at 0.01 significance levels while the coefficient of multiple determinations (R^2) was 0.241. This implies lack of accessibility to certified seeds due to high cost contributed to 24.1% of the food security problem in the study area. The Government's policy on seed production and marketing was affected by introduction of structural adjustment programmes that advocated for liberalized market. The poor rural households are exposed to unscrupulous seed dealers who hike prices and occasionally sell fake seeds. Many households were not able to purchase required seeds during planting season hence this contributed to low yields. Similarly, NGOs and other organizations have not helped significantly because of poor coordination in seed distribution.

The variable entered in step two of the stepwise multiple regression analysis was **institutional intervention on extension services in the rural areas...** V17

Multiple R	=0.563
R square	=0.317
Adjusted R^2	=0.310
Standard error of the estimate	=27.83926
F calculated (statistics)	=21.736
F critical at 0.01 significant level	=4.75
Degrees of freedom	=2,195

This implies that the role of extension services is important in reducing food insecurity in the study area through promoting farm productions, educating farmers on post-harvest loss reduction, soil and water conservation techniques, and utilization of credit facilities among others. Multiple correlation coefficient (R) increased from 0.491 to 0.563 that indicates positive relationship between extension services and food security. Similarly, coefficient of multiple determinations (R^2) increased from 0.241 to 0.317. Despite this relationship, institutional

intervention on extension services has failed in the study since introduction of SAPS and subsequently reduction of donor support. Such important services have been privatized and few households have access to them as earlier discussed.

Variables entered in step three of the stepwise multiple regression analysis was **institutional intervention on relief food supply and distribution.....V₁₆**

Multiple R	=0.615
R square	=0.378
Adjusted R ²	=0.368
Standard error of the estimate	=26.64175
F calculated (statistics)	=18.924
F critical at 0.01 significance level	=3.91
Degrees of freedom	=3.194

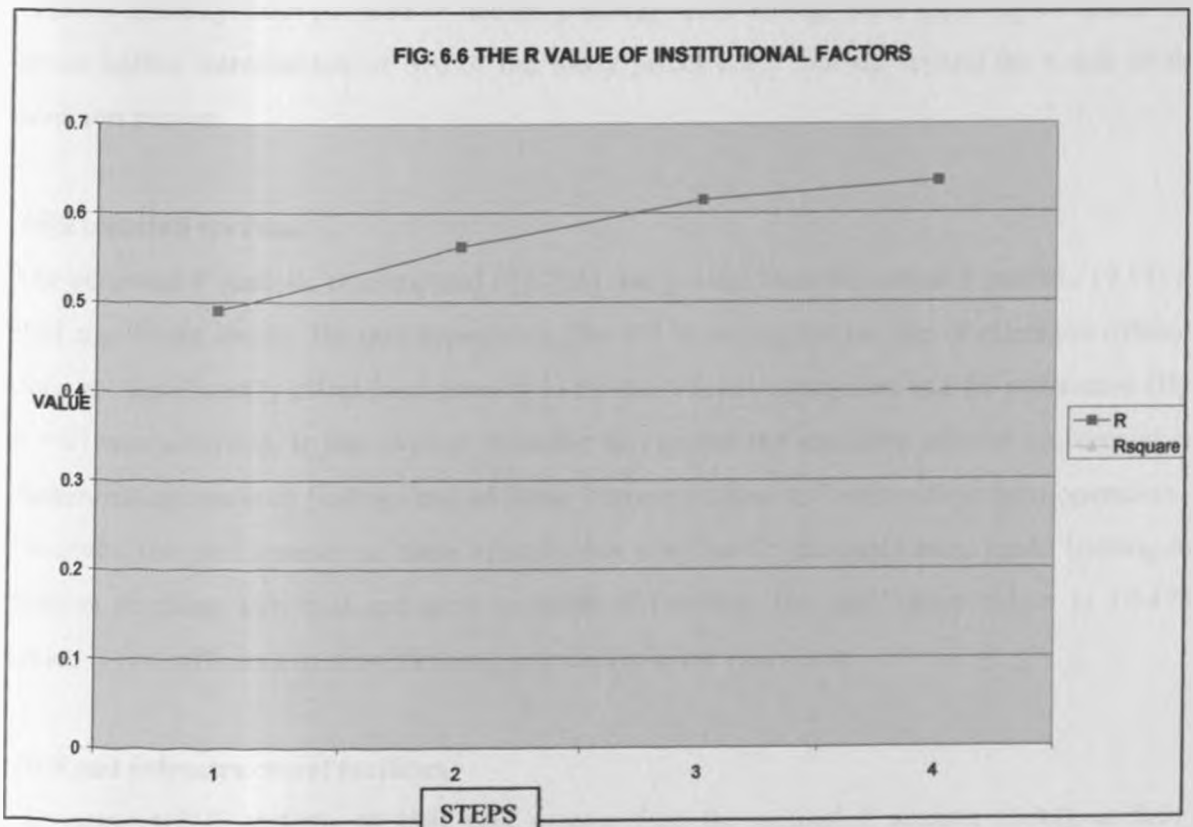
The results show that reliance on food relief services has put some households into food security problem. Food relief has relationship with food security problem as indicated by change of multiple correlation coefficients (R) from 0.563 to 0.615 while the coefficient of multiple determinations (R²) increased from 0.317 to 0.378. This implies that households that depend on food relief have continued on being more food insecure because food relief distribution is unreliable, inadequate, changes feeding habits and tastes and does not offer solution to food security problem.

Variable entered in step four of the stepwise regression analysis was **status of road infrastructureV₁₉**

Multiple R	=0.636
Rsquare	=0.404
Adjusted R squared	=0.392
Standard error of the estimate	=26.14191
F calculated (statistical)	=8.489
F critical at 0.01 significance	=3.44
Degrees of freedom	=4,193

These results, implies that government intervention in rural road transport development has relationship with food security problem in the semi-arid areas of Makueni district. Poor roads have contributed to increase in food prices beyond the reach of the common rural households hence high chances of food insecurity. This is shown by increase in multiple correlation coefficients (R) from 0.615 to 0.636 and coefficient of multiple determinations (R^2) from 0.378 to 0.404. Fig 6.6 shows the increment of the relationship up to the fourth variable.

When the four factors i.e. government policy on input supply and marketing, extension services, food relief and status of road transport were put together, they accounted for 40.4% of the food security problem amongst the institutional factors in the study area. The remaining 59.6% is accounted by other government intervention services which were not rated highly significant but whose relationship to food insecurity is worthy mentioning as discussed earlier (also see correlation matrix in *Table 6.10*).



Source: Field Survey Data, 2001 - 2006

6.8.1: Test of hypothesis based on institutional factors

The second hypothesis in chapter one stated in null form ($H_0: \beta = 0$) assumes that there is no significant relationship between government intervention in support services (farm inputs, extension services, and transport facilities) and food security. These services are linked to institutional factor in terms of delivery, affordability and availability.

(i) Accessibility to certified seeds

The observed F statistic or computed (62.271) was greater than the critical F statistic (6.81). The null hypothesis ($H_0: \beta = 0$) stating that farm input application such as certified seeds does not significantly affect food security was rejected and the alternative ($H_1: \beta \neq 0$) was accepted. It was noted that the use of certified seeds has direct relation with the food security in Makueni District. Yields are low because farmers either plant late or fail to plant due to lack of seeds. Government and NGOs support in making available and affordable seeds has been low since liberalization of the economy. Seed market has been liberalized to the disadvantage of the farmers. Initially farmers used to access planting seeds among other farm inputs under fair prices before introduction of SAPS, but today prices have shot up beyond the reach of the common person.

(ii) Extension services

The observed F statistic or computed (21.736) was greater than the critical F statistic (4.75) at 0.01 significant levels. The null hypothesis ($H_0: \beta = 0$) stating that the role of extension officers does not significantly affect food security in the study area was rejected and the alternative ($H_1: \beta \neq 0$) was accepted. It was evident from the survey that the extension officers are crucial in disseminating research findings and advising farmers on how to improve their farm operations. However, the performance of these officers was very low in the study area, hence leading to farmers resulting into trial and error methods of farming. The staff farmer ration is 1:1479 which is not sufficient to serve farmers' population in the study area.

(iii) Road infrastructural facilities

The computed F statistic (8.489) was greater than the critical F statistic (3.44) at 0.01 significant levels. These statistical results prove the null hypothesis ($H_0: \beta = 0$) wrong hence it was rejected and the alternative ($H_1: \beta \neq 0$) adopted. The alternative confirms that there is

relationship between the status of the roads that affect prices and food security. Prices were too high in areas where roads were in either pathetic condition or lacking.

Therefore, institutional interventions in improving food security in the study area are far from being realized. The area has continued to face food shortages partly due to poor implementation on vital government and NGOs intervention on food self-sufficiency such as adequate farm inputs, efficient extension services and accessibility to market centres. In the absence of such services, food security has become a problem at household level.

Table 6.11: summary results of the Stepwise Regression Analysis on institutional factors.

Variable no	Variable label	Multiple R	Rsquare	R ² change	Simple R	Standard error of the estimate	Beta	Computed F	D F	Critical F at 0.01 sig level
23	Government policy on seed supply	0.491	0.241	0.241	-0.491	29.27488	-0.491	62.271	1,196	6.81
17	Extension services	0.563	0.317	0.076	0.400	27.83926	0.287	21.736	2,195	4.75
16	Food relief services	0.615	0.378	0.061	-0.218	26.64175	-0.247	18.924	3,194	3.91
19	Status of road infrastructure	0.636	0.404	0.026	-0.404	26.14191	-0.180	8.489	4,193	3.44

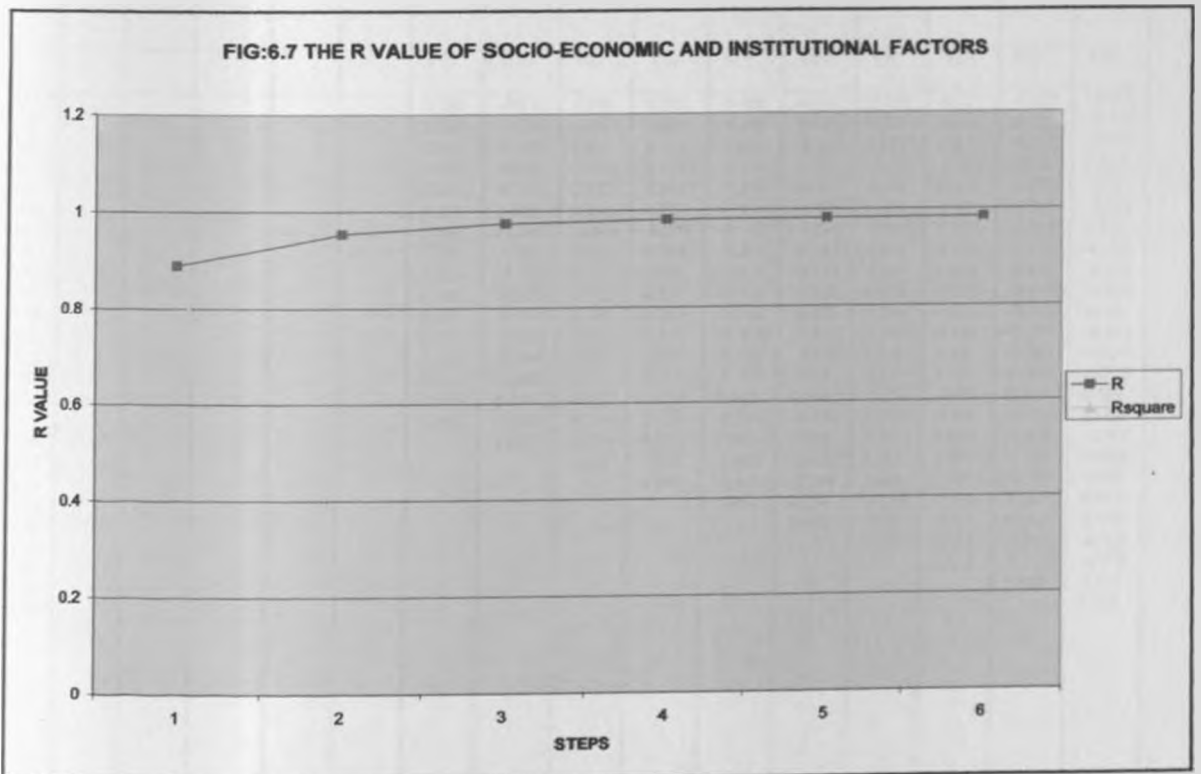
Source: Analysis of Field Sample Survey Data, 2001 - 2006

It can be concluded that developing an effective institutional intervention depends on creating an environment on poverty reduction that is a major function of the economy. Within the environment an understanding of the causes of hunger and their connections to the food system provides a starting point for the design of programs and policies that will aim at increasing the household income and purchasing power. Transfer of technology to farmers and investment in rural production and infrastructure could achieve this. Availability of credit facilities and effective access to efficient extension services will enable households diversify their sources of livelihood and subsequently, be able to access food during seasons of hunger.

6.9: STEPWISE MULTIPLE REGRESSION ANALYSIS BASED ON THE MAJOR SOCIO-ECONOMIC AND INSTITUTIONAL SUPPORT SERVICES

When all the 24 variables (socio-economic and institutional factors) were subjected to stepwise multiple regression analysis, the results indicated six variables as the most significant towards variation in food security problem. These results are shown in *Figure 6.7* where R and R squared increased up to the sixth variable. Such variables were household income level, production of drought resistant traditional food crops notably millet, post-harvest food losses, farm size under crop production, level of education of household head and food relief services. The remaining 18 variables showed relationship to food security problem but not highly

significant. Details of all the 24 variables are shown in *Table 6.11*. What is important to note is that factors contributing to food security problem are interrelated and complex. Some factors may appear to have weak relationship with food security problem but such factors may be indirectly affecting food security through others. This scenario is shown by multicollinearity problem because of high interdependence among the independent variable. Subsequently, this led to application of principle component analysis to solve the problem of collinearity.



. Source: *Field Survey Sample Data, 2001 - 2006*

Table 6.12: correlation matrix based on socio-economic and institutional factors

	V	v1	v2	v3	v4	v5	v6	V7	v8	v9	v10	v11	v12	v13	v14
V	1.000	0.162	0.249	0.177	0.686	0.590	0.486	0.380	0.364	0.890	0.698	0.718	0.791	0.854	-0.381
V1		1.000	0.612	0.368	0.163	0.158	0.129	0.240	0.167	0.201	-0.001	-0.023	0.060	0.171	-0.189
V2			1.000	0.229	0.269	0.152	0.129	0.294	0.143	0.259	0.143	0.102	0.162	0.211	-0.216
V3				1.000	0.208	0.213	0.290	0.121	-0.079	0.236	0.072	0.017	0.044	0.121	0.120
V4					1.000	0.619	0.715	0.527	0.279	0.641	0.427	0.480	0.597	0.705	-0.347
V5						1.000	0.311	0.376	0.220	0.664	0.307	0.422	0.464	0.395	-0.428
V6							1.000	0.360	0.125	0.431	0.294	0.379	0.471	0.543	-0.103
V7								1.000	0.275	0.368	0.248	0.149	0.381	0.380	-0.322
V8									1.000	0.327	0.304	0.108	0.221	0.360	-0.427
V9										1.000	0.499	0.477	0.569	0.709	-0.318
V10											1.000	0.436	0.485	0.584	-0.251
V11												1.000	0.947	0.612	-0.301
V12													1.000	0.702	-0.379
V13														1.000	-0.436
V14															1.000
						V15	V16	V17	V18	V19	V20	V21	V22	V23	V24
V						0.301	-0.221	0.396	0.342	-0.400	-0.341	0.282	0.312	-0.495	-0.361
V1						0.285	-0.206	-0.013	0.135	-0.190	-0.079	0.121	0.078	-0.223	-0.157
V2						0.066	-0.198	0.023	0.110	-0.222	-0.130	0.089	0.074	-0.235	-0.095
V3						0.166	-0.045	-0.071	0.028	-0.128	0.160	-0.129	-0.087	0.010	0.020
V4						0.241	-0.174	0.222	0.199	-0.254	-0.120	0.172	0.118	-0.272	-0.173
V5						0.324	0.004	0.348	0.301	-0.369	-0.185	0.165	0.118	-0.323	-0.312
V6						0.068	-0.070	-0.033	-0.099	-0.132	-0.010	-0.015	0.014	-0.189	0.037
V7						0.176	-0.282	0.212	0.208	-0.244	-0.241	0.147	0.136	-0.192	-0.187
V8						0.333	-0.128	0.531	0.426	-0.365	-0.473	0.410	0.384	-0.271	-0.479
V9						0.298	-0.123	0.374	0.397	-0.344	-0.354	0.258	0.338	-0.577	-0.340
V10						0.126	-0.142	0.299	0.263	-0.256	-0.286	0.290	0.202	-0.245	-0.281
V11						0.193	-0.088	0.221	0.112	-0.305	-0.197	0.120	0.198	-0.257	-0.206
V12						0.240	-0.169	0.280	0.157	-0.347	-0.240	0.148	0.217	-0.313	-0.252
V13						0.267	-0.285	0.321	0.279	-0.360	-0.254	0.332	0.262	-0.400	-0.290
V14						-0.468	0.185	-0.425	-0.288	0.343	0.368	-0.252	-0.196	0.203	0.409
V15						1.000	-0.132	0.315	0.251	-0.299	-0.327	0.187	0.089	-0.236	-0.159
V16							1.000	0.054	0.093	0.082	-0.087	0.041	0.022	-0.029	-0.015
V17								1.000	0.575	-0.352	-0.454	0.447	0.483	-0.277	-0.548
V18									1.000	-0.366	-0.448	0.469	0.487	-0.250	-0.491
V19										1.000	0.280	-0.148	-0.284	0.324	0.337
V20											1.000	-0.482	-0.481	0.434	0.500
V21												1.000	0.461	-0.362	-0.420
V22													1.000	-0.431	-0.458
V23														1.000	0.274
V24															1.000

Source: Field Survey Sample Data, 2001 - 2006

6.10: PRINCIPAL COMPONENT ANALYSIS BASED ON SOCIO-ECONOMIC AND INSTITUTIONAL FACTORS

Results from the Multiple Regression Analysis indicated presence of multicollinearity among the independent variables. Therefore, to eliminate the problem of collinearity, principal component analysis was used as the extraction method to classify the large number of interrelated variables into a limited number of dimensions or components. The procedure involved computation of bivariate correlation (Pearson's r) between all the variables and placing the correlation into a matrix format. The correlations matrix was then used as input in the component analysis procedure to detect inter-correlations between independent variables and isolate the common elements present in two or more variables.

The model was also used to reduce the data into manageable size. To make the components orthogonal and uncorrelated, a computer orthogonal rotation technique called Kaiser's varimax was performed for the purposes of analysis. All the 24 variables were grouped into 6 components as indicated in *Table 6:12*.

Table 6.13: Component loadings for the six orthogonally rotated components

VARIABLES	COMPONENTS						COMUNALITIES
	1	2	3	4	5	6	
V1 Age of respondents	0.290	0.134	0.794	0.086	-0.106	-0.197	0.790
V2 Cost of labour	0.333	0.195	0.626	0.077	-0.314	-0.219	0.693
V4 Size of total land in ha	0.702	0.493	-0.066	0.039	-0.031	0.301	0.833
V5 Ha under Katumani composite B	0.651	0.208	-0.011	0.100	0.456	0.069	0.690
V ₆ Ha under other maize variety	0.430	0.625	-0.112	0.186	-0.070	0.270	0.700
V ₇ Ha under traditional crops	0.526	0.225	0.226	-0.181	-0.120	0.409	0.594
V ₈ Gender access to resources	0.594	-0.364	0.119	-0.229	-0.057	0.237	0.611
V ₉ Income resources	0.799	0.198	-0.039	0.264	0.040	0.016	0.751
V ₁₀ Post-harvest food losses	0.596	0.119	-0.250	0.009	-0.197	0.104	0.482
V ₁₁ Education level	0.606	0.340	-0.461	-0.050	0.001	-0.428	0.881
V ₁₂ Yield of millet per season	0.717	0.376	-0.367	-0.105	-0.044	-0.281	0.883
V ₁₃ Total farm size in ha	0.791	0.307	-0.166	-0.052	-0.184	0.022	0.784
V ₁₄ % growing Katumani maize	-0.606	0.117	-0.091	0.512	-0.184	0.088	0.693
V ₁₅ Credit facilities	0.460	-0.069	0.256	-0.298	0.457	-0.194	0.617
V ₁₆ Food relief	-0.172	-0.286	-0.257	0.582	0.371	-0.037	0.654
V ₁₇ Extension services	0.608	-0.487	-0.101	-0.063	0.198	0.145	0.681
V ₁₈ Water accessibility	0.552	-0.493	0.086	0.157	0.145	0.166	0.629
V ₁₉ Status of roads	-0.559	0.080	-0.137	0.036	-0.221	0.243	0.447
V ₂₀ Market forces	-0.563	0.499	0.015	-0.026	0.114	0.083	0.587
V ₂₁ seed supply	0.493	-0.476	-0.017	0.120	-0.262	0.129	0.570
V ₂₂ Loan facilities	0.501	-0.481	-0.064	0.247	-0.266	-0.047	0.621
V ₂₃ Commodity prices	-0.569	0.123	-0.048	-0.369	0.195	0.302	0.607
V ₂₄ Cost of fertilizers	-0.573	0.459	-0.023	-0.002	-0.036	-0.049	0.543
V ₃ Household size	0.126	0.405	0.446	0.393	0.323	0.104	0.649
ELGEN VALUE	7.501	3.006	1.926	1.318	1.203	1.037	
PERCENTAGE (%) OF THE VARIANCE EXPLAINED	31.255	12.524	8.026	5.491	5.013	4.320	
PERCENTAGE (%) OF CUMULATIVE VARIANCE	31.253	43.777	51.803	57.294	62.307	66.307	

Source: Field Survey Sample Data, 2001 - 2006

6.10.1: Varimax Rotated Component Loadings

In this analysis the variables closer to - or +1.00 indicates great contribution to the total variance accounted for. Where there is a high component loading on a variable, it indicates that the variable is a good fit in explaining the variation of the dependent variable (food security). For purposes of analysis, component loadings > +0.45 were considered significant factors that influence variation of food security problem in the study area. In the Varimax Rotation (Principal Component Analysis Extraction method), 6 components with Eigen values greater than 1.00 were obtained and considered important in affecting food security problem in the study area. Eigen values indicate how many of the variables are explained by each of the

identified components while communality of components is the proportion of the variance of a variable that is common to other components (e.g. that which is shared with other variables). The following results show individual component analysis.

Component one

Component one explains 7.501 of the Eigen values and 31.3% of the total variance accounted for by household's income level in Ksh. that loaded 0.799. Other significant variable in component one are total farm size in ha loaded 0.791, production of traditional crops such as millet loaded 0.717, ha under Katumani maize composite B loaded 0.651, extension services loaded 0.608, performance of Katumani maize variety loaded 0.666, education level of the household head loaded 0.606, post harvest food losses loaded 0.594, hectares under beans loaded 0.594, use of oxen plough loaded 0.573 and input supply loaded -0.569. The results confirm the importance of household income resources as the engine to solve the problem of food insecurity in the semi- arid areas of Makueni District. Most of these variables revolve around finance hence component one can be renamed **household financial status**. Component one appears to be the strongest of all the others. This view is also reflected in stepwise regression analysis discussed in an earlier section.

Component two

Component two accounts for 3.00 of the Eigen value and 12.5% of the total variance accounted for by hectares under maize production that loaded 0.625. Others were status of road transport that loaded 0.499, perception towards food relief that loaded 0.493. Component two represents **Food Accessibility** which can be achieved through farm production, purchase and transportation from market and social safety nets i.e. food relief. All these have relationship with food security as earlier discussed

Component three

Component three explains for 1.926 of the Eigen values and accounts for 8.03% of the total variance determined by age of the household head, which loaded 0.794. Others were educational level of the household head loaded 0.626 and household size loaded 0.446. This component was labelled as **household social characteristics**. Such characteristics have relationship to food security as discussed in chapter five.

Component four

Component four accounts for 1.318 of the Eigen values and explains 5.5% of the total variance determined by food relief services which loaded 0.582 followed by maize production loaded 0.512 and household size loaded 0.393. This component was labelled as **household food consumption**. The variable grouped under this component are interrelated and have a relationship to food security because a majority of the households rely on maize production and when the yield is low, chances of food insecurity are normally high. The immediate solution is food relief distribution that increases the problem of food insecurity as discussed in chapter six. Sustainability of food produced from the farm and that provided through relief services depends on family size. The bigger the family, the faster the depletion of food, hence chances of facing food shortages are high.

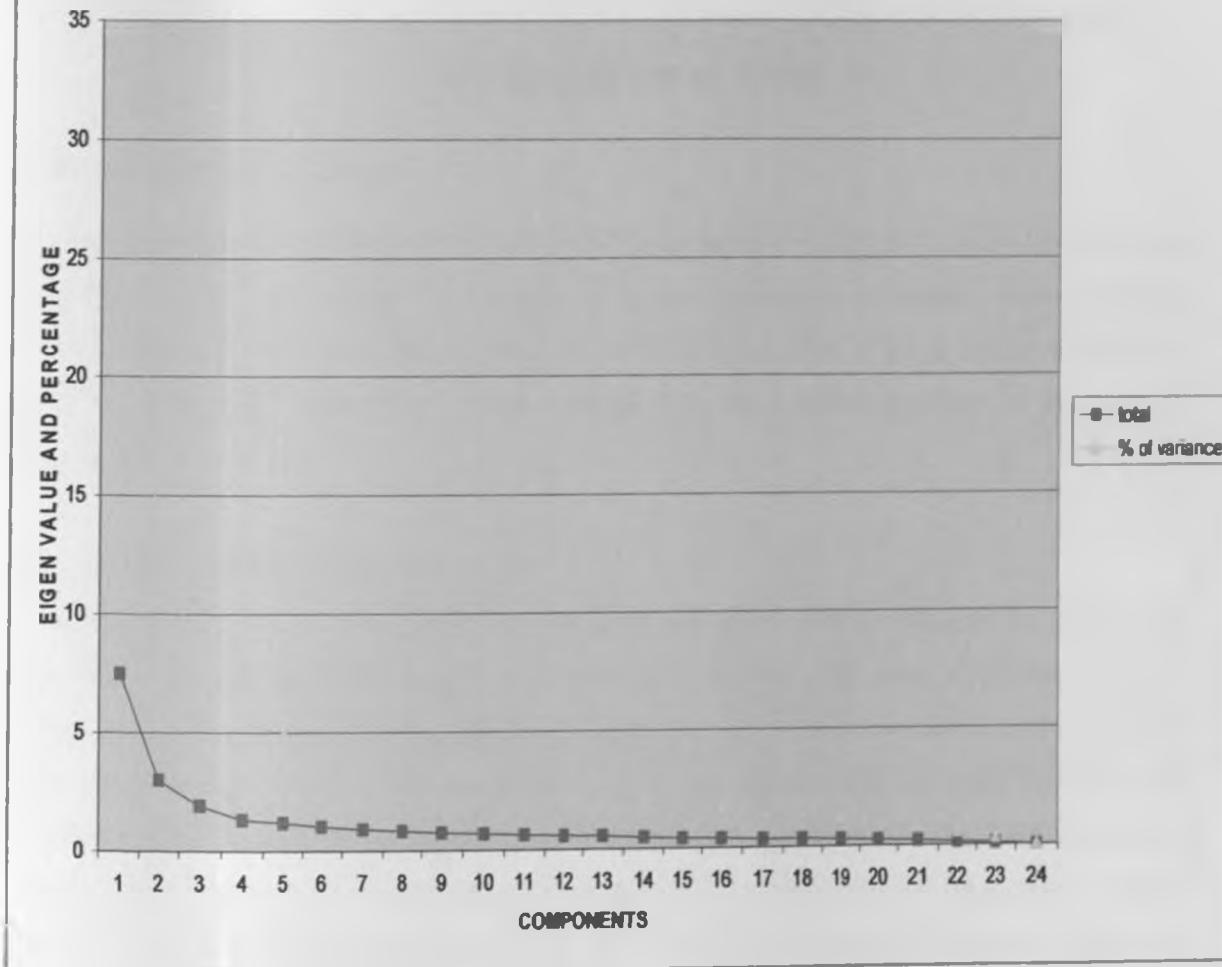
Component five

Component five explains for 1.203 of the Eigen value and accounts for 5.01% of the total variance determined by among others institutional intervention on credit facilities that loaded 0.457, hectares under katumani maize variety loaded 0.456 and food relief loaded 0.371. The component was labelled as **institutional intervention in food production, emergency supplies and accessibility**. The results showed the importance of accessibility to credit facilities that are lacking in the study area. Such facilities enable households to expand farm size, increase production and diversify sources of income. Subsequently, this leads to increased household food supply and reduction in reliance on food relief.

Component six

Component six accounts for 1.04 of the Eigen value and 4.32% of the total variance explained. This variance was accounted for by two variables namely educational level of the household head that loaded 0.428 and production of traditional crops such as millet that loaded 0.409. This component was labelled as **response to technological changes influenced by level of education**. However, the component appeared weak towards its relationship to food security. Figure 6.8 shows Eigen values and the percentage for all the components. However, only the first six were rated as significant with values above 1.0

FIG:6.8 EIGEN VALUE AND THE PERCENTAGE OF THE EXPLAINED SIX COMPONENTS



Source: Field Survey Data, 2001 – 2006

6.11 CONCLUDING REMARKS

Institutional interventions in production support services such as seed and fertilizer supply, extension advisory services and credit facilities has been poor in enhancing food security partly due to SAPS. Distribution of food relief services has not helped the needy households because of malpractices in committees charged with this responsibility. The situation of the food security problem in the study is worsened by poor infrastructural facilities that hinder food transportation and subsequently leads to increases in food prices. Consequently, the role of institutional factors in the food security problem in the study area is significant.

CHAPTER SEVEN

SUMMARY OF RESEARCH FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

7.1 Summary and conclusions

The primary objective of the present study was to examine the effects of socio-economic and institutional factors on household food security in semi-arid areas of Makueni District. While particular findings have emerged in the course of the discussion in the previous chapters, a general summary and conclusions on the findings from the specific objectives of the study is given below.

Status of food security in the study area

In addressing Objective 1, the study findings show that food security status in the study area varied from household to household and from year to year. This was exhibited by farm production figures taken from 1992 to 2001 on food crop yields as discussed in chapter five and in line with objective one of the study. The production records left no doubt the fact that households have lost their production based entitlement according to Sen's Model. Food supplies could not meet food demand at household level hence caused a food deficit which could not be realised through market purchase. About 70% of the households were at food risk because of either poor production or low purchasing power. It can be concluded that, food security is a problem in the study area and households have not been able to have sufficient food availability and accessibility.

Performance of drought resistant food crops

In addressing Objective 2, socio-economic and institutional factors have contributed to the shift from growing traditional food crops (such as sorghum, millet, pigeon peas, cassava) and Katumani Maize variety. These crops are drought resistant and can withstand moisture stress hence their production is essential in semi-arid areas where climatic factors poses limitation. However, findings show that households have reduced production of such crops in favour of local white maize among other hybrid varieties that are vulnerable to moisture stress. Results

from the field showed that negative attitude; changes in food preferences, labour constraints and lack of effective extension advisory services have contributed to poor production and low adoption of traditional food crops and Katumani maize variety. Adequate food is now largely equated with self- sufficiency in maize production to the detriment of other cereals. It can be concluded that shifting away from growing traditional food crops in favour of maize in semi-arid areas of Makueni District has contributed to low food availability from farm production.

Household social characteristics and gender factors

Household social characteristics have contributed to food security problem in the study area. The parameters discussed include age, education level and family size as mentioned in objective three of this study. The age composition of household members influenced ability to obtain food both in terms of the quantities that are required and the methods that could possibly be used to secure it. Households with several young men had the advantage of active labour that could open up the frontiers and clear the fields of cultivation. Subsequently, a comparison between the age distribution of household heads and the food security position of their households indicates that middle aged households (31-45 years) are relatively more food secure than the aged household (61-75 years). However, this depended on the food procurement strategy that households pursued.

The second aspect of household social characteristic was education level. Results from the study showed that, households with better-educated members (secondary and post- secondary comprising 29%) stood better chances of getting employment as well as implementing agronomic practices in farm production. The less educated members (30% with no formal education) of the households who happened to be the aged group had limited ideas on how to improve their farms and were disadvantaged because of being unemployable in many formal sectors. Hence, education is important in fighting food security problem at the household level through employment opportunities.

The third social characteristic of households in relation to food security was family size. A command of required food varied with the number of consumers. For example, whereas 80% of households with only three or fewer members obtained adequate food, less than 50% of households with 10 or more persons had no access to adequate food. This pattern tends to

imply that food shortages result from households with more people to feed because they deplete their stocks before the next harvest is realised. It is concluded that, household size dictates the consumption rate that determines the period a household can maintain food stocks and subsequently chances of vulnerability to food insecurity.

Further to examining Objective 3, the findings of the study show that solution to food security problem in the rural households need recognition of the pivotal role played by women. Women spend many hours in farming operations and food processing besides their involvement in various domestic activities. However, the study showed that women lack accessibility, control and ownership to means of production that include land resource, working capital, agricultural input, family assets, and agricultural education services among others. Male who are not easily available to implement them monopolizes decisions concerning use of such resources and services. Consequently, women tend to define themselves by their roles and social identities as the food providers in the household and not managers with full control of household activities and hence negative effect on food security.

On the other hand, household headed by female seem to be more food secure than those headed by males. The findings of this investigation suggest that women are better financial managers as compared to men. Men spend a greater proportion of the income they earn on luxury and unbudgeted goods such as alcohol and cigarettes while in contrast, women are more likely to purchase goods for children and for general household consumption hence reducing severity of food insecurity. The researcher concluded that, given equal opportunities with men, women will perform better towards solving the problem of food security at household level. For rural women, combining farm and non-farm income earning activities will be an adaptive strategy to allow them to reduce the risk of starvation for themselves and their families during periods of food insecurity.

Economic factors

Objective 3 of this study further examined the contribution of economic factors to food security and the results showed that food security problem in the study area is mainly perpetuated by poverty in comparison to environmental limitation. Although drought is often thought of as the precipitating cause of famine, drought does not necessarily lead to food shortage or its extreme

manifestation in famine if food is available through market channel. This argument is based on the fact that, physical limitation could be surmountable if resources are made available to mitigate their disastrous effect. However, results from the field showed that about 80% of the households earn below Ksh. 5000 per month (total family earnings) which cannot sustain continuous food purchase during shortages. This amount is below FAO/World bank recommendation of Ksh. 927 per person per month that translates to Ksh. 5562 for a family of six members. This situation is because of the high percentage (57%) of economically inactive population, lack of cash crops to boost farm earnings, few business opportunities, limited assets, and low education to promote employment skills. Therefore, the results indicate loss of purchasing power as an entitlement according to Sen's Model hence high vulnerability to food insecurity.

Consequently, low income and lack of adequate resources is the major contribution to food insecurity in the study area. Low-income forces households to dispose off their produce immediately after harvest when prices are extremely depressed to enable households meet domestic needs among other necessities because of what they harvest. In the process, future food needs are forfeited for more pressing (non- food) concerns. Some household had already sold all the grain stock one month after harvest. Unfortunately, the same households involved in disposing off such food tend to be the ones highly affected by food insecurity when the stocks are depleted and food prices are hiked.

Similarly, lack of income leads to labour shortage because households cannot afford to hire permanent workers. Households are also not able to purchase the required farm implements to improve farm production. It is therefore clear that whether rural households are able to obtain adequate food will depend on what resources are at their disposal and much more importantly, how they mobilize these resources for meeting their needs. This is important because it is becoming clear that most households buy food rather than produce it due to environmental and economic constraints faced in farm production.

The land factor is a source of livelihood in semi -arid areas where resources are a lacking. The amount of land available provided some households with the possibility of meeting their food needs in spite of low yields. The study findings reveal that there is a relationship between the

amount of land available to the households and their ability to meet consumption needs. For example, whereas about 40% of households with three to four hectares of land or less obtained adequate supplies, this figure rose to 65% among households with 6 to 8 hectares, and over 85% of those with ten hectares or more obtained adequate supplies. The land factor therefore has a critical link to the food security problem because it gives households flexibility in practising crop rotation, multiple-cropping, leasing part of the land to gain income, and keeping more livestock as insurance investment to boost food security during famine.

The food security problem was further aggravated by the magnitude of food losses incurred during pre-harvest and post-harvest. The study findings showed that a lot of food goes to waste with or without the knowledge of the household. Pests, animals and birds cause damage during pre-harvest, especially in areas such as Tsavo West and Chyulu National parks. Pest and rodents damage the rest during post-harvest storage. Poor storage facilities and lack of adequate funds to purchase pesticides were cited the causes of post-harvest wastage. Households have also abandoned the traditional methods of grain preservation that were cheap, effective and available. They replaced traditional methods of preservation with modern methods of storage that are expensive as discussed in Chapter Five. Subsequently, some households are forced to sell off their grain at throwaway prices because of lack of storage facilities. Food shortages have been witnessed after a period of successful rainy season with bumper harvest, simply because of waste and losses. The researcher concluded that post-harvest food wastage is significant and therefore leads to food insecurity at a period when households are supposed to enjoy bumper harvest. With minimal food losses and adoption of better methods of preservation, households can reduce the level of their food insecurity.

Institutional factors

In addressing Objective 4, the study findings show that poor government and non-governmental intervention in agricultural support services has been significant towards food insecurity in the semi arid areas of Makueni District. Introduction of structural adjustment policies removed government role in provision of subsidized farm inputs to farmers without giving alternative support. Production and marketing of seeds and fertilizers was left under private sector where unscrupulous dealers have been increasing prices and occasionally sale fake seeds. Majority of households were unable to purchase the required certified seeds during

planting season and therefore, they started planting late due to lack of seeds. Fertilizers are too expensive for most of the households because of liberalized market and lack of subsidized prices. The alternative that is manure was not adequately available because of limited number of livestock due to land factor. Therefore, many households did not have adequate and quality inputs hence led to low yields. Although international agencies, NGOs and local institutions have intervened in the supply of seeds and fertilizers during dry spells, their activities are uncoordinated and therefore the distribution of such inputs is unfairly done. The supplies are also limited and subsequently the impact towards improving food security is not felt. The situation was made worse by lack of credit facilities bearing in mind that most of the households do not have income generating activities. Financial institutions for credit facilities are few and operate under strict lending conditions.

Some few NGOs have tried to fund CBOs to boost farm production among other related activities. Reliable and well-coordinated credit facilities would have given households opportunity to improve farm production and increase off-farm income activities aimed at solving the problem of food insecurity. Hence, farmers are unable to plant at the right seeds at the right time because prices for the certified seeds are too high for the ordinary farmer. The seeds sold in the market do not guarantee the yields prescribed because of liberalized market that lacks government control and supervision.

The performance of the agricultural extension workers was dismal. These officers were not available to the farmers for advice and guidance on utilization of farm inputs, credit facilities, and pre-harvest and post-harvest food management. Most households resorted to trial and error methods in farm production. Generally, the Government's intervention in promoting extension advisory services has been low since introduction of the structural adjustment policies that led to liberalization of agricultural services. The role of the government was reduced at a time when household needed financial support. Most of the services were privatized including veterinary services, extension services, and credit facilities among others. International agencies, NGOs and CBOs have been involved in providing extension advisory services in selected areas. However, the capacity to offer these services is constraint by shortage of work force and resources.

Institutional intervention in food security was noted in food relief services. The distribution of food relief by government, International Agencies, NGOs and church organizations is poorly coordinated and comes after households have already suffered. Most of the food is given to those people who do not deserve it due to corrupt provincial administration system. A lot of it is sold as children go hungry. When given, the rations are too low to save a large family from starvation (e.g. 5 kgs of maize per month). This implies that households have lost the right to receive food assistance as a transfer based entitlement according to Sen's model. The researcher concluded that food relief contributes to food insecurity because it has introduced foreign food taste and preferences that do not encourage local people to grow local crops. This is one reason why traditional food crops are being neglected despite their suitability in the study area. Food relief should be given to those who deserve and it should be done at appropriate time. There is need to separate food relief from politics because for many years it has been used to give politicians political mileage.

Institutional intervention in infrastructural facilities was rated poor within Makueni District. Specifically the study addressed roads network and water facilities in relationship to food security problem. Examination of transport facilities showed that the study area is served by few and poor roads. Analysis of the road network and surface area covered revealed serious problem of inaccessibility to most parts of the district. The existing roads are out of use after damage caused by torrential rains. Many parts of the district are yet to be connected. Subsequently, lack of transport facilities limits movement and distribution of grain from areas of surplus to areas of deficiency. Grain dealers are forced to hike prices to make cereals and legumes reach interior market centers. Distribution of seeds and other essential farm inputs was affected by poor infrastructure.

In addition, sufficient food and farm inputs may be available in the district's major towns or neighbouring areas but such essentials fail to reach the rural households in good time due to poor infrastructural facilities. Households with perishable produce such as horticulture and dairy products cannot sell their products in good time because of poor infrastructural facilities. Subsequently, this leads to high rate of perishability and poor prices. Consequently, poor infrastructural facilities enhance food insecurity condition in the study area. The government has done very little to improve rural access roads. District development committee has raised

issue of poor roads in the district development plans but the national budget allocations have not taken into account the problem of proposed roads construction in the district.

Water facilities are few and scattered. The district is not well endowed with adequate ground and surface water resources. Therefore, households are forced to walk several kilometres in search of domestic water. This leads to waste of valuable man-hour which can be translated into either farm production or other off-farm income generating activities. The most affected are women because of their key role in rural food production. NGOs and churches have tried to improve water supply through construction of water tanks and dams but maintenance of such projects has faced financial constraints. There is need to make water accessible at short distance so as to reduce unnecessary waste of useful hours which can be channelled towards solving food security problem.

The researcher concluded that weak and poorly coordinated institutional activities in the study area have contributed to the problem of food security. Although the government must take the lead role in policy reform and development, it cannot succeed alone. There is need of partnership against food poverty between government, NGOs, private sector business and traders and Community Based Organizations.

Household food security coping strategies

In addressing objective five of this study, it was established that households have devised strategies to survive during periods of food shortages. These strategies included change in feeding habits during famine, diversification of sources of income to access market food, rural-urban movement in search of employment opportunities and dependence on social safety nets that include assistance from relatives, neighbours and organizations. Today, social safety nets strategy has been eroded by market opportunity cost principal, whereby food can fetch in more money on market than giving freely or exchanging with other commodities. A diversification strategy that involves reliance on off-farm activities appears to be the most effective drought and famine coping mechanism. This involves off-farm income generating activities such as small scale businesses in the local markets, exploitation of few local resources like charcoal burning, pottery products, 'kiondos' and basket weaving from sisal fibres, curio products and

traditional beer production among others. Such income is used to purchase the required foodstuff among other domestic needs.

The general conclusions of this investigation are that food insecurity is a significant problem in the semi-arid areas of Makueni District. All our analyses leave no doubt that human factor have played key role in creating sufficient ground for food insecurity. The leading factor associated with food security is household poverty because of low income and limited assets. Poverty affects the food production support services (such as land, farm technology, labour, and post harvest management among others) and food purchase process. The other important factors are role of gender in household management, post harvest food management and poor institutional coordination in implementation of policies aimed at reducing food insecurity in the study area. Social, economic and political approaches seem to address food security adequately by touching on farm production support services, food transportation and distribution, market purchase, social safety nets and donation as sources of food security. This is summarized as physical, economic and social access to food.

7.2 RECOMMENDATIONS AND POLICY IMPLICATIONS

The results from this study are important not only in academic circle but also in development, planning, and policymaking. In order to achieve a meaningful degree in food security at household level, the findings from this study were considered important to policy makers and planners, non-governmental organizations and other stakeholders interested in reducing food insecurity and promoting development of semi-arid areas. Once implemented, such recommendations as shown below will go along way in achieving food security in the marginal areas of Makueni District and other parts of the country.

- a) The situation in the study area requires more emphasis on cultivation of traditional food crops and more research on drought resistant varieties that are adaptable to semi-arid areas. Improvement on production for all these crops will succeed by making extension workers effective in advising farmers on relevant agronomic practices, nutritional value and economics of producing such crops. The consumption rate of the traditional crops can be improved by diversification of cooking techniques and creating awareness on the nutritional value to make them palatable. This can be done through department of home

economics in the ministry of agriculture. Such a move will increase foodstuff, diversify crop yields and remove the perceived notion that maize is the only food.

- b) The district suffers from limited cash crops that can be used to create income. Since small-scale horticultural farmers have emerged along areas of reliable water supply, the study recommends government support in developing both ground and surface water resources to increase production of local vegetables, Asian vegetables and fruits for domestic and international market. There is need to dam most of the rivers in order to harvest water which goes into waste during rain season. Investment in low cost irrigation technology e.g. furrows using gravitational force is recommended in the study area. This is already being practiced in Kibwezi and Kiboko area. Once implemented, the move will make available sufficient vegetables for household consumption as well as generating income to purchase the needed foodstuff and reduce poverty in line with the government's poverty reduction strategy paper.
- c) Although cotton production has declined as discussed earlier, the study recommends that the Government take the initiative to revive cotton production to take advantage of the AGOA market in USA. There is need to give farmers free seeds and subsidized pesticides to revive production. More so, the marketing chain needs improvement by removing the intermediaries and establishing efficient cooperative society. These are recommendations that the government can address seriously, as it has done in the coffee, tea, and sugarcane agricultural sectors to provide households in semi-arid areas with alternative sources of income to fight food insecurity.
- d) The study findings reported that over 70% of the rural households were rated food insecure due to low-income, limited sources of income and economically inactive. Subsequently, this study recommends policies aimed at increasing sources of income such as setting up medium financial institutions able to lend money at affordable interest rates to farmers willing to expand their farm and non-farm activities. The International Agencies, NGOs and other organizations operating in the study area should help CBOs with seed money that can be revolving among members through borrowing as practiced in Makindu Division. Members can guarantee one another and ensure the amount is repaid back. Such facilities will enable households not only

improve farm production but also open up small and medium scale businesses such as honey processing, pottery works, posh mills, hand craft curios, and retail shops among others. Others will be able to expand small scale horticultural irrigation production, buying and selling of livestock, expansion of land size, access education to gain employable skills and improvement in general livelihood to enable access to food stuff at all times.

Empowering households with income will free them from environmental constraints associated with poor yields by enabling them access food from the market when farm production is not sufficient. Households will also minimize disposal of foodstuffs immediately after harvest when prices are depressed. They result to this act because of lack of income to finance domestic expenses.

- e) The study recommends that the gender issue should seriously be addressed with a view to give women the right to ownership of property and freedom in decision-making and management at the household level. This can be achieved by enacting laws that recognize women in property ownership and inheritance as already proposed in the current draft constitution of Kenya. Women duties should also be balanced to create sufficient time for improving farm production. There is need of employing more women as extension workers because of their personal touch to farm activities. Moreover, women's source of income needs to be increased and enhanced because the findings of the study seem to suggest that they are better financial managers than men in matters concerning food security. This can be done by improving their education level and training. Their role in rural development should not be down played.
- f) Post-harvest losses and poor management was reported as salient problem leading to food insecurity. This study recommends improvement in storage facilities by encouraging household to construct ventilated granaries. The extension workers need to advise farmers on methods of grain drying, use of recommended agro-chemicals to preserve grain against weevils and other pests' infestation.
- Traditional methods of food storage and preservation should be encouraged through improved approaches because they are cheap and efficient. The study also recommends

strengthening the role and capacity of NCPB depots at various urban centers in the district by allocating sufficient funds which can be used to purchase cereals from households during bumper harvest at reasonable price instead of leaving households at the mercy of traders whose motive is profit driven. The grain can be stored at NCPB depots until the area reverts to food scarcity and therefore households can be authorized to buy back at affordable prices instead of being overcharged by traders. Such a move will stem down grain movement from the study area to other part of the country at cheap prices.

g) There is a need for supervision of extension workers by their seniors. These officers are field based but in practice, they have become office based. Ministry of agriculture needs to increase numbers of extension workers and preferably more women. These officers should be exposed to seminars and in-service courses to be updated on new developments in the farming field. A case in point is the farmers who require education on agro-ecological conditions of their area and varieties of crops that can do well. They require information on how to detect pest and disease infestation and how to handle them. In addition to services from extension workers, there is need to revitalize the FTCs to enhance informal agricultural education to farmers. The Government should therefore ensure that the mobility of extension workers is improved by providing them with transport facilities like motorbikes. The role played by non-governmental organizations in extension services should be harmonized with those provided by the Government.

h) Provision of relief food should be re-examined in order to develop strategies that focus more on genuine, needy cases. The study recommends integrated approach in distribution of food relief by expanding the organs involved. Use of churches, NGOs and CBOs will deliver such services more efficiently than the provincial administration that is corrupt and inefficient. Relief services should focus more on seeds to enable recovery from famine. Instead of giving free food; the government can lower prices so as to enable many families' to access food. The implementation of the school feeding programme should be encouraged to avoid school drop outs due to food shortages. There is need of strengthening food security and early warning systems right from sub-

location to National level. This will provide intervention measures at the right time instead of waiting for catastrophes to strike for the Government to act.

- i) Lastly, the study recommends that improvements be made on the roads and water infrastructure. Road repairs and construction of new ones will increase efficiency in food distribution as well as transportation of perishable products to the market. The study recommends utilization of local community in construction, planning and maintenance through community based road committee. These committees should work closely with public works. The same applies to water facilities that need to be increased to reduce long distances covered in search of water. By drilling more boreholes and construction of more dams will increase water supply.

In addition, the study recommends a suspension of the sand harvesting business along the rivers because it has contributed to lowering of water table. More techniques of water harvesting like roof catchments should be encouraged. All these will lead to more water for domestic and livestock consumption hence reduce waste of valuable man hours which can be utilized in search of food through farm production and off-farm income generating activities. Accordingly, food insecurity solution will require interdisciplinary approach because of crosscutting issues in human environment which interplay and intern affect food security level.

7.2.1 Recommendations for further research.

The findings of this investigation were that poverty is a major problem in fighting food insecurity problem in the semi-arid areas of Makueni District. Therefore, there is need of research focusing on strategies for alleviating rural poverty at household level in the study area. Such a study should embrace intergrated approach between private and public sectors in raising rural incomes because population growth in semi-arid areas is increasingly becoming significant.

There is a pertinent need to conduct further research on improving health care and solving the food insecurity problem. In particular, research needs to be focussed on the impact of HIV/AIDS on labour and productivity at household level. Researchers because of the unwillingness from families to reveal information on HIV/AIDS status and its effect have

avoided this field. Nonetheless, this area needs further investigation because of the emerging issues on HIV/AIDS on food insecurity in developing countries. Moreover, the impact of Malaria on health status of rural households can be studied to establish how it affects food security. Families are spending a lot of money on treatment of malaria and related diseases hence little resources are left to solve food insecurity problem.

Lastly, there is need of more research on the effect of Structural Adjustment Programmes (SAPS) on food security and poverty in semi-arid areas because such policies are no longer relevant to agricultural sector. The Government stands to perform poorly by embracing SAPS that have not promoted competition to ensure fair prices of commodities in the market. It is not worthy to continue enforcing these policies at the expense of the disadvantaged groups of people in the rural areas of Kenya.

7.2.2 Contributions made by the study

The findings, conclusions and recommendations presented in the analysis of this research form a major contribution in the field of agricultural geography and specifically to the understanding the issue of food security problem in the semi-arid areas of Kenya. Although no originality is claimed from various statistical tools used in this study (simple regression analysis, multiple regression analysis and principal component analysis), their application in data analysis, interpretation and presentation gave useful contribution to the researchers dealing with the nature and magnitude of food security problem in the study area.

The specific contributions include the following points. Firstly, the study has brought a new dimension in the research towards solving the food security problem in the semi-arid lands of Kenya. Previous approaches focused more on physical limitations as the main cause to food insecurity. However, the findings of this investigation confirm the significant role that human factors such as socio-economic and institutional attributes play in promoting food insecurity. This confirms the view that drought does not necessarily have to bring about famine. However, human error can create and enhance food insecurity at the household level.

The study established national food security does not necessary translate into household food security as emphasized by researchers and policy makers. Similarly, not all households are

affected by food insecurity despite sharing the same agro-ecological conditions. Therefore, for households to be more food secure than the others do, the entitlement approach used in this study has to be applied. Some households have more endowments or possessions than others that leads to stability in food supply. However, these endowments can be lost and subsequently, paves way to food insecurity. The approach that was used in this study to understand food insecurity at household level is indeed a major contribution.

Lastly, the study developed a technique to measure food insecurity at household level based on consumption characteristics of the local diets and household population size. The amount of consumption used was 135 kgs of cereals (farm production, market purchase and social safety nets) per month for an average family of six members (i.e. Ksh. 5500 per household of six members). This figure was based on a field survey and it was used concurrently with FAO/WHO model of 2250 calories per adult person per day which is equivalent of Ksh. 927 per person per month in rural areas (Ksh. 5562 per household of six members per month) to determine food poverty line. Although the model used in this investigation does not emphasize nutritional component of food consumption, it can be used in other semi-arid parts of Kenya where households rely on agri-livestock systems.

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APPENDIX 1

PART 1:

HOUSEHOLD SURVEY QUESTIONNAIRE- MAKUENI DISTRICT

The aim of this questionnaire is to collect data on socio-economic and institutional factors influencing household food insecurity in semi – areas; the case of Makueni District. The research is for academic purpose and therefore any information provided will be confidential.

1. HOUSEHOLD'S BACKGROUND INFORMATION

- (i) Name
- (ii) Division
- (iii) Location
- (iv) Household head (a) Age (Years) 20-30 ()
30-40 ()
40-50 ()
50-60 ()
Over 60 ()
(b) Gender.....
(c) Educational level.....
- (v) Household size.....
- (vi) What is your occupation? (a) Farmer ()
(b) Employment ()
(c) Casual labourer ()
(d) Business ()
(e) Others (specify)
- (vii) What is your average income per month in Ksh?
- (viii) What of the average income of all members of the house hold?
- (ix) What is your average expense per month on household food consumptions?

2. LAND FACTOR

(1) Land ownership (Tick the appropriate answer)

- (a) Individual ()
- (b) Communal ()
- (c) Lease ()
- (d) Others (specify).....

(ii) What is the size of your farm?.....hectares

(iii) Number of the farms

(iv) How many hectares are under the following crops?

- (a) Katumani composite B.....
- (b) Other maize variety.....
- (c) Sorghum.....
- (d) Millet.....
- (e) Cassava.....
- (f) Beans.....
- (g) Pigeon peas.....
- (h) Cow peas.....
- (i) Others.....

(v) Name the cash crops grown.....

(vi) Indicate your cropping combination.....

(vii) Give reasons for cropping patterns

- a) Ensures security of harvest
- b) Lack of adequate land
- c) Lack of labour
- d) Others (specify)

2. YIELD CHARACTERISTICS

(i) What is the average yield harvest per season for the following crops (sacks/kg etc?)

- (a) Maize.....
- (b) Beans.....
- (c) Sorghum.....

- (d) Millet.....
- (e) Cassava.....
- (f) Pigeon peas.....
- (g) Others.....

(ii) For the last 5 years, has your crop production been:

- Decreasing ()
- Increasing ()
- Constant ()

Give reasons for your answer

- Low rainfall amount ()
- Low soil fertility ()
- Poor methods of farming ()
- Others ()

(iii) Has your farm acreage

- Increased ()
- Decreased ()
- Constant ()

Give reasons for your answer

- Lack of labour ()
- Low production ()
- Others ()

(iv) State the reasons for not growing traditional crops namely sorghum, millet and cassava.

- Negative attitude ()
- Unpalatable ()
- Low prices ()
- Low demand ()
- Lack of labour ()

(v) Do you grow Katumani maize variety?

Give reasons if not grown.

- Yields low ()

- Seeds scarce ()
- Seeds expensive ()
- Negative attitude ()
- Lack of information ()
- Others-(specify) ()

4. OTHER SOURCES OF FOODSTUFF AND ITS MANAGEMENT

- (i) What is your average cereals and legumes farm produce per season?
- (ii) How much does your family consume per month?-
- (iii) Is your farm harvest enough for household consumption?
- (iv) If the answer is no, where do you get the deficit? Tick where appropriate.

Source	()	quantities
(a) Buy from the market	()Kg per month
(b) Food relief	() Kg per month
(c) Friends donations/social safety nets	() Kg per month
(d) Food for work	()Kg per month.
(e) Depends on relatives	()	... Kg per month
(f) Other (specify)	Kg per month.

(iii)(a) If food stuff is bought, is the money enough...

(b) Where do you get money to purchase food stuff during shortages? Tick where appropriate.

- Employment ()
- Business ()
- Selling family assets ()
- Trade ()
- Barter trade ()
- Family assistance ()
- Friends assistance ()
- Others (specify).....

(iv) a) If food relief is given, name the types provided.....

b) Source of the food relief:

- Government ()
- Church ()
- NGO (name) ()
- Others (specify).....

c) How much do you get?

Per day.....Kg

Per month.....Kg

Per year.....Kg

d) Can you survive without food relief?

e) Is food relief of great importance to you?

(v) What in your opinion are the causes of food shortages in your household?

Tick appropriately.

- Low production ()
- Inaccessibility due to scarcity ()
- Inaccessibility due to lack of money ()
- Prices are too high ()
- Inaccessibility due to lack of transport facilities()
- Others (specify).....

(vi) What are the common combination of household food stuff prepared in daily meals?.....

.....
.....

(vii) How much food do you sell per season?.....kg

(viii) At what stage do you sell?

- Immediately after harvest ()
- When a new harvest is about to start ()
- When the need arises ()

(a) Why do you sell your food produce?

- For school fees ()
- Treatment ()
- Household expenses ()
- Other (specify)-----

(b) After selling, do you leave sufficient food for household consumption?

(c) What is the average price per kg for cereals and legumes during?

Bumper harvest-----Ksh

Food scarcity-----Ksh

5. LABOUR PROVISION

(i) Which is your source of labour?

- Parents ()
- Children ()
- Permanent employees ()
- Casual employees ()
- Other (specify)-----

(ii) a) is the labour force enough?-----

b) If not, why? -----

(c) How do you meet the deficit? -----

(iii) How much do you pay your labour force per month?

Permanent-----Ksh

Casual (per day) -----Ksh

(iv) If casual labour is used, at what stage in crop production do you need it?

- Preparation ()
- Planting ()
- Weeding ()
- Harvesting ()

6. FARM INPUTS

(i) a) Where do you get planting seeds?-----

- Market-----
- End off season-----
- Relief supply-----
- Neighbours / friends-----

b) Do you experience a shortage in seeds' supply? -----

c) If yes, state the crop variety affected and give reasons-----

d) Compare seed prices during government control prices and the current liberalized market-----

e) Is planting time affected by seeds availability? -----

f)

(ii) Do you use manure? -----

If yes, state the quantities applied per hectare in Kg-----

a) If no, give reasons-----

(iii)(a) Do you use fertilizers? -----

If yes, state the quantities applied per hectare in kgs. -----

b) If no, give reasons-----

(iv) Which farm implements do you use?

- Tractor ()
- Ox-plough ()
- Jembes ()
- Hoes ()

- Others (specify)-----

a) Give reasons for its use-----

b) State problems faced in farm implements (as stated above) -----

7. RESEARCH AND EXTENSION SERVICES

(i) Do you have any agricultural training? -----

(ii) If no, give -----

(iii) How do you receive information on farming?

- Radio ()

- Neighbours ()

- Agricultural shows ()

- Extension officers ()

- Trial and error ()

- Other (specify)-----

(iv) (a) How many times have you been visited by an extension officer?

Per month-----

Per year-----

Never visited-----

b) Do you think extension services are important in crop production? -----

c) How can extension services be improved to serve you better?

d) Do you think farmers training centres are important in crop production

8. CREDIT FACILITIES

(i) a) Have you ever received a loan for agriculture purpose?-----

b) What are the requirements for loans provision? -----

(ii) If you have not received a loan, what are the reasons?

(iii) Have you ever been given any farm input or implement on credit? -----

If yes, name it. -----

If no, give reasons -----

(iv) Do you think you could improve your food crop production if loan or credit facility is given? -----

(v) Do you think you could improve your sources of income if loan or credit facility is given? -----

9. FOOD WASTE

(i) How much food do you think is wasted by pests, birds and rodents in the field before harvest? -----

(ii) How much food do you think is wasted by pests and diseases during storage? -----

(iii) Do you start consuming the produce right in the farm or do you wait until it is harvested? -----

(iv) Do you experience grain losses during harvesting? -----

(v) Is there wastage during cooking and consumption? -----

10. FOOD STORAGE

a) Where do you store your food produce?

- Traditional thatched granary ()
- Modern thatched granary ()
- Modern roofed granary ()
- Others ()

b) Is the produce properly dried before storage? -----

What problems do you face during storage?

- Lack of space ()
- Weevils ()
- Rats ()

11. FOOD SHORTAGES COPING STRATEGIES

- (i) How do you manage to cope with food insecurity?
- Relies on farm production only ()
 - Relies on market sources ()
 - Relies on social safety nets ()
 - Adjustments in feeding habits ()
 - Others (specify) ()
- (ii) What are the short comings of the strategies used to manage food insecurity?

12. ROLE OF WOMEN IN CROP PRODUCTION

- (i) Who owns the farm?
- Mother ()
 - Father ()
 - Both ()
- (ii) Are women supposed to inherit land? -----
- (iii) Are women supposed to own title deeds? -----
- (iv) What decisions are women allowed to make independently?
- Purchase of seeds ()
 - Engaging labour ()
 - Selling the produce ()
 - Expanding the farm ()
 - Other (specify)-----
- (v) Generally what are the roles of women in farming and food management? -----

- (vi) What problems do women face in decision making on farming? -----

13. Infrastructural facilities

- (i) How far is your Household from the nearest market where food is purchased?
- (ii) Are the roads in this division accessible throughout the year?

If no explain the condition-----

- (iii) Does the condition of road infrastructure affect food prices?
- (iv) How do you transport food from market to your home?
- (v) State problems faced in food transportation from the farm to the house
 - Poor roads ()
 - Lack of facilities ()
 - Farms far from home ()
 - Lack of labour ()
 - Others (specify-----)

14. GENERAL OPINION

- (i) How do you earn your living-----
- (ii) What are the major causes of food insecurity in this division? -----

- (iii) How can the problem of food insecurity be solved by the households
- (iv) What are your views towards rural poverty eradication?

APPENDIX 2

PART 2:

MINISTRY OF AGRICULTURE AND PROVINCIAL ADMINISTRATION SURVEY QUESTIONNAIRE- MAKUENI DISTRICT

Ministry of Agriculture officials

- 1 a) Officer's rank.....
b) Gender.....

2 a) Number of farming households in the district/ division.....

b) Actual and estimated yield per hectare for the following crops

Crops	Estimated yield	Actual yield
Katumani maize
Local maize
Millet
Sorghum
Cassava
Pigeon peas
Cow peas
Beans

3 a) Comment on farmers' perception towards Katumani maize variety production

.....
.....

b) Comment on farmers' perception on traditional food crops production namely

Sorghum.....

Millet

Cassava.....

4 what are some of the coping strategies applied by farmers during drought periods?

5 a) How does food waste affect crop yields in the following stages

Production

Harvesting

Post-harvest storage

b) Name the common pests and diseases affecting food crops in this division

6 a) what are the linkages between the farmers and the extension services?

b) What are the problems faced by the extension officers in discharging their duties?

7 a) In your own assessment, what are the problems contributing to low yields in food crops in this division/district?

b) What factors are contributing to food insecurity in this division/ district?

8 a)What are the roles of NGOs, International organizations, financial institutions, Churches and other institutions (specify) in the following

Extension services

Farm inputs

Credit facilities

9a) From your own assessment, what are the impacts of structural adjustment policies on agriculture in the district?

b) Does the government has mechanisms in place to monitor and coordinator institutional intervention services in addressing food security problem?

Provincial Administration officers' questionnaire

1) District Commissioner/ District officer

a) How much food is given in form of food relief in this division/ district per year?

b) How much food is allocated to each household per month?

c) What criteria is used to select those who deserve food relief

d) List the other organizations involved in food relief services a part from the government

2). In your own assessment, what are the problems affecting food security in this district/ division?

3) What are your suggestions to the possible solution on food security problem in this district/ division?

Thank you for your co-operation.

Boniface N. Wambua

University of Nairobi

APPENDIX 3

DIVISIONS AND SUB-LOCATIONS SAMPLED FOR STUDY

KASIKEU DIVISION

Uvaleni sub-location

***Kasikeu sub-location**

Wathini sub-location

Kiou sub-location

Kwale sub-location

Muani sub-location

Sultan Hamud sub-location

Mumela sub-location

WOTE DIVISION

Unoa sub-location

Wote sub-location

*** Kambi mawe sub-location**

Kikumini sub-location

Kitonyini sub-location

Itaa sub-location

Kako sub-location

KIBWEZI DIVISION

Kikumbulyu sub-location

*** Ngandani**

Kilungu sub-location

Kathyaka sub-location

Masongaleni sub-location

Utithi sub-location

Kinyambu sub-location

KATHONZWENI

Kathonzweni sub-location

*** Kwakavisi sub-location**

Kavingoni sub-location

Mavindini sub-location

Mbuvo sub-location

Kitise sub-location

Kiangini sub-location

MAKINDU DIVISION

Ngaaka sub-location

Kali sub-location

Kiboko sub-location

Makindu sub-location

Nguumo sub location

*** Syumile sub-location**

Kaunguni sub-location

Kisingo sub-location

*N.B: * Refers to sub-locations sampled for study*