

POVERTY EFFECTS OF STRADDLING: RURAL INCOME DIVERSIFICATION IN
NYERI AND KAKAMEGA COUNTIES, KENYA.

A MESO AND MICRO RESEARCH REPORT

FOR COLLABORATIVE RESEARCH AMONG
LUND UNIVERSITY, UNIVERSITY OF NAIROBI

AND

KENYATTA UNIVERSITY

BY

STEPHEN K. WAMBUGU¹

AND

JOSEPH T. KARUGIA²

1- Department of Geography, Kenyatta University

2- Department of Agricultural Economics, UoN / ReSAKSS (ILRI)

The Research inputs by Lucy W. Ngare, Rosaline Karimi and Field Enumerators are highly appreciated.

TABLE OF CONTENTS

LIST OF TABLES	iv
LIST OF FIGURES	vi
LIST OF ACRONYMS	vi
ABSTRACT.....	vii
1.0 INTRODUCTION AND PROBLEM OVERVIEW	1
1.1 Background	1
1.2 Statement of the Problem	2
1.3 Overall Aim and Purpose of Study	4
1.4 Research Objectives	5
1.5 Literature Review	5
1.5.1 Agricultural Transformation Process.....	5
1.5.2 Diversification, Straddling and the Process of Agricultural Transformation.....	7
1.6 Organization of the Report.....	9
2.0 METHODOLOGY	10
2.1 Sampling Design	10
2.2 Data Sources and Methods of Data Collection.	11
2.3 Methods of Data Analysis.....	12
2.3.1 Analysis of General Trends in Livelihood Portfolios.....	13
2.3.2 Analysis of Diversification Trends.....	13
2.3.3 Analysis of Impact of Off-Farm Income on Agricultural Investment and Productivity	14
2.3.4 Analysis of Regional Differences in incomes and Levels of Development.....	15
3.0 RESULTS AND DISCUSSION.....	16
3.1 Meso Section: Characteristics of the Sampled Counties and Villages.....	16
3.1.1 Agro-ecological Potential and Market Access in Nyeri County.	16
3.1.2 Contrasts in Agro-ecological Potential and Market Access in Kakamega County	18
3.1.3 Village Characteristics and Crops Grown	20
3.1.4 General Trends in Livelihood Portfolios among Villages in Nyeri and Kakamega Counties.....	24

3.2 Section Two: Micro Section.....	32
3.2.1 Crop and Livestock Contribution to Household Income.....	32
3.2.2 Non-Farm activities' Contribution to Household Income.....	33
3.3 Trends in Livelihood Diversification in the Households	35
3.3.1 Household Economic Diversification.....	35
3.4 Drivers of Diversification and Specialization	38
3.4.1 Factors Affecting Adoption and Intensity of Use of Fertilizer in Maize.....	38
3.5 Estimates of Income Inequalities in Nyeri and Kakamega Counties.....	46
4.0 CONCLUSIONS, POLICY RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH.	66
4.1 Conclusions	66
4.2 Policy Recommendations	67
4.3 Areas/Suggestions for Further Research.....	68
LIST OF REFERENCES	70

LIST OF TABLES

Table	Page
3.1: The ten survey villages and their geographical locations.....	21
3.2: Characteristics of the Surveyed Villages.....	22
3.3: Categorized Contribution to Total Household Income as a Percentage of the Total (%).....	24
3.4: Mean income in the sampled Villages.....	25
3.5: Mean Cultivated Area in Acres.....	26
3.6: Mean number of different crops grown per village.....	27
3.7: Area allocated to different crop categories.....	28
3.8: Mean number of non-food cash crops grown in the villages.....	29
3.9: The mean number of livestock per village.....	30
3.10: Agricultural contribution to Gross household income as a percentage of the total.....	31
3.11: Non-Agricultural contribution to Gross household income as a percentage of the total.....	33
3.12: Diversification Indices at Various Levels.....	34
3.13: Crop Diversification Indices.....	35
3.14: Livestock Diversification Indices.....	36

3.15:	Income Diversification Indices.....	37
3.16:	Correlation between non farm income and farm investment.....	39
3.17:	Probability of Investing and the Intensity of Improved Fertilizer use in Maize (Aggregated off farm income).....	40
3.18:	Probability of investing and the intensity of improved fertilizer use in maize (Disaggregated off farm income).....	43
3.19:	Household Income Shares by Deciles.....	44
3.20:	Overall Gini Coefficients for Kakamega and Nyeri, 2013.....	46
3.21:	Selected Land Types by Region ('000 ha), 1998.....	52
3.22:	HIV Prevalence Rate by Gender and Ethnic Group.....	57
3.23:	Income distribution by household headed (1999).....	60
3.24:	Number of unemployed by gender age groups, 1999.....	60
3.25:	Literacy by Gender and Region, %.....	61

LIST OF FIGURES

Figure	Page
2.1: Values of Herfindahl Concentration index assuming equal share of each economic activity.....	14
2.2: A Typical Lorenz Curve	15
3.1: Lorenz Curve for Kakamega.....	47
3.2: Lorenz Curve for Nyeri.....	47
3.3: Lorenz Curve for Kakamega males.....	48
3.4: Lorenz Curve for Kakamega females.....	48
3.5: Income Distribution by Regions.....	49
3.6: Access to Water.....	53
3.7: Regional Access to Electricity.....	54
3.8: Gross School Enrolment by Region.....	55
3.9: HIV Prevalence by Region and Gender.....	56
3.10: Lorenz Curve for Kakamega Males for the Year 2013.....	57
3.11: Lorenz Curve for Kakamega Females for the Year 2013.....	58
3.12: Lorenz Curve for Nyeri Males.....	58
3.13: Lorenz Curve for Nyeri Females.....	59
3.14: HIV Prevalence by Age Group and Sex, 2003.....	62

LIST OF ACRONYMS

FGDs	Focus Group Discussions
KARI	Kenya Agricultural Research Institute
KNBS	Kenya National Bureau of Statistics
KWFT	Kenya Women Finance Trust
PPAs	Participatory Poverty Assessments
PRSP	Poverty Reduction Strategy Paper
PWDs	Persons With Disabilities
RoSCAs	Rotating and Saving Credit Associations
SSA	Sub Saharan Africa
UN	United Nations

ABSTRACT

This study examines the effects of income straddling on poverty. Some of the key questions addressed in the study include, what are the general trends in livelihood portfolios in Nyeri and

Kakamega Counties? What are the diversification trends at various levels in Nyeri and Kakamega agricultural sectors? What is the impact of off-farm income on agricultural investments and productivity? The study was guided by the following research objectives: To analyze the general trends in livelihood portfolios in Nyeri and Kakamega Counties; to quantify the levels of diversification at crop, livestock and income levels; to assess the impact of off-farm income on agricultural investments and productivity; to explain regional differences in the level of development of the non-farm sectors of the rural economy and to assess the implications of income diversification on the distribution of assets and incomes and more generally on life chances at the village level. The study relied on a panel data set collected in the years 2002, 2008 and 2013 from two counties in Kenya namely Nyeri and Kakamega. The data was collected in 10 villages and 300 households. Some of the key findings are that households in Nyeri and Kakamega counties are diversifying rather than specializing in their agricultural activities. The impact of off-farm earnings on input use, agricultural specialization and intensification was found to be minimal. The tobit and double hurdle models showed that non-farm income had negative coefficients on adoption and intensity of agricultural input use. The two counties exhibit wide inequalities in income as depicted by the Gini coefficients and the Lorenz curves. Gender income inequalities were found to be higher in Kakamega than in Nyeri. The study makes a number of policy recommendations. These include designing policies that will encourage a shift from promoting broad agricultural diversification to facilitating specialization among households that are likely to do so. It also recommends a multifaceted approach to policy that considers other constraints to intensification and specialization especially with regard to technology generation, returns to input use, input delivery systems and effectiveness of extension.

1.0 INTRODUCTION AND PROBLEM OVERVIEW

1.1 Background

Poverty remains a pervasive national problem presenting formidable challenges that call for urgent and sustained actions. The poor constitute more than half the Kenyan population. According to the PRSP (2004), at least one in every two Kenyans is poor. Poverty is a multi-dimensional phenomenon. It includes inadequacy of income and deprivation of basic needs and rights, lack of access to productive assets as well as to social infrastructure and markets.

Using the quantitative approach of measuring poverty, the poor are seen as those who cannot afford basic food and non-food items. The 1997 Welfare Monitoring Survey estimated the absolute poverty line at KSh1, 239 per person per month and 2,634 respectively for rural and urban areas (PRSP, 2004).

Using the qualitative approach (PPAs), people define, view and experience poverty in different ways. In the 2001 PPA reports, Kenyans mainly defined poverty as the inability to meet their basic needs. Poverty was characterized by such features as lack of land, unemployment, inability to feed oneself and one's family, lack of proper housing, poor health and inability to educate children and pay medical bills. While different people and communities define poverty differently, poverty is invariably associated with the inability to meet/afford certain basic need (PRSP, 2004).

For more than half a century, many people in the development sector have worked at alleviating extreme poverty so that the poorest people can access basic goods and services for survival such as food, safe drinking water, basic sanitation, shelters and education.

However, when the current national averages are disaggregated there are individuals and groups that still lag too behind. As a result, the gap between the rich and the poor, urban and rural areas, among ethnic groups or between genders reveal huge disparities between those who are well endowed and those who are deprived

According to the world inequality statistics, Kenya was ranked 103 out of 169 countries making it the 66th most unequal country in the world. Kenya's inequality is rooted in its history, politics, economics and social organization and manifests itself in the lack of access to services,

resources, power, voice and agency. Inequality continues to be driven by various factors such as: social norms, behaviors and practices that fuel discrimination and obstruct access at the local level and/or at the larger societal level; the fact that services are not reaching those who are most in need of them due to intentional or unintentional barriers; the governance, accountability, policy or legislative issues that do not favor equal opportunities for the disadvantaged; and economic forces i.e. the unequal control of productive assets by the different socio-economic groups.

According to the 2005 report on the World Social Situation, sustained poverty reduction cannot be achieved unless equality of opportunity and access to basic services is ensured. Reducing inequality must therefore be explicitly incorporated in policies and programmes aimed at poverty reduction. In addition, specific interventions may be required, such as: affirmative action; targeted public investments in underserved areas and sectors; access to resources that are not conditional; and a conscious effort to ensure that policies and programmes implemented have to provide equitable opportunities for all.

1.2 Statement of the Problem

It has been widely argued that, during early stages of development and in societies where most of the population is composed of rural smallholder farmers as in much of Sub-Saharan Africa (SSA), increased agricultural productivity is necessary to increase incomes of most of the poor directly, and to stimulate the development of the rural non-farm economy (Timmer, 1984; Block, 1994; Reardon et al., 1994; Reinert, 1998; Byrlee et al., 2005). Without such impetus, broader growth in the rural economy will be constrained and poverty reduction much more difficult to achieve.

Three observations are noteworthy in this regard. First, agricultural productivity has stagnated in SSA and, in many instances, poverty is rising (World Bank, 2004). Productivity growth in the smallholder sector has been especially difficult to achieve. Second, research has shown that large minorities and, in some cases, majorities of households in rural Africa earn larger shares of their income from off-farm employment than they do from on-farm work (Reardon and Taylor, 1996; Reardon et al., 2000; Tschirley and Benfica, 2001). These findings point to the important role that off-farm employment can play in poverty reduction as enumerated in vast literature (Reardon, 1997; Lanjouw, 2001; Barrett et al., 2001; Barrett et al., 2005). Finally agricultural

credit for small holders is severely lacking in most countries of SSA, making it difficult for poor farmers to finance the inputs typically needed for increased productivity (Carter et al., 2004). This difficulty is especially great for food crops, which lack the institutional arrangements that sometimes relieve credit constraints for cash crops such as coffee, tea and cotton.

While the above studies and many more have made numerous contributions on the role of both farm and off-farm employment to poverty reduction, little is known about the exact nature of interaction between these two sectors at the household level. Specifically, there exists minimal empirical literature on the relationship between off-farm work and agricultural productivity. At an aggregate level, the relationship between farm and off-farm sectors can be explained through growth of linkages whereby an increase in agricultural productivity increases agricultural output and incomes which spur growth in the non-farm sector (Reinert, 1998). While this is indeed very important for rural development, the design of specific pro-poor policies could benefit from more specific information on the nature of the interaction between farm and off-farm sectors at the household level.

Approximately half of the population of the SSA earn incomes of less than one dollar a day and as such are defined as poor by the UN. The ambitions of the first Millennium Development Goal: to halve the share of Africa's poor by 2015 appear unrealistic one year from the finishing line. African poverty is predominantly a rural phenomenon and the key to improving the livelihoods of the poor must be sought in the rural areas of the continent. While most of the poor are engaged in small-scale, semi-subsistence farming, they also earn income from non-farm activities. In thus diversifying their incomes they straddle the farm and non-farm sectors; straddling forms an important complementary source of income for cash strapped households.

The importance of non-farm income for livelihood strategies of rural people has attracted much attention among development scholars, policy makers and donors during the past decade. Although non-farm incomes on an aggregate level are important in the rural economies of SSA, the distribution of such incomes is normally much skewed in favor of the better-off. The bulk of studies on income diversification out of agriculture into the non-farm sector have therefore focused on mechanisms that can lower entry barriers and increase the participation of the poor in such income generation. Much less attention has been devoted to the question of how non-farm activities affect farming even though the great majority of rural Africans still source their income

from agricultural production. Disregarding the household level linkages between farm and off-farm activities severely limits the scope for designing policies and interventions capable of reducing rural poverty. Several questions emerge from the knowledge gaps that exist in the field of diversification research.

Are non-farm activities competing with or complementary to agricultural incomes? Can non-farm incomes pull smallholders out of poverty by generating capital for investments in technology, improved land management, diversification into high value crops and livestock production? Or are such activities draining the farm of labor and capital? Under what institutional circumstances is the non-farm sector capable of promoting agricultural investments? How is land and income distribution affected by the growth of non-farm incomes? What are the gendered effects of income diversification and its consequences? How do the composition and distribution of non-farm incomes vary according to the village level characteristics? Are diversification processes less or more unequal in marginal areas?

The proposed project offers to fill some of these knowledge gaps. The study draws on existing databases comprising general livelihood portfolios, cropping patterns, income and production data for 2002, 2008 and 2013 for 300 farm households in 10 villages situated in two regions in Kenya. In addition to the surveys carried out in 2002 and in 2008, the households were resurveyed in 2013 in order to obtain a panel data set allowing detailed analysis of the mentioned linkages over time.

1.3 Overall Aim and Purpose of Study

The aim of the project is to determine the impact of non-farm income on farm production among small holders in two counties in and Kenya (Nyeri and Kakamega Counties). The two regions have been selected to represent variation in terms of agricultural dynamism. For this reason we hypothetically assume that non-farm-farm linkages will differ between the regions. The purpose of the project is to answer some central questions:

1. What are the general trends in livelihood portfolios in Nyeri and Kakamega Counties?
2. What are the diversification trends at various levels in Nyeri and Kakamega agricultural sectors?
3. What is the impact of off-farm income on agricultural investments and productivity?

4. What, if any are the regional differences in the level of development of the non-farm sectors in the rural economy? Are for example, smallholders in more agriculturally dynamic regions deriving more or less income from non-farm income sources than those in more stagnant regions?
5. What are the implications of income diversification on the distribution of assets and incomes and more generally on life chances at the village level?

1.4 Research Objectives

This study was guided by the following objectives:

1. To analyze the general trends in livelihood portfolios in Nyeri and Kakamega Counties.
2. To quantify the levels of diversification at crop, livestock and income levels.
3. To assess the impact of off-farm income on agricultural investments and productivity.
4. To explain regional differences in the level of development of the non-farm sectors of the rural economy
5. To assess the implications of income diversification on the distribution of assets and incomes and more generally on life chances at the village level.
6. To draw conclusions and offer policy recommendations that can help in the design of specific pro-poor policies and programmes benefiting from more specific information on the nature of the interaction between farm and off-farm sectors at the household level.

1.5 Literature Review

1.5.1 Agricultural Transformation Process

As stated by Staatz (1998), the agricultural transformation is the process by which individual farms shift from highly diversified, subsistence-oriented production towards more specialized production oriented towards the market or other systems of exchange. The process involves a greater reliance on input and output delivery systems and increased integration of agriculture with other sectors of the domestic and international economies. Agricultural transformation is a necessary part of the broader process of structural transformation, in which an increasing proportion of economic output and employment are generated by sectors other than agriculture (Staatz, 1998).

According to Timmer (1988), the agricultural transformation moves through four phases that call for different policy approaches. The process starts with a rise in agricultural productivity, which generates surpluses that can, in the second phase, be tapped to develop the non-agricultural sector. For resources to flow out of agriculture, rural factor and product markets must become integrated into the rest of the economy. The progressive integration of the agricultural sector and the macro economy, through infrastructure development and better markets, marks the third stage of transformation. A successful third phase will lead to a fourth phase, where the role of agricultural sector in an industrial economy will not be any different from other sectors like manufacturing and services.

Though literature suggests that, the economic benefits from agricultural transformation eventually create their own momentum to move the process forward; the process can be derailed or greatly slowed in a number of ways by government policy. Governments can directly slow the process by maintaining tight restrictions on staple food trade, by not allowing land markets to emerge to facilitate the consolidation of farms in response to economies of scale, by failing to invest in the agricultural research and hard and soft infrastructure that will bring down unit costs throughout the food system, and by economic mismanagement that discourages the kind of large-scale private investment that will help pull labor off the farm and into the industrial and service sectors. Civil strife can of course slow or reverse the process.

Since the mid 1990s, several factors in Kenya have likely promoted its agricultural transformation. Yet other factors have likely held the transformation back; how these opposing factors have played out in the evolution of Kenya's rural economy is the central empirical question addressed in this research report using case studies of Nyeri and Kakamega Counties. The fact that the country has been at peace (except in a few isolated instances) has preserved and perhaps strengthened its long established role as a center of farm (e.g. horticultural exports) and non-farm investment in East Africa. High population densities in all but the semi-arid areas tend to reduce the cost of exchange in markets and thus promote a market orientation; the rural populace's relatively high level of education compared to neighboring countries will reinforce this tendency. Long investment in agricultural research through KARI and other research centers should increase productivity and facilitate the transformation. Finally, substantial economic liberalization starting around 1994 should have accentuated all these positive factors and spurred

further market development and thus agricultural transformation. At the same time, per capita incomes declined through the 1990s, making it difficult for urban and rural non-farm sectors to absorb agricultural labor. Road infrastructure has deteriorated badly in some rural areas, making it more costly to rely on markets. All these factors hold back the agricultural transformation, as does the periodic civil strife in some areas and, possibly, continuing uncertainty following the post-election violence of 2008.

1.5.2 Diversification, Straddling and the Process of Agricultural Transformation.

By diversification we mean the number of economic activities an economic unit is involved in and the dispersion of those activities' shares in the total economic activity of the unit; diversified units have many activities with similar shares, while specialized units may have few activities or many activities but with only a few accounting for high shares. An economic unit refers to a household, a village, or any other geographical aggregation up to the national level. To generate expectations about patterns of diversification in Kenya since 2002, we adapt a model first proposed by Timmer (1997) that relates the process of agricultural transformation to agricultural diversification. A relationship is expected between agricultural transformation and economic diversification. While agricultural transformation overall implies greater economic specialization (less economic diversification) of individual farms, we expect farm level diversification to increase in the initial stages of the transformation due to different rates of market development for staple foods and cash crops. Markets for staple foods develop more slowly than those for cash crops for three reasons. First, staples have a lower value for weight than cash crops, implying a higher relative burden of downstream costs (transport, transformation, transactions costs) and thus more restricted scope for trade. Second, these crops in developing countries are typically traded only domestically or regionally, not internationally, and their processing requirements are more flexible than those of many cash crops. As a result, staples tend not to receive the same level of investment from agribusiness firms, with backward linkages to farmers, which typify many cash crops in Africa such as cotton, tobacco, and sugar, and their markets remain more fragmented. Finally, governments in the developing world are more likely to follow policies that restrict the development of private food staple markets due to concerns that unrestricted trade could lead to food security crises. As a result, food staples tend to have a large wedge between sales and purchase prices, to suffer from very high seasonal prices, and tend to become very scarce in more isolated markets whenever supplies fall short. For all three of these

reasons, smallholder farmers in the early stages of the agricultural transformation are likely to become more diversified as they add cash crops and traded livestock products to their portfolio while attempting still to produce all their staple food needs.

The trend towards greater economic diversification at the farm level eventually peaks and then reverses course for two reasons. First, as trade and (slowly at this stage) increasing productivity drive increases in cash income, and as the broader economy presents more off-farm income earning opportunities, farmers' opportunity cost of labor begins to surpass the high wedge between purchase and sales prices, and they become more willing to purchase their food while pursuing more remunerative activities on and off the farm. Second, historically throughout the developing world, governments fairly early in the transformation process have moved away from the most comprehensive and restrictive regulation of staple food trade towards a more liberalized policy environment; in most countries of East and Southern Africa, restrictions on the physical movement of food staples began to be lifted in the early 1990's, with major positive effects on staple availability and on lowering prices to consumers (Jayne and Jones, 1997). Together these factors drive farmers increasingly to specialize in those activities in which they have a comparative advantage (due to agro-ecological and human capacity factors), moving rapidly away from small diversified farming operations to larger, more capital intensive and, specialized operations. The rate of change can be dramatic in some cases; see Pingali, (1997) for examples of large, measurable changes over the course of 10 years in Asia.

Because agro-ecology and consumer preferences are not homogenous over space, overall agricultural production will always be more diversified than will production on individual farms. Moreover, diversification at this level will increase as the transformation proceeds, driven by income growth and urbanization that lead consumers to diversify beyond staples into fresh produce, livestock products, and an array of value added products. Thus the typical pattern over the course of the agricultural transformation is that aggregate agricultural production will become more diverse as production on individual farms becomes more specialized (less diverse). Overall consumption of agricultural products will diversify at an even more rapid rate, as traders and food companies, draw on regional and international trade to complement national production and meet the demand for more diverse consumption by wealthier consumers (Kimenju and Tshirley, 2008).

Looking beyond agriculture, rural households can be expected to follow a broadly similar pattern with regard to livelihood diversification, i.e. economic diversification beyond agriculture. In the early phases, those households with the capacity to do so will diversify into salaried wage employment and profitable off-farm businesses while maintaining their farm operation. Eventually, however, their rising opportunity cost of time and the increasing knowledge and capital intensity of agriculture will drive them either to leave agriculture entirely or to re-specialize as full-time farmers; a very small share of farm production will remain long-term in the hands of part-time farmers. (Mathenge and Tschirley, 2008)

In this report straddling is used to refer to scenarios whereby farmers engage in both on farm and off farm activities. In the normal English usage to straddle means to stand or to sit with ones legs on either sides of something. It also refers to a scenario whereby one tends to favour both sides of an issue. The on farm activities that farmers engage in include growing of crops and keeping of livestock. The off farm activities which farmers engage in include *inter alia* large scale and micro businesses. When farmers derive their income from both on farm and off farm activities then we can say that they are straddling. This report examines *inter alia* aspects of poverty effects of income straddling.

1.6 Organization of the Report

As the title of this report suggests, the report is dichotomized into two main sections. The first section presents an analysis of the ten re-surveyed villages (meso section) and the second section gives an analysis of the re-surveyed three hundred households in the ten sampled villages (micro section). The report draws on the panel data sets collected in 2002, 2008 and in 2013. The meso section concentrates on the characteristics of the ten sampled villages, capturing the salient changes which have occurred in the villages since 2008. The meso section draws on information collected using FGDs and key informants interviews. The section concentrates on capturing information on the changes that have occurred on crops grown and diversification, conservation farming, crop diseases and use of pesticides, extension services, labour availability, availability of credit, livestock, irrigation, marketing, farm and non-farm activities and sundry topics which captured information such as occurrence of extra ordinary weather conditions and use of mobile phones.

The micro section draws on data collected using a structured questionnaire. The questionnaire captured information such as household demographic and socio-economic characteristics, main crops grown, agricultural techniques, land resources, livestock and fish products, labour resources, institutional conditions, incomes and expenditure. The paper is organized as follows. In section 2, we present the data sources zeroing in on the instruments used to collect the data, the data sources and the sampling design. The paper in section 3 gives an expose on the analytical methods. This is followed by section 4 which presents the results and discusses them. Section 5 gives the conclusions and the recommendations. The last section discusses briefly areas for further research.

2.0 METHODOLOGY

2.1 Sampling Design

Administratively, Kenya is divided into eight regions (formerly provinces), forty seven counties and over two hundred sub-counties (formerly districts). However, the process of redefining the sub-counties' boundaries is still ongoing and the number of sub-counties is expected to increase. Each sub-county is further sub-divided into divisions, locations, sub-locations and villages. Villages consist of a number of households. Agricultural data is available on the basis of the above administrative set up. Maize and its derivatives is the most important staple food crop and it is grown in almost all the households. Multistage purposive sampling as was done during the Afrint1 in 2002 and in Afrint II in 2008 was used from the region (formerly a province) down to the household. In selecting the regions, counties, sub-counties, divisions, sub locations and the villages; this study just like Afrint1 and Afrint II was guided by the following factors:

- The area having considerable variability in agro-ecological potential (from high to low)
- The area having different levels of market access
- Population density and farm sizes.
- Significant levels of agricultural and income diversification
- Significant levels of poverty and inequality

Consequently, at the national level two Counties selected during Afrint1 and in Afrint II were again selected for this study. Kakamega County in western region was selected as an area with a very high population density. Nyeri County in Central region was chosen for its considerable variability in agro-ecological potential and market access. The same five villages as identified in

Afrint1 and II were selected from each county primarily on the basis of differences in agro ecological potential and market access.

This study used the sampling frame as was used in Afrint1 and II in 2002 and 2008 studies. In the 2002 Afrint1 study, the process of sampling the households started with the selection of villages where informal discussions on the objectives of the study were held with agricultural officers, village elders and farmers. Once villages were purposefully selected, enumerators with the help of location chiefs, sub location assistant chiefs and village elders compiled sample frames consisting of households in each village. From each sample frame, this consisted of between 150 and 200 households, 30 households were randomly selected. Most categories of households were represented in the final sample which consisted of 30 households from ten villages. Attrition is a problem in all panel studies like this one, since a portion of the original units might disappear from the population, either by passing away or by emigrating from the area. In this study the problem of attrition was dealt with in a number of ways. In cases where we had more than one descendant household, we randomly selected one descendant household to replace the original one. We also tried to trace households which had migrated from the villages by making enquiries with neighbors. This study tried to make the 2013 sample representative of the current village agrarian population by making lists of households who have settled in the village since 2008 and drew a random sample of these. Consequently the new 2013 had the following categories of households: unpartitioned households with the same head as in 2008 (which were the majority), unpartitioned households with new head, newly sampled offspring households, in-migrated households (sampled from list of in-migrants) and out-migrated households. No serious problems were reported in relation to the administration of the household and the village diagnostics questionnaires. They had relatively few questions that were considered problematic or unduly time consuming. However, some cultural factors such as disclosing the actual number of children and incomes caused some minor problems which were addressed by the researchers. Thus, the overall the quality of data collected was judged to be quite good and met the objectives of the study.

2.2 Data Sources and Methods of Data Collection.

The main micro-study data collection instruments were a household survey questionnaire directed at three hundred sampled households sampled during Afrint1 and II. Treating the 2002 Afrint1 and the 2008 Afrint II surveys as baselines the 300 households were resurveyed. A

combination of both quantitative and qualitative household data offered an opportunity to investigate the important dynamic relationship between diversification, livelihood portfolios, technology adoption, incomes, agricultural commercialization and household welfare. More specifically the household survey questionnaire enabled the researchers to identify the key drivers of agricultural development in terms of temporal changes in production and yields of food staples, i.e. area expansion or intensification based on available technologies or the adoption of new ones. The questionnaire also collected data that enabled the researchers to examine the relationship between, on the one hand, temporal changes in yields and technology adoption and temporal changes in the household welfare using a selection of proxy indicators for welfare available at the household level. The main respondents to the household survey were the household heads or the farm managers.

At the meso-level a village diagnostics questionnaire containing open ended questions and issues that required careful probing interviews with key informants and farmer groups was used to collect information. The village diagnostic questionnaire was administered in the ten villages, the ones selected in Afrint1 and II, was used to collect information on the general village situation with respect to agricultural diversification, including among others kinds of state interventions, market access, farmer organizations, agricultural techniques and gender aspects. The questionnaire also contained a number of open-ended questions of a qualitative nature touching on the role of the local government in impending and/or facilitating agricultural specialization/diversification and in commercialization of small holder agriculture that were reported in a text format by the researchers.

An important aspect of the village diagnostics and household survey questionnaires was their ambition to capture the agricultural and livelihood dynamism that has occurred over time. This was captured by asking farmers and key informants to recollect how the situation was like in 2002 and 2008 when Afrint1 and II studies were done (as reflected in the indicators of livelihood diversification) in both questionnaires. The questionnaires had questions linking various kinds of farm management, resource access, crop strategies and productivity to various demographic and socio-economic characteristics of the household.

2.3 Methods of Data Analysis

A number of analytical techniques were employed in this study. These include the Herfindahl index of diversification, the Tobit and Double Hurdle models, Wald's tests, Regression Analysis,

Gini coefficients and the associated Lorenz curves. Also a number of descriptive statistics were used to explain the salient variables used in the study.

2.3.1 Analysis of General Trends in Livelihood Portfolios

In order to analyze the general trends in livelihood portfolios in Nyeri and Kakamega Counties, descriptive statistics were used. In particular percentages, means and proportions were used to explain household income sources, crop production trends, livestock production trends and crop cum livestock contributions to household gross income.

2.3.2 Analysis of Diversification Trends

The Herfindahl index of diversification, as applied by Kurosaki (2003) and Kimenju and Tshirley (2008) was used to quantify the amount of diversification at various levels in Nyeri and Kakamega agricultural sectors. The Herfindahl index of diversification is given by the formula:

$$D_k = 1 - \sum_{i=1}^N (S_{i,k})^2$$

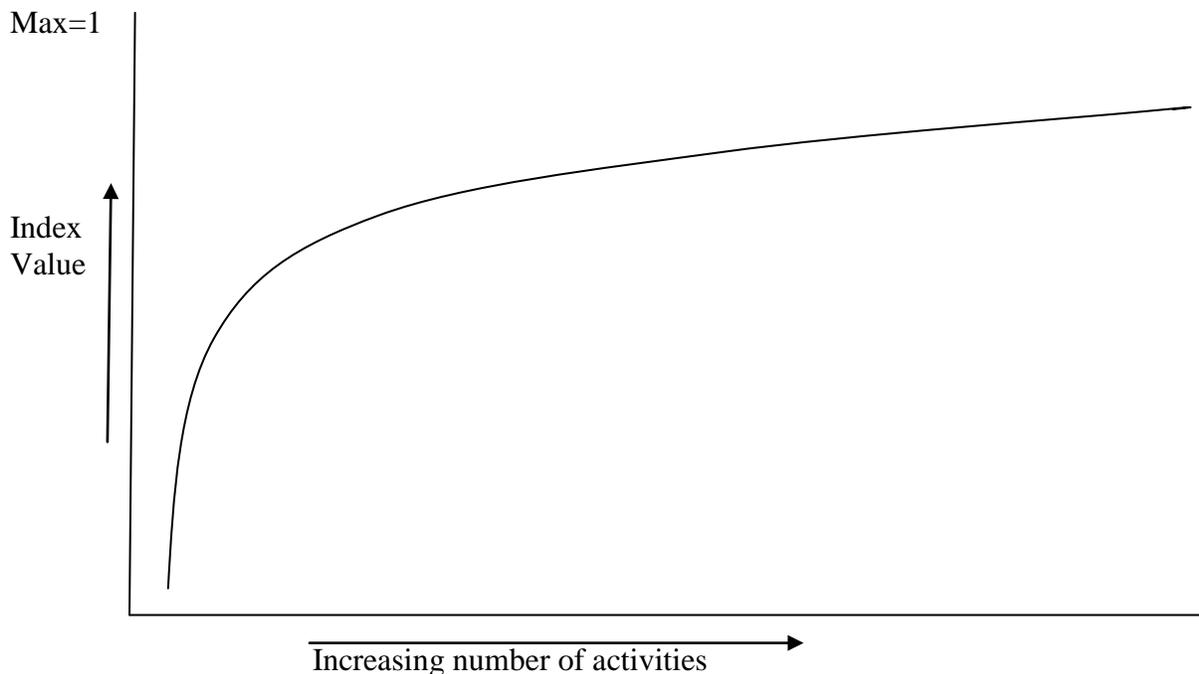
where S_i refers to share and $\sum_{i=1}^N (S_{i,k}) = 1.0$.

D_k varies from a value of zero, indicating complete economic specialization in one activity or complete spatial specialization into one spatial unit ($S_i = 1$ in each case), to 1.0, indicating that economic output comes from many different activities or spatial units, none with a predominant share.

The interpretation of k , i , and N depends on the type of diversification being computed (see Figure 2.1). For economic diversification (diversification across economic activities within an economic unit), k refers to the economic unit of interest, i refers to a specific economic activity, and N is the total number of activities being considered. For example, to compute how diversified a household (or region) is across all economic activities, k refers to the household (or region) and i refers to the N different crop, livestock, and off-farm activities in which the household is involved (or which take place in the region). Economic diversification within a sector, e.g. diversification across crops within all cropping activities, can be computed by limiting the computation to that set of activities. When calculating spatial diversification, k refers to the spatially most aggregated unit (e.g., country), i to a less aggregated unit within k (e.g., region), and N to the number of less aggregated units.

Figure 2.1 shows the trend the index takes on as a function of the number of activities (i) in which the economic unit is involved, and assuming that each activity has an equal share in overall economic activity.

Figure 2.1: Values of Herfindahl Concentration index assuming equal share of each economic activity



Source: Modified from Kimenju and Tschirley, 2008

We based our crop diversification calculations on five groups of crops: cereals, tubers and pulses, fruit and vegetables, industrial crops, and all other crops. In calculating agricultural diversification we added three livestock categories to these five crop categories: cattle, goats, sheep and pigs, and poultry. Livelihood diversification is then calculated by adding four off-farm activity groups to the eight agricultural groups: salaried employment, informal businesses, remittances, and farm *kibarua* (labour).

2.3.3 Analysis of Impact of Off-Farm Income on Agricultural Investment and Productivity

In order to assess the impact of off-farm income on agricultural investment and productivity, input demand functions were modeled to determine the factors that drive farmers' decisions to use inputs and to assess how engagement in off-farm work affects this decision. Separate regression models for fertilizer and hybrid seeds (the major inputs), were estimated each with

aggregated and disaggregated off-farm work types. Tobit and double-hurdle models were run for fertilizer demand and demand for hybrid seed. The models were disaggregated and aggregated for off-farm income. Finally, Wald test was conducted to show the combined effects in fertilizer and hybrid seed models.

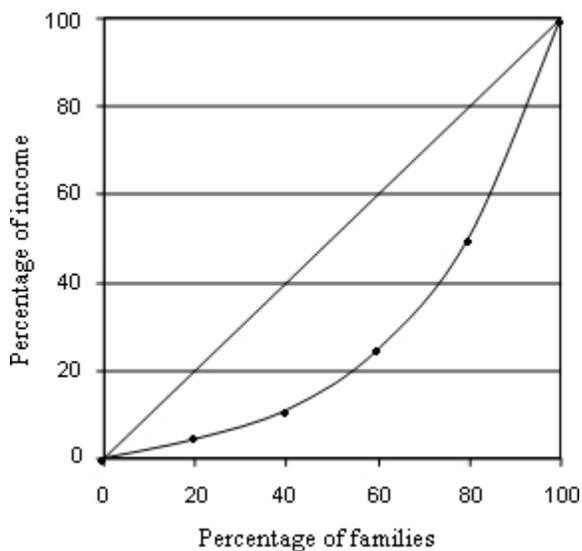
2.3.4 Analysis of Regional Differences in incomes and Levels of Development

In order to analyze the distribution of income and to depict the existing inequalities, the Gini coefficients based on the Lorenz curve were computed. The Gini coefficient is given by the formula:

$$\text{Gini} = 1 - \frac{2}{N} \sum_{i=1}^N (x_i - x_{i-1})(y_i + y_{i-1})$$

The Gini coefficient varies between ‘0’ which reflects complete equality and ‘1’ which indicates complete inequality. Graphically, the Gini coefficient can easily be represented by the area between the Lorenz curve and the line of equality. Figure 2.2 depicts a typical Lorenz curve

Figure 2.2: A Typical Lorenz Curve



Source: KNBS, 2013.

The Lorenz curve maps the cumulative income share on the vertical axis against the distribution of the population on the horizontal axis. The Gini coefficient is calculated as the area (A) divided

by the sum of the areas (A and B) i.e. $A / A+B$. If $A=0$, the Gini coefficient becomes zero which means perfect equality, whereas if $B=0$, the Gini coefficient becomes 1 which indicates complete inequality. Gini coefficients were computed to depict income inequalities in the two regions (Nyeri and Kakamega) and also gender.

3.0 RESULTS AND DISCUSSION

3.1 Meso Section: Characteristics of the Sampled Counties and Villages

This section presents the results of the information collected using the FGDs and Key informants interviews in the selected counties and in the sampled villages. The information was supplemented by other pertinent information collected using the structured household questionnaire and which had a bearing on the villages.

3.1.1 Agro-ecological Potential and Market Access in Nyeri County.

Nyeri County partly lies on the South Western part of the moist windward side of Mount Kenya (a giant volcano) and also on the driver Western leeward side of this mountain. It also borders the semi-arid Laikipia plateau and the moist windward Eastern slopes of the Aberdare ranges. Consequently, the contrast in natural potential is therefore enormous.

Nyeri County is divided into several administrative sub-counties among them:-Mathira, Nyeri Municipality, Mukurwe-ini, Tetu, Othaya, Kieni East and Kieni West. There are considerable variations in the agro-ecological potential found on the slopes of Mt. Kenya and the Aberdare Ranges. Kabarua area in Mathira sub-county is a good example of an area with very good potential and is a major producer of food and cash crops. However, the potential for some of these areas can be enhanced if the road network is improved, to allow the crops produced to reach the market particularly during the rainy seasons.

Except for Kieni East, Kieni West, and some parts of Mukurwe-ini, Nyeri County can generally be classified as an area of high agro ecological potential. However, there are intra-sub-county variations in some high potential areas of the county. There are less intensive farming patterns in Ngorano and Ruguru Locations in Mathira, Rutuna in Mukurwe-ini, Gachika and Nyaribo in Nyeri Municipality sub-county. These have been identified as pockets whose potential can be exploited through provision of water for irrigation. The lower parts of Mukurwe-ini and also parts of Kieni Plateau experience aridity and this has hindered the full exploitation of the existing agricultural potential. Provision of water for irrigation would enhance exploitation of the

horticultural potential in these areas especially in Kieni East and West sub-counties. The soils in Rutune area of Mukurweini sub-county are somewhat excessively drained and cannot sustain agricultural activity.

In Kieni East and West sub-counties, only about 50% of the total agricultural land has been put into productive use. Maize, beans and Irish potatoes are mainly grown for subsistence. Horticultural products are the leading cash crops in these sub-counties, although some pyrethrum is also grown on the eastern slopes of the Aberdare Ranges. The two sub-counties have substantial potential in horticultural production which can be better exploited through provision of water for irrigation. The county's potential in the production of horticultural products is yet to be fully exploited. Potential exists not only in Kieni East and West, but also in Mathira and the upper parts of Tetu sub-counties. However, the problem of poor access roads has hindered its full exploitation. Some of the agricultural produce fails to reach the market particularly during the rainy seasons.

Coffee is a major cash crop grown in all the sub-counties except in Kieni East and West. Tea is also a major cash crop grown in Mathira, Othaya and Tetu sub-county, i.e. on the well drained slopes of the Aberdare ranges and Mount Kenya. The poor state of roads in the tea growing areas causes a lot of waste resulting in reduced earnings. Macadamia nuts are also grown in the coffee growing areas. Mulberry farming is on as a pilot project in Kieni East. Wheat is grown in the large farm sector particularly in Kieni East. In addition to zero grazing, commercial livestock farming/ranching is a major economic activity in Kieni West. Solio ranch is famous for beef cattle production.

Nyeri Municipality sub-county has the highest density of roads and markets in this sub-county are quite accessible. Mathira sub-county has the widest coverage of roads, although the greatest length is of the minor access roads. This is followed by Tetu, Othaya and Mukurwe-ini. The least coverage is in Kieni East and West, which are relatively newly settled areas. Some of the roads in areas such as the lower parts of Mukurwe-ini, upper parts of Tetu, Magutu, Mount Kenya and Ngorano in Mathira sub-county become inaccessible during the rainy seasons.

As noted earlier, Kieni East and West sub-counties produce a lot of horticultural products. However, a substantial amount of this produce does not reach the market because of lack of motorable roads in these areas. These areas therefore need to be opened up through provision of all weather roads if the horticultural sector is to play a greater role in the economy of County.

Although the County has a fair share of classified roads, most of them are poorly maintained. Most of the gravel works have been eroded. The feeder roads which are supposed to be maintained through coffee and tea cess by the Nyeri county council remain impassable during the rainy season due to poor maintenance.

The most affected areas are the lower parts of Mukurwe-ini, upper parts of Tetu, Ngorano, Konyu and Magutu areas of Mathira sub-county. In these areas a substantial amount of coffee and tea gets wasted or lose quality by the time it reaches the factories. Kieni East, Kieni West and some other areas particularly on the slopes of Mount Kenya and Aberdares being newly settled areas, have not been fully opened up and consequently they become inaccessible to the market especially during the rainy season. In these areas, a substantial amount of horticultural produce therefore goes to waste due to lack of feeder roads. The poor condition of roads in some parts of the County is therefore, one of the major constraints which has to be addressed if the full productive potential is to be realized.

Nyeri County is also highly endowed in tourism potential, but his has not been fully exploited due to inaccessibility of roads leading to the national parks. This situation is worse during the rainy season. Some parts of Nyeri County (in particular the Northern part of Kieni sub-county) suffer prolonged periods of drought (Kenya, 1984) and since the County has no famine relief programme, agricultural produce is distributed from the areas of surplus production to the areas of deficit through the system of market places. Kieni East and West sub-counties provide examples of places with a poor spatio-temporal integration of periodic markets (Wambugu, 1994).

3.1.2 Contrasts in Agro-ecological Potential and Market Access in Kakamega County

Kakamega County today comprises of the sub- Counties of Vihiga, Butere-Mumias, Kakamega and Lugari. The rich and varied ecological base (high temperatures, reliable rainfall, fairly fertile soils and various rocks and forests) has been a significant factor in determining human activities such as settlement and farming. Kakamega County is one of the Counties with a very high population density in Kenya. The high population density and the high population growth rate are some of the obstacles to the development efforts in the County for they overburden the resource base. Every part of the County is virtually inhabited except the rocky hills in the southern and central parts and the Kakamega forest. The density of population tends to increase from north to south. The southern part of Kakamega County has well drained soils and a fairly

flat area and swampy soils lead to regular flooding and water logging, making construction of roads difficult. Kakamega has annual rainfall of between 1200 – 2100 mm suggesting a high potential area. In the centre of the County, rainfall is too high and this leads to leaching of the soils and crop spoilage. The County borders the Nandi escarpment to the east. However, although the escarpment has fertile soils, the road infrastructure is not very well developed making communication difficult. This leaves the area suitable for livestock keeping and forestry only. The southern parts of the County receive more rainfall than the northern parts of Lurambi and Lugari sub-counties. The land use patterns are as follows: the northern parts namely Lugari and Likuyani sub-counties are the major producers of maize and beans which are sold to the other sub-counties, the western parts (Butere and Mumias) are under sugarcane. Tea is grown on small scale in Shinyalu and Ikolomani sub-counties. Coffee is grown all over the County, sunflower is also an important cash crop and livestock keeping is also an important land use type. Over exploitation of the land has led to environmental degradation.

Since Kakamega County receives a lot of rain, all weather roads are necessary. Sub-counties and divisions such as Shinyalu, Ikolomani, Kabras, Lugari and Likuyani with great agricultural potential require improvement in the road coverage. Mumias sub-county and parts of Butere and Lurambi sub-counties in the sugar belt have good graveled roads which are maintained by Mumias Sugar Company.

Development in the county is hindered by inadequate infrastructural facilities (such as roads) and poor marketing systems among others. Most of the roads in the County are earth roads and only a small proportion is all weather. Due to the heavy rains, roads are impassable during the rainy season. As a result of this accessibility of farm produce and other raw materials to markets becomes difficult. The high potential areas such as Lugari, Navakholo and Kabras sub-counties have poor roads. In the tea producing sub-counties of Shinyalu and Ikolomani most roads leading to tea buying centres are impassable during the wet season when green leaf production is highest, leading to substantial amounts of green leaf being uncollected and hence wasted. In these areas other perishable farm produce such as milk and vegetables cannot reach the market on time.

As a whole, Kakamega County has uneven distribution of the road network with a concentration in the southern and central parts but dispersion in the northern parts. The county has notable variations in the distribution of indices of the road network namely density, accessible distance, beta, theta and gamma indices. Nodes (market centres) on the road network have varying levels

of accessibility broadly classified as high, medium and low. The small urban and market centres act as relays of movement as well as providing essential services to their hinterlands.

In a nutshell and considering the two Counties, Nyeri has better market access in the regional towns of Nyeri, Karatina, Nanyuki and Nairobi (the capital city of Kenya). The County also has a higher road density.

Consequently, its agriculture is relatively more developed. In contrast, although Kakamega is better endowed agro-ecologically than Nyeri, the high population density, inadequate infrastructure and poor market access have prevented the County from realizing its full agro-ecological potential.

3.1.3 Village Characteristics and Crops Grown

The same five villages as identified in Afrint1 and II were again selected from each County. The ten villages selected and their geographical locations are shown in Table 3.1.

Table 3.1: The ten survey villages and their geographical locations

Village	Region	Nearest town
Shikomoli	Larger Kakamega	Jepsis
Ekeru	Larger Kakamega	Ekeru
Chegulo	Larger Kakamega	Malava
Munyuki	Larger Kakamega	Lumakanda
Mukuyu	Larger Kakamega	Makutano
Gatondo/Thegenge	Nyeri	Gatondo
Ichuga/gathumbi	Nyeri	Ichuga
Kiambii	Nyeri	Kiamariga
Gatagati	Nyeri	Kimahuri
Irigithathi	Nyeri	Irigithathi

Source: Karugia and Wambugu, 2009.

The villages in Mathira and Kieni East sub-counties of Nyeri County provided a good transect for studying the agricultural diversification among smallholder farmers. The transect running from Thegenge through Ichuga, Kiambii, Gatagati and Irigithathi villages in Nyeri County was chosen as it exhibits the following characteristics:

- Most, if not all, of the crops grown in the County are found in these villages
- It shows a gradation in the levels of agricultural intensification, diversification and specialization and
- The villages have marked differences in market access

The villages in Mathira sub-county, namely Gatundu, Ichuga and Kiambii are agro-ecologically better endowed than the villages in Kieni East (Gatagati and Irigithathi) and they also have better market access. The higher road density and the proximity to a major market (Karatina) which is well linked to other important urban markets make the villages to have better market access. Thegenge/Gatondo village was chosen to represent an area of high agro-ecologically potential and good market access. Ichuga/Gathumbi village was chosen to represent an area of medium potential and good market access. Kiambii village has poor agro-ecological potential and average market access. Gatagati village was chosen to represent areas with poor market access, good agro-ecological potential coupled with some irrigation. Irigithathi village was chosen to represent

an area with relatively large farm sizes, poor agro-ecological potential and average market access.

Similarly, the villages in Kakamega County were selected on the basis of having different agro-ecological potential, market access and population density. Shikomoli village was chosen to represent an area with very high population density (hence small farm sizes), relatively poor agro-ecological potential (the village is rocky and hilly with poorly developed soils) and average market access. Ekeru village was chosen to represent a village with relatively good market access. The village has good graveled roads maintained by Mumias Sugar Company. The village is also served by the Mumias – Kakamega tarmac road. Ekeru village provides an example of an Outgrower scheme in sugar where farmers grow maize for subsistence. Chegulo village was chosen to represent an interior, hard to access village, but with medium potential and some small-scale irrigation. Munyuki and Mukuyu villages in Lugari sub-county were selected to represent areas of maize monoculture with high agro-ecological potential. However, some diversification in the form of sugarcane and sunflower growing is now on-going. Munyuki has a fairly good market access in the markets of Lumakhanda and Kipkarren River while Mukuyu has very poor market access. The two villages have relatively low population densities. The characteristics of these villages are summarized in Table 3.2.

Table 3.2: Characteristics of the Surveyed Villages

Village	Average farm size	Population Density	General soil fertility	Average annual rainfall	AEZ	AEP	Market access	Major crops Grown
Shikomoli	Small	848	Poor	2000	UM1	Medium	Medium	Coffee, tea, maize
Ekeru	Medium	617	Good	1800	LM1	Good	Good	Sugarcane, maize
Chegulo	Medium	287	Medium	1600	LM2	Poor	Poor	Sugarcane, sweet potatoes
Munyuki	Very Large	436	Good	1400	UM4	Good	Good	Maize, beans, sweet potatoes
Mukuyu	Small	373	Good	1200	UM4	Good	Poor	Maize, beans, sweet potatoes
Gatondo/ Thegenge	Small	494	Good	1400	LH1	Good	Good	Tea, horticultural products
Ichuga/ Gathumbi	Small	512	Medium	1000	UM3	Medium	Good	Coffee, maize
Kiambii	Small	510	Medium	900	UM4	Medium	Medium	Maize
Gatagati	Large	128	Good	1000	LH3	Medium	Poor	Horticultural products
Irigithathi	Nyeri	126	Poor	800	LH4	Poor	Medium	maize

Source: Karugia and Wambugu, 2009.

3.1.4 General Trends in Livelihood Portfolios among Villages in Nyeri and Kakamega Counties

Before presenting and discussing results of the analysis using the Herfindahl index, this study looks at trends in less formalized indicators of diversification that include; sources of household income, cultivated acreage, number of crops cultivated, cultivated area allocated to different crops, proportion of improved cows, and number of people moving into off-farm activities. The study also looks at different activities' contribution towards gross revenue within crops, agriculture and overall household livelihood.

3.1.4.1 Household Income Sources

Given the problems encountered in collecting and calculating total incomes from households, this study tried to aggregate incomes as given by the respondents from various sources such as sale of food staples and other food crops, sale of animals and animal produce, leasing out machinery and other equipment, payments from agricultural labour (*kibarua*), nonfarm salaried employment, micro and large businesses, rent, remittances, pension, etc. Aggregating incomes from these sources was deemed to be a fairly accurate way of coming up with total household income.

As shown in Table 3.3, households derive their income from a number of sources which include; sale of food staples, sale of other food crops, sale of non food cash crops, sale of animals and animal products, leasing out machinery and equipment, sale of agricultural labour, non-farm salaried employment, micro-business, large-scale business, rents and interests, pension, and remittances.

Table 3.3: Categorized Contribution to Total Household Income as a Percentage of the Total (%)

Income category	Year	Villages									
		Shikomoli	Ekeru	Chegulo	Munyuki	Mukuyu	Gatondo /Thegenge	Icuga/Gathumbi	Kiambii	Gatagati	Irigithathi
Sale of food staples	2008	1.01	1.63	0.64	0.88	1.86	14.32	1.51	33.55	0.48	14.10
	2013	4.00	0.95	12.15	20.17	16.14	5.22	15.40	13.93	1.57	30.99
Sale of other food crops	2008	16.24	16.44	7.37	40.92	27.44	29.04	1.34	17.57	2.04	28.64
	2013	4.91	21.82	18.16	9.44	15.49	2.27	10.66	5.93	2.86	20.29
Sale of non-food cash crops	2008	26.27	25.73	15.89	12.46	11.92	6.01	68.65	2.22	29.78	0.99
	2013	42.99	36.66	20.96	0.00	0.18	14.72	37.24	4.98	26.81	11.29
Sale of animals/animal produce	2008	21.62	26.48	29.47	34.07	22.13	0.00	10.73	6.44	4.77	36.90
	2013	9.71	35.46	28.29	44.50	19.75	3.47	13.47	21.65	7.16	9.87
Leasing out machinery/equipment, etc.	2008	0.00	0.02	0.00	0.00	0.00	0.00	0.00	1.11	0.00	0.00
	2013	1.17	0.00	0.00	0.00	0.00	0.00	0.00	4.29	0.55	0.00
Work on others' farms/agricultural labour	2008	2.51	1.75	0.91	3.61	2.72	35.50	15.63	1.11	35.45	2.74
	2013	9.33	0.50	0.00	1.59	2.63	25.53	2.67	0.70	0.87	1.56
Non-farm salaried employment	2008	27.61	16.29	42.00	4.64	27.42	0.00	0.00	4.78	26.46	4.22
	2013	17.04	0.63	0.00	13.60	26.13	1.81	5.17	17.33	34.90	1.14
Micro business	2008	3.77	7.40	0.00	2.65	3.43	0.00	0.00	0.00	0.00	6.04
	2013	5.92	3.97	0.00	3.31	8.76	36.30	13.46	1.00	9.91	21.86
Large-scale business	2008	0.00	0.00	0.00	0.77	0.80	0.00	0.00	0.00	0.00	0.00
	2013	0.00	0.00	9.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rent, interest	2008	0.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2013	1.08	0.00	0.19	3.36	2.55	1.81	0.34	3.20	4.23	0.00
Pensions	2008	0.57	1.85	1.73	0.00	2.12	0.00	0.00	9.33	0.00	0.00
	2013	0.99	0.00	5.87	2.47	2.63	0.00	0.00	12.19	7.68	0.00
Remittances	2008	0.40	1.06	1.99	0.00	0.17	15.13	2.14	23.88	1.03	6.36
	2013	2.87	0.00	4.98	1.56	5.76	8.87	1.58	14.80	3.45	3.00
N	2008	30	30	30	30	30	30	30	30	30	30
	2013	30	30	30	30	30	30	30	30	30	30

Source: Field Survey Data, 2013.

Table 3.4 shows the mean and the standard deviation of the sources of income in the villages for the year 2013. It is clear from the table that households in the sampled villages derive more of their income from on farm sources save for the villages of Shikomoli, Mukuyu and Chegulo which had a higher mean income source from nonfarm sources.

Table 3.4: Mean income in the sampled Villages (Ksh.)

Village	Mean Farm income	Std. Dev	Mean Nonfarm income	Std. Dev
Shikomoli	5375.17	7977.41	18963.33	38098.43
Ekeru	63368.33	61001.38	22370.00	39279.78
Chegulo	88836.67	88739.06	141346.67	266743.43
Munyuki	52880.00	73997.34	19226.67	54711.47
Mukuyu	34667.50	46582.37	38318.33	60982.83
Gatondo/thegenge	140566.67	145992.37	106731.03	120719.44
Icuga/gathumbi	79828.33	84944.20	55700.00	40199.63
Kiambii	73962.67	76765.95	18933.33	43209.14
Gatagati	161084.48	138671.97	57413.79	162360.48
Irigithathi	114978.33	101345.37	92913.33	119923.71

Source: Field Survey Data, 2013.

3.1.4.2 Crop Production Trends

Mean cultivated area in acres: Cultivated acreage per household increased marginally from 2.331 in 2002, through 2.439 in 2008 to 2.442 in 2013 (table 3.5). This can be attributed to the households opening more land for cultivation as the population increases. Chegulo village has the highest cultivated acreage, while Shikomoli has the lowest followed by Kiambii.

Table 3.5: Mean Cultivated Area in Acres

Village Name	2002	2008	2013	Overall Mean
Shikomoli	1.66	1.20	1.29	1.38
Ekeru	2.25	2.14	2.58	2.32
Chegulo	4.38	4.73	3.80	4.30
Munyuki	2.94	2.60	3.14	2.89
Mukuyu	3.50	3.69	2.80	3.33
Gatondo/Thegenge	2.18	2.71	1.97	2.28
Icuga/Gathumbi	1.27	1.41	1.70	1.46
Kiambii	1.94	1.96	2.11	2.00
Gatagati	1.87	2.29	2.63	2.26
Irigithathi	1.33	1.66	2.42	1.80
Overall Mean	2.33	2.44	2.44	2.40

Source: Field Survey Data, 2013.

Mean number of crops grown: The mean number of different crops cultivated per household increased from 5.82 in 2002 through 6.28 in 2008 to 7.41 in 2013 (table 3.3). A consistent trend appears for the three years, when looking at both cultivated land and the number of crops grown; i.e. a consistent but marginal increase in the area cultivated and crops grown. This finding suggests a trend towards greater crop diversification as land area increases. This trend towards greater crop diversification can be explained by the need to manage risks and the associated vulnerability of households and in some cases the need to increase incomes from sale of a wide variety of crops. This finding is in agreement with Delgado and Siamwalla (1997), and Kimenju and Tschirley (2008) who found that for many households that produce primarily for their own consumption with small surpluses for sale, diversifying by adding other crops (especially cash crops: cotton, tea, coffee, sugarcane, fresh horticultural produce etc) while continuing to produce for their own consumption can lead to greater incomes. Also, heavy reliance on few crops for cash can, in an open market economy with widely fluctuating prices, lead to instability in income that threatens rural livelihoods. Diversification into salaried wage labor and remunerative non-farm business can also greatly increase (and stabilize) total household incomes. Thus, generally from the perspective of managing risk and associated vulnerability of rural households, and in some cases from a desire to increase incomes, farm diversification makes a lot of sense as a policy goal.

From table 3.6, the villages of Chegulo, Munyuki and Mukuyu had the highest mean number of crops grown while Irigithathi, kiambii and Gatagati had the lowest. Apart from stabilizing and increasing incomes, FGDs in the ten villages revealed that farmers are diversifying their cropping patterns to manage risks occasioned by high agricultural inputs, climate variability and by crop pests and diseases. Other reasons cited by the farmers for diversifying their agricultural practices include need to respond to the market needs and the need to mitigate the effects of declining soil fertility and land sizes.

Table 3.6: Mean number of different crops grown per village

Village	Village name	2002	2008	2013	Overall
301	Shikomoli	6	6	6	6
302	Ekeru	6	7	7	7
303	Chegulo	7	8	8	8
304	Munyuki	6	7	8	7
305	Mukuyu	6	7	8	7
306	Gatondo/Thegenge	5	6	9	7
307	Icuga/Gathumbi	6	6	8	6
308	Kiambii	5	5	7	6
309	Gatagati	5	6	7	6
310	Irigithathi	6	5	6	6
	Overall Mean	6	6	7	7

Source: Field Survey Data, 2013.

Cultivated land allocated to different crops: Cultivated area allocated to maize declined slightly from 34.56% in 2002 to 33.87% in 2008. However, the area increased to 47.77% in 2013. Variations are observed in the areas devoted to maize in the surveyed villages, with Shikomoli, Munyuki and Mukuyu villages devoting over 50% of the total cultivated area to maize as depicted in table 3.7. Munyuki and Mukuyu villages were virtually areas where farmers were practicing monoculture growing of maize but the farmers are now diversifying to non-food cash crops such as sugarcane. Though intercropped especially with beans and irish potatoes, maize still takes the highest proportion of cropped land among Kenyan rural households. The area allocated to other food crops and vegetables, which are high value crops, fell from 38% in 2002 through 31% in 2008 before rising to 38% in 2013, but the pattern is quite diverse across the surveyed villages. This could possibly mirror the declining prices of the major cash crops in the world market. However, and the above trend notwithstanding, the mean number of non-food cash crops increased from 0.65 in 2002 to 0.90 in 2008 before declining to 0.73 in 2013 (Table 3.8).

Table 3.7: Area allocated to different crop categories (Acres)

Crop	Village	2002	2008	2013	overall
Maize	Shikomoli	40.94	50.50	70.19	53.88
	Ekeru	19.92	30.62	51.72	34.08
	Chegulo	30.17	27.90	29.39	29.15
	Munyuki	51.74	58.51	42.05	50.77
	Mukuyu	49.43	46.90	68.06	54.80
	Gatondo/Thegenge	20.51	6.65	20.58	15.91
	Icuga/Gathumbi	31.20	28.18	49.06	36.14
	Kiambii	39.20	38.80	57.53	45.18
	Gatagati	23.00	18.75	33.00	24.92
	Irigithathi	39.79	31.87	56.15	42.60
	Overall Mean		34.59	33.87	47.77
Other Food crops and vegetables	Shikomoli	31.99	22.66	73.04	42.56
	Ekeru	49.84	20.27	39.48	36.53
	Chegulo	27.25	25.19	23.60	25.35
	Munyuki	52.20	59.03	49.64	53.62
	Mukuyu	61.92	58.75	47.97	56.21
	Gatondo/Thegenge	19.30	6.26	25.95	17.17
	Icuga/Gathumbi	25.06	22.63	18.85	22.18
	Kiambii	30.45	30.14	36.82	32.47
	Gatagati	42.04	34.27	25.31	33.87
	Irigithathi	42.80	34.28	36.88	37.99
	Overall Mean		38.28	31.35	37.75
Non-food cash crops	Shikomoli	69.46	40.47	38.85	49.59
	Ekeru	68.81	64.79	48.47	60.69
	Chegulo	47.46	43.88	67.96	53.10
	Munyuki	26.84	30.35	25.49	27.56
	Mukuyu	6.85	6.50	50.74	21.36
	Gatondo/Thegenge	65.37	21.21	54.11	46.89
	Icuga/Gathumbi	50.00	45.15	23.30	39.48
	Kiambii	26.183	25.92	27.79	26.63
	Gatagati	77.212	62.94	5.52	48.56
	Irigithathi	18.09	14.48	2.07	11.55
	Overall Mean		45.63	35.57	34.43

Source: Field Survey Data, 2013.

This trend shows a diversification into non-food cash crops by the farmers to earn cash from their agricultural activities. FGDs conducted in the surveyed villages showed that farmers are diversifying into non-food cash crops such as sugarcane, soya beans and sunflower especially in the areas where monoculture growing of maize was hitherto widely practiced.

Table 3.8: Mean number of non-food cash crops grown in the villages

Village	Village name	2002	2008	2013	Overall
301	Shikomoli	2	1	0.30	0.8
302	Ekeru	0.80	1.04	0.97	0.93
303	Chegulo	0.81	0.97	0.77	0.85
304	Munyuki	0.30	1.00	0.37	0.56
305	Mukuyu	0.14	1.00	0.23	0.46
306	Gatondo/Thegenge	0.86	0.36	0.87	0.70
307	Icuga/Gathumbi	0.90	1.00	1.10	1.00
308	Kiambii	0.87	1.14	1.43	1.15
309	Gatagati	0.00	1.13	0.37	0.50
310	Irigithathi	0.03	1.08	0.03	0.38
	Overall Mean	0.65	0.90	0.64	0.73

Source: Field Survey Data, 2013

3.1.4.2 Livestock Production Trends in the Villages

The overall mean number of livestock declined from 1.72 in 2002 to 1.19 in 2008. However, it increased to 1.60 in 2013 (Table 3.9). Poultry had the highest mean compared to other livestock. Combining cows, oxen, heifers, calves and bulls we see a marginal increase in the mean number of cattle through the years from 2.51 in 2002 through 2.52 in 2008 to 2.85 in 2013. Shikomoli had the lowest mean number of livestock at 7.38 while Mukuyu had the highest mean at 25.18.

Table 3.9: The mean number of livestock per village

		Cows	Oxen	Heifers	Calves	Bulls	Goats/Sheep	Donkeys/Camel	Pigs	Poultry	Rabbits	Overall Average
Shikomoli	2002	1.73	.47	.00	.00	.00	.73	0.00	0.00	6.82	.00	0.98
	2008	1.67	.47	.00	.00	.00	.63	0.00	0.00	3.70	.00	0.65
	2013	1.27	0.00	.03	.23	.07	.50	0.00	0.00	3.83	0.00	0.59
Ekero	2002	.90	.57	.00	.00	.00	.77	0.00	.67	16.13	.00	1.90
	2008	1.47	.57	.00	.00	.00	.27	0.00	0.00	5.10	.00	0.74
	2013	1.57	0.00	.03	.43	.10	.60	0.00	.03	12.20	0.00	1.50
Chegulo	2002	3.17	2.47	.00	.00	.00	1.53	0.00	0.00	14.93	.00	2.21
	2008	2.30	1.77	.00	.00	.00	1.53	0.00	0.00	11.27	.00	1.69
	2013	1.73	1.07	.37	1.10	.20	.60	0.00	0.00	8.63	.10	1.38
Munyuki	2002	2.30	1.23	.00	.00	.00	1.20	0.00	0.00	16.66	.00	2.14
	2008	1.60	1.60	.00	.00	.00	1.37	0.00	0.00	6.47	.00	1.10
	2013	1.77	.35	.06	.65	.35	1.42	0.00	.06	7.48	1.26	1.34
Mukuyu	2002	2.43	1.47	.00	.00	.00	2.03	.13	.03	25.28	.00	3.14
	2008	2.00	1.27	.00	.00	.00	1.43	0.00	0.00	12.37	.00	1.71
	2013	1.66	.66	.21	.86	.24	1.10	.07	0.00	22.14	.17	2.71
Gatondo/Thenge	2002	1.30	.03	.00	.00	.00	1.37	0.00	.40	7.00	.00	1.01
	2008	1.87	.17	.00	.00	.00	1.53	0.00	.53	5.07	.00	0.92
	2013	1.13	.07	.30	.30	.03	1.17	0.00	.03	14.03	1.67	1.87
Icuga/Gathumbi	2002	1.67	0.00	.00	.00	.00	1.10	0.00	0.00	21.70	.00	2.45
	2008	1.67	.10	.00	.00	.00	1.33	0.00	.07	5.27	.00	0.84
	2013	1.53	0.00	.27	.43	.03	2.10	0.00	.17	9.60	1.40	1.55
Kiambii	2002	1.53	.03	.00	.00	.00	2.33	0.00	.03	5.43	.00	0.94
	2008	1.67	.17	.00	.00	.00	2.27	0.00	0.00	10.07	.00	1.42
	2013	1.37	0.00	.30	.67	.13	2.90	0.00	0.00	8.10	1.57	1.50
Gatagati	2002	2.07	.07	.00	.00	.00	2.71	0.00	0.00	6.17	0.00	1.10
	2008	2.60	.03	.00	.00	.00	3.53	0.00	0.00	6.40	0.00	1.26
	2013	2.07	0.00	1.03	.67	.23	3.23	0.00	0.00	8.20	3.57	1.90
Irigithathi	2002	1.47	.23	.00	.00	.00	2.60	.07	.03	9.07	.00	1.35
	2008	2.03	.17	.00	.00	.00	4.07	0.00	0.00	9.60	0.00	1.59
	2013	1.73	.03	.40	.67	.13	3.63	0.00	0.00	7.97	1.47	1.60
Overall Average		1.78	0.50	0.10	0.20	0.05	1.72	0.01	0.07	10.22	0.37	

Source: Field Survey Data, 2013.

3.2 Section Two: Micro Section

This section presents the results of the information collected using the structured questionnaire which was administered to the 300 households in the ten sampled villages. It starts by looking at the sources of household income (both on farm and off farm). This is followed by a section that examines the trends in livelihood diversification zeroing in on crop, livestock and income.

3.2.1 Crop and Livestock Contribution to Household Income

As noted earlier, diversified households derive their income from more sources with none being dominant, unlike specialized households. The decision to diversify is a conscious household decision and may be driven by factors such as prices factors, new technology, government policy, or even emergence of new markets. The contribution to gross income from a certain activity is another indicator of household diversification into or out of a certain economic activity. Gross revenue is also a proxy for time and effort allocated by a household to a certain activity hence may be a better indicator of diversification than net incomes. Diversification within agriculture considers revenues from both crops and livestock. In our case, the categories have been combined. As shown in Table 3.10, the overall contribution from the sale of food staples was lowest in 2008 at 7% while the sale of non-food crops was the highest at 19.92%. Although there are no significant variations in the overall sources of agricultural incomes, there are significant variations among the villages. Table 3.10 shows that households in Kiambii and Irigithathi derive their incomes mainly from the sale of food staples. In comparison, we see that shikomoli, Munyuki, Mukuyu, Kiambii and Gatagati are more specialized deriving their agricultural revenue largely from the two sources as opposed to the other villages which are more spread out.

Table 3.10: Agricultural contribution to Gross household income as a percentage of the total

Village	Year	Sale of food staples	Sale of other food crops	Sale of non-food cash crops	Sale of animals/ animal produce	Overall Mean
Shikomoli	2008	1.01	16.24	26.27	21.62	16.29
	2013	4.00	4.91	42.99	9.71	15.40
Ekeru	2008	1.63	16.44	25.73	26.48	17.57
	2013	0.95	21.82	36.66	35.46	23.72
Chegulo	2008	0.64	7.37	15.89	29.47	13.34
	2013	12.15	18.16	20.96	28.29	19.89
Munyuki	2008	0.88	40.92	12.46	34.07	22.08
	2013	20.17	9.44	0.00	44.50	18.53
Mukuyu	2008	1.86	27.44	11.92	22.13	15.84
	2013	16.14	15.49	0.18	19.75	12.89
Gatondo/ Thegenge	2008	14.32	29.04	6.01	0.00	12.34
	2013	5.22	2.27	14.72	3.47	6.42
Icuga/ Gathumbi	2008	1.51	1.34	68.65	10.73	20.56
	2013	15.40	10.66	37.24	13.47	19.19
Kiambii	2008	33.55	17.57	2.22	6.44	14.95
	2013	13.93	5.93	4.98	21.65	11.62
Gatagati	2008	0.48	2.04	29.78	4.77	9.26
	2013	1.57	2.86	26.81	7.16	9.60
Irigithathi	2008	14.10	28.64	0.99	36.90	20.16
	2013	30.99	20.29	11.29	9.87	18.11
Overall Sample	2008	7.00	18.70	19.92	19.26	64.88
	2013	12.05	11.18	19.58	19.33	62.14

Source: Field Survey Data, 2013.

3.2.2 Non-Farm activities' Contribution to Household Income

Excluding income from agricultural activities (sale of crops, livestock and livestock products), non-farm salaried employment was the highest contributor to household gross income. However, as shown in Table 3.11, the contribution of non agricultural activities to households' gross revenue is generally on an upward trend.

The overall contribution of agricultural activities to gross revenue decreased from 64.88% in 2008 to 62.14% in 2013 while that from off-farm activities increased from 35.05 in 2008 to

37.85% in 2013. This could be an indicator of households slowly diversifying from on-farm to off-farm activities. However, and taking the two time periods, agricultural sources still dominate as sources of income at 63.51% while off-farm activities contribution stand at 36.45%, (Tables 3.10 and 3.11).

Table 3.11: Non-Agricultural contribution to Gross household income as a percentage of the total

Village	Year	Leasing out Machinery/ Equipment	Work on Others' Farms Agricultural Labour	Non-Farm Salaried Employment	Micro-Business	Large-Scale Business	Rent, Interest	Pensions	Remittances	Overall Mean
Shikomoli	2008	0.00	2.51	27.61	3.77	0.00	0.00	0.57	0.40	4.36
	2013	1.17	9.33	17.04	5.92	0.00	1.08	0.99	2.87	4.80
Ekero	2008	0.02	1.75	16.29	7.40	0.00	1.35	1.85	1.06	3.71
	2013	0.00	0.50	0.63	3.97	0.00	0.00	0.00	0.00	0.64
Chegulo	2008	0.00	0.91	42.00	0.00	0.00	0.00	1.73	1.99	5.83
	2013	0.00	0.00	0.00	0.00	9.40	0.19	5.87	4.98	2.55
Munyuki	2008	0.00	3.61	4.64	2.65	0.77	0.00	0.00	0.00	1.46
	2013	0.00	1.59	13.60	3.31	0.00	3.36	2.47	1.56	3.24
Mukuyu	2008	0.00	2.72	27.42	3.43	0.80	0.00	2.12	0.17	4.58
	2013	0.00	2.63	26.13	8.76	0.00	2.55	2.63	5.76	6.06
Gatondo/Thegenge	2008	0.00	35.50	0.00	0.00	0.00	0.00	0.00	15.13	6.33
	2013	0.00	25.53	1.81	36.30	0.00	1.81	0.00	8.87	9.29
Icuga/Gathumbi	2008	0.00	15.63	0.00	0.00	0.00	0.00	0.00	2.14	2.22
	2013	0.00	2.67	5.17	13.46	0.00	0.34	0.00	1.58	2.90
Kiambii	2008	1.11	1.11	4.78	0.00	0.00	0.00	9.33	23.88	5.03
	2013	4.29	0.70	17.33	1.00	0.00	3.20	12.19	14.80	6.69
Gatagati	2008	0.00	35.45	26.46	0.00	0.00	0.00	0.00	1.03	7.87
	2013	0.55	0.87	34.90	9.91	0.00	4.23	7.68	3.45	7.70
Irigithathi	2008	0.00	2.74	4.22	6.04	0.00	0.00	0.00	6.36	2.42
	2013	0.00	1.56	1.14	21.86	0.00	0.00	0.00	3.00	3.44
Overall Sample	2008	0.11	10.19	15.34	2.33	0.16	0.14	1.56	5.22	35.05
	2013	0.60	4.54	11.78	10.45	0.94	1.68	3.18	4.69	37.86

Source: Field Survey Data, 2013.

3.3 Trends in Livelihood Diversification in the Households

This section uses the Herfindahl index of diversification to examine economic diversification (crop, agricultural and livelihood) by the households. This is disaggregated by crop, agriculture and by livelihood. This is followed by a section that examines the drivers of agricultural diversification and specialization. The last section gives estimates of income inequalities by region and by gender and discusses them.

3.3.1 Household Economic Diversification

Table 3.12 presents results for diversification at crop, agricultural and livelihood levels. Several results stand out; first, crop diversification (Table 3.13) increased over the period from 2002 through 2008 to 2013. Livestock diversification increased (Table 3.14) over the period but at a slightly decreasing rate and actually fell slightly from 2002 to 2008 before increasing slightly in 2013. This may imply that specialization in livestock production may have started to occur. Second, agricultural diversification may have stabilized, falling slightly in 2008 but increasing in 2013 though the trend is not very clear. Income diversification fell slightly from 2002 to 2008 but increased in 2013.

Table 3.12: Diversification Indices at Various Levels

	Type of Diversification			
	Crop	Income	Livestock	Livelihood
2002	0.84	0.88	0.72	0.81
2008	0.85	0.84	0.69	0.79
2013	0.88	0.86	0.75	0.83

Source: Field Survey Data, 2013.

All in all, these results suggest that households are beginning to respond to the changing policy and economic environment by slowing or even reversing their crop and broader agricultural diversification by beginning slowly to specialize in certain crops and livestock but are continuing to diversify their broader livelihoods by adding off-farm activities while maintaining most of their agricultural activities (Table 3.12). This suggests that the two counties (Nyeri and Kakamega) and indeed, the country as a whole remains at quite an early stage of the agricultural transformation.

Table 3.13: Crop Diversification Indices

Village	2002	2008	2013
Shikomoli	0.86	0.83	0.86
Ekeru	0.83	0.86	0.88
Chegulo	0.83	0.88	0.89
Munyuki	0.86	0.88	0.89
Mukuyu	0.86	0.88	0.88
Gatondo/Thegenge	0.83	0.86	0.89
Icuga/Gathumbi	0.83	0.83	0.88
Kiambii	0.83	0.83	0.86
Gatagati	0.80	0.83	0.88
Irigithathi	0.83	0.80	0.86
Overall Mean	0.84	0.85	0.88

Source: Field Survey Data, 2013.

Table 3.13 shows that crop specialization is yet to begin in most of the villages save for Shikomoli and Irigithathi where specialization started in 2008 and then the farmers went back to diversification in 2013. Consequently, most of the villages remain in the diversified phase. This need for most households to remain diversified can be explained by the need for households to manage risks and to meet their subsistence needs. Key informants interviews and FGDs in the villages revealed that farmers are diversifying away from maize to other crops due to the high cost of inputs and new diseases such as the lethal maize necrosis disease. Diversification is also being driven by the changes in the markets where the consumers are now demanding high value foods. Farmers also said that they are diversifying into crops that are drought resistant and to those that are resistant to pests and diseases. In addition to the above reasons, the farmers also said that they are diversifying into newly introduced cash crops such as tea tree, soy beans, and grain amaranth which fetch good prices in the market.

Table 3.14 indicates that households in Ekeru, Mukuyu, Kiambii and Irigithathi villages started livestock specialization in 2008 before going back to diversification in 2013. Households in the villages of Shikomoli and Chegulo remained in the livestock diversification phase throughout the study period. However, households in the villages of Munyuki, Gatondo and Gatagati though remaining in the diversification phase in the two time periods (2002 and 2008), started to diversify in the year 2013. The higher livestock diversification can be attributed to the introduction of emerging livestock such as the dairy goats, turkeys, rabbits, guinea fowls and

quails. These are being introduced due to the diminishing land sizes occasioned by land subdivisions as sons inherit land and break away from their nuclear families to establish their own households. The ‘craze’ with healthy eating can also explain this observed trend of greater livestock diversification into the emerging livestock.

Table 3.14: Livestock Diversification Indices

	2002	2008	2013
Shikomoli	0.67	0.67	0.67
Ekeru	0.75	0.67	0.75
Chegulo	0.67	0.67	0.67
Munyuki	0.67	0.67	0.80
Mukuyu	0.8	0.67	0.75
Gatondo/Thegenge	0.75	0.75	0.80
Ichuga/Gathumbi	0.67	0.75	0.80
Kiambii	0.75	0.67	0.75
Gatagati	0.67	0.67	0.75
Irigithathi	0.80	0.67	0.75
Mean Index	0.72	0.69	0.75

Source: Authors’ Field and Data Analysis, 2014

Table 3.15 depicts income diversification trends in the surveyed villages. Households in the villages of Shikomoli, Ekeru, Chegulo, Mukuyu, Gatondo, Kiambii, Gatagati and Irigithathi (i.e. 80% of the households in the surveyed villages) started income specialization in 2008. However, most of them reverted to greater income diversification in 2013 save for households in Munyuki, Ichuga, Kiambii, Gatagati and Irigithathi. Households in the villages of Munyuki and Irigithathi remained in the income diversification phase with Herfindahl indices of 0.86 for the periods 2008 and 2013.

However, households in the villages of Ichuga and Kiambii started to move to the phase of income specialization in 2013. The only village showing a consistent trend towards income specialization is Gatagati whose Herfindahl indices show a consistent downward trend for the periods 2002, through 2008 to 2013 (Table 3.15). The higher income diversification trend can be attributed to the need for households to earn greater income by diversifying into salaried wage labour and remunerative non-farm businesses which can also greatly increase (and stabilize) total household incomes. As depicted in Tables 3.10 and 3.11 above, households in the surveyed villages derive their income from a variety of sources both on-farm and off-farm. Key informants

interviews, FGDs and participants/researchers’ observations noted that households are diversifying into various non-farm income sources such as *boda boda* (bicycle) and motorcycle transport, brick making, sand harvesting, micro businesses (shopkeepers, posho milling, tailoring, *M-Pesa* (mobile money) shops etc), formal and informal salaried employment (in private schools and agro-processing factories), and as artisans in the *jua kali* (informal) sector.

Table 3.15: Income Diversification Indices

	2002	2008	2013	Mean Index
Shikomoli	0.86	0.75	0.86	0.82
Ekeru	0.90	0.80	0.86	0.85
Chegulo	0.89	0.83	0.88	0.87
Munyuki	0.88	0.86	0.86	0.87
Mukuyu	0.89	0.86	0.88	0.88
Gatondo/Thegenge	0.88	0.86	0.88	0.87
Icuga/Gathumbi	0.86	0.88	0.86	0.87
Kiambii	0.90	0.83	0.8	0.84
Gatagati	0.88	0.86	0.83	0.86
Irigithathi	0.89	0.86	0.86	0.87
Mean Index	0.88	0.84	0.86	

Source: Field Survey Data, 2013.

3.4 Drivers of Diversification and Specialization

This section discusses the drivers of agricultural and livelihood diversification in the rural households of Nyeri and Kakamega. The section also examines the relationship between nonfarm income and agricultural investment.

3.4.1 Factors Affecting Adoption and Intensity of Use of Fertilizer in Maize

Farm households often have to make complex decisions regarding consumption, investment and income earning activities. These decisions are influenced by a variety of external and internal factors. Farmers are often expected to invest off farm income in farming if the farm investment allows them to maintain or increase farm output (Harris et al., 2010). Investing part of the off farm income in the farm in this case is expected to increase the total income. Off farm income may also be utilized to satisfy the family’s consumption demands thereby making more farm profits available for reinvestment.

Generally, farmers' decisions to invest in improved agricultural technologies and the intensity of the use in a given period of time are hypothesized to be influenced by a combined effect of various factors such as household characteristics, socioeconomic and physical environments in which farmers operate. The investment decision can be viewed as a binary one, i.e. to invest or not, and thus can be analyzed using a dichotomous choice model. However, farmers are also faced with the decision of how much to invest. Modeling both decisions together is more desirable since such a model would provide information about who invests and how much. Estimating just the level of investment ignores the potential extra information in the data about who actually invests.

One of the purposes of this study was to investigate whether off farm income is invested in agriculture. This section looks at the factors that determine the amount spent on fertilizer (a key agricultural input) in maize (the main staple crop) production using the double estimation technique. As a robustness check, the estimated parameters are compared to the corresponding standard tobit estimation. The standard tobit specification is defined as

$$t_i^* = X_i' \beta + \varepsilon_i \text{ with } \varepsilon_i \sim N(0, \sigma^2) \text{ and } i=1, \dots, n \quad (1)$$

$$t_i = \begin{cases} t_i^* & \text{if } t_i^* > 0 \\ 0 & \text{if } t_i^* \leq 0 \end{cases}$$

Where t_i^* is a latent endogenous variable representing individual i 's desired level of expenditure on fertilizer, and t_i is the corresponding actual observed expenditure on fertilizer. X_i is a set of individual characteristics that explain the use and level of expenditure on fertilizer, and β is a corresponding vector of parameters to be estimated, ε_i is assumed a homoskedastic normally distributed error term. Equation (1) states that the observed amount spent on fertilizer become positive continuous values if only positive amount of money spent are desired, but zero otherwise. Since there is no negative expenditure, the censoring could be placed at zero without any loss of generality.

In the double-hurdle model specification an individual has to overcome two hurdles in order to report a positive amount of money spent. The first hurdle is based on whether farmers use fertilizer in maize production and the second hurdle models the decision on how much to invest

in the fertilizer. The double-hurdle model, originally formulated by Cragg (1971) by modifying the standard tobit model, assumes that two hurdles are involved in the process of investment decisions, each of which can be determined by a different set of explanatory variables. In order to observe a positive level of investment, two separate hurdles must be passed. A different latent variable is used to model each decision process,

$$y_{i1}^* = w_i' \alpha + v_i \quad \text{Investment decision}$$

$$y_{i2}^* = x_i' \beta + u_i \quad \text{Level of investment}$$

$$y_i = x_i' \beta + u_i \quad \text{if } y_{i1}^* > 0 \text{ and } y_{i2}^* > 0$$

$$y_i = 0 \quad \text{Otherwise}$$

We can envision simultaneity (e.g. use of fertilizer and hybrid seed) and multicollinearity (e.g. agricultural income and off farm income) of some of the variables used in the model. Off farm income could increase farm investment leading to increased agricultural income, while farmers often use hybrid seed in combination with fertilizer. Partial correlations were used to determine the relationship between both on farm and non farm income and relationship with farm investment. Off farm income was then disaggregated into different sources in the second regression model to minimize chances of multicollinearity. Partial correlation coefficients will also test for multicollinearity of the variables that were used in the regression.

Nonfarm income has relatively high returns, low risks and is likely to suffer less from shocks such as weather that impact income from farming. Thus nonfarm income is expected to be invested in productivity enhancing technologies and improved farming techniques. The relationship between non farm income and farm investment is presented in table 3.16.

Table 3.16: Correlation between non farm income and farm investment

Farm investment	Total nonfarm income
Expenditure on fertilizer	.001
Expenditure on herbicides	.232
Area under cash crops	.317**
Total farm size cultivated	.164**
Farm size rented in	.335**
Total cattle owned	.099
No. of graded/ cross-bred cows	.131*
Total farm income	.274**

Source: Field Survey Data, 2013.

Total non farm income is positively and significantly correlated with area under cash crops, total cultivated area, amount of land rented in, number of graded/cross breed cows and total farm income. Cash crops farming and keeping of graded cows is often capital intensive and farmers are likely to invest more of the non farm income to take care of the investment and running costs. Nonfarm income also enables farmers to increase total area cultivated as well as expansion of cultivated land by way of renting in, hence the significant correlation coefficient. There is however insignificant correlation between non farm income and investment in fertilizer and herbicides in maize production. This may imply that most of non farm income is invested away from food production possibly to buy household assets and other consumer goods.

To estimate the drivers of intensification of maize production, Tables 3.17 and 3.18 present parameter estimates of the fertilizer demand model with aggregated and disaggregated off farm income respectively. The dependent variable is total amount spent on fertilizer per hectare of maize grown. Coefficients in the first hurdle indicate how a given decision variable affects the likelihood (probability) to adopt fertilizer in maize. Those in the second hurdle indicate how decision variables influence the amount spent on fertilizer per hectare. The results for Tobit and double hurdle are reported side by side for comparison. The results show that fertilizer adoption

decisions are driven by different mechanisms from intensity decisions. This is so for variables such as use of hybrid seed, off farm income and access to agricultural credit.

Table 3.17 Probability of Investing and the Intensity of Improved Fertilizer use in Maize (Aggregated off farm income)

Variables	First hurdle	Second hurdle	Tobit
Education	0.055 (0.023)**		54.564 (66.685)
Age of the hhh	0.009 (0.006)**		20.224 (16.677)
Hybrid seed	0.687 (0.280)**	6270.193 (4470.798)	1729.536 (927.427)*
Sex of the hhh	0.200 (0.210)		646.880 (603.719)
Maize area recent season	0.524 (0.266)**	8788.056 (1642.504)***	4198.623 (690.056)***
off farm income	-1.42E-06 (7.44E-07)*	-0.0022 (0.0088)	-0.004 (0.002)
Distance to the nearest town	0.044 (0.059)	-206.321 (413.010)	123.892 (159.358)
Plan to sell maize		8907.295 (2510.339)***	2292.117 (585.157)***
Access to agricultural credit	1.031 (0.305)***	-91.479 (1827.553)	1242.266 (580.935)**
Maize production previous season		2.867 (0.591)***	2.266 (0.284)***
agricultural income		0.006 (0.009)	0.001 (0.003)
Constant	-1.088 (0.503)***	-20633.660 (6465.075)***	-5009.355 (1541.048)***
Log likelihood		-2406.8	-2350.69
Wald χ^2		218.66	30.89
P Value		0.000	0.0001

***=significance at 1%, **=significance at 5%, *=significance at 10%

Source: Field Survey Data, 2013.

Agricultural credit services are the major sources of finance to those farmers who adopt improved agricultural technologies like fertilizer application. Although agriculture credit is mostly provided for cash crop farming, there is expected to have a spillover effect to cereals and other food crops. It is therefore expected that households that can access agricultural credit will

have a higher likelihood of using fertilizer and will use it more intensively when they do. Access to agricultural credit had the expected positive and significant effect on the decision to invest in fertilizer. However, agriculture credit was not significantly influencing the level of investment in fertilizer. The previous season's maize production was included based on the naïve expectation model of farmers' decision making. Amount of maize harvested the previous season positively influence the intensity of investment in fertilizer meaning that when farmers experience increase production they tended to invest more in fertilizer following season.

Maize area had positive and significant influence both the decision to invest and the level of investment in fertilizer use in maize production. Larger farms require more capital investment and farmers are expected to use more fertilizer as land size increases. Use of hybrid maize seed was a significant factor influencing the probability of investment in fertilizer, but was not significantly influencing the level of investment. Most of the households using hybrid seed tend to also use fertilizer, thus the two inputs are likely complements. While the fertilizer adoption decision could be relatively independent of the hybrid seed adoption, decisions on hybrid seed use seem to be made jointly with those of fertilizer, but not on the level of investment in fertilizer.

Distance to the village center was included to proxy for cost of transport. Proximity of farmers to markets is essential for timely input delivery and output disposal and results in less transport cost of inputs and outputs. The coefficient of distance was however not significant for the intensity of use of fertilizer, meaning farmers interested in using fertilizer were not deterred by cost of transport.

The farmers' age and education level had positive and significant coefficients. This indicates that probability of investment in fertilizer increases with age and as the farmers gained more experience in farming. This might suggest that older and more experienced farmers may be using off farm incomes to finance farm investment or substitute higher off farm income for farm income. This could be attributed to the experience gathered over the years in coping with the menace of soil infertility. However, sex of the household head did not significantly influence the decision to invest in fertilizer. The results also contradict common belief that male farmers often

have more access to information, extension and credit services than their female counterparts, thus use more fertilizer.

Off farm income had negative coefficients for adoption and intensity models. The negative and insignificant impact of off farm income and the small magnitude of its decision model coefficient imply that, holding other factors constant, off farm income seems not to impact both adoption and intensity of investment in fertilizer. This suggests that these households are not using some of their off-farm earnings to purchase fertilizer for maize production, but instead were investing in other activities. In this case, off-farm earnings may not be needed to relieve cash constraints for fertilizer purchase. Likewise, agricultural income was not significantly influencing the decision and intensity to invest in fertilizer in maize production. Therefore it cannot be concluded that off farm income is driving the level of farm investments.

Based on the magnitude of slope coefficients, use of hybrid seed, maize area in the current season and access to agricultural credit impacted more on the probability of adopting fertilizer in maize production (0.68, 0.52 and 1.03 respectively). However, it is the estimated coefficient for maize area that indicates that it is greatly and highly significant in both probability and intensity of use of fertilizer in maize.

Table 3.18 presents the regression results with disaggregated off-farm earnings. This analysis was done to identify which of the different types of off-farm income may be driving decisions to investment in farm production.

**Table 3.18 Probability of investing and the intensity of improved fertilizer use in maize
(Disaggregated off farm income)**

Variables	First hurdle	Second hurdle	Tobit
Education	0.053 (0.023)**		43.4646 (65.745)
Age of the hhh	0.007 (0.006)		25.19892 (16.932)
Hybrid seed	0.680 (0.280)**	6295.845 (4215.420)	1742.968 (922.783)*
Sex of the hhh	0.211 (0.212)		603.6265 (600.648)
Maize area recent season	0.493 (0.267)*	8703.147 (1571.385)***	4363.447 (692.717)***
Distance to the nearest town		-230.782 (439.793)	144.0235 (161.751)
Plan to sell maize		8281.015 (2339.345)***	2225.763 (583.624)***
Access to agricultural credit	1.038 (0.305)***	264.866 (1738.058)	1293.454 (575.932)**
Maize production previous season		2.906 (0.612)***	2.230 (0.287)***
agricultural income		0.008 (0.008)	0.002 (0.003)
Salary	-2.01E-06 (1.02E-06)**	0.003 (0.010)	-0.003 (0.003)
Micro business	-4.90E-07 (2.31E-06)	0.000 (0.022)	0.0001 (0.007)
Remittances	7.11E-06	-0.072	-0.025

	(2.10E-06)**	(0.042)*	(0.012)*
Constant	-1.004	-19718.440	-5315.03
	(0.510)**	(6020.926)***	1549.199
Log likelihood	-2348.44		-2405.7405
Wald χ^2	31.10		22.79
P Value	0.0003		0.000
***=significance at 1%, **=significance at 5%, *=significance at 10%			

Source: Field Survey Data, 2013.

Off farm salaried employment negatively impacted adoption of fertilizer in maize but was insignificant in influencing the intensity of use of fertilizer. Income from micro business also had negative and significant impact on decision to use fertilizer but with small coefficients, implying that income from the micro businesses were important in the decision to invest in fertilizer. Remittances however had positive and significant impact on the level of investment in fertilizer. The fact that remittances are positive and significant in determining the level of investment in fertilizer, suggests that for the households using income from remittances, the level of investment increased as the income increased. Remittances from absent household members are likely to be in high amounts and on a regular basis, hence making it possible to facilitate investment into agriculture. Fertilizer adoption is greatly and highly significant in the use of hybrid seed and access to agricultural credit (0.68 and 1.04 respectively). The variables however, do not significantly impact on the level of investment in fertilizer in maize production.

3.5 Estimates of Income Inequalities in Nyeri and Kakamega Counties.

This sub-section presents estimates of income inequalities in Nyeri and Kakamega counties using evidence from field data. The information is also supplemented with facts and figures on inequality in Kenya as presented in a booklet by the Society for International Development (SID) and the Kenya National Bureau of Statistics (KNBS). The booklet by SID and KNBS relied solely on secondary data and official publications. It summarizes the striking aspects of inequality in Kenya and is based on a much larger report titled “*Pulling Apart: Facts and Figures on Inequality in Kenya*”. This report focuses on three broad and key dimensions of inequality: income, regional and gender inequalities. It presents facts and figures on inequality in both opportunities and outcomes across regions, gender and population groups.

Income inequality measures are concerned with the entire income or expenditure distribution. As noted in section 3.1.4.1 and given the problems encountered in coming up with accurate income measures, this study measured total household income by aggregating income from various sources such as sale of food staples, sale of other food crops, sale of animals and animal products, leasing of machinery and other equipment, working on other peoples' farms (*kibarua*), non-farm salaried employment, micro-and macro-businesses, rent, pensions and remittances. Table 3.19 shows the percentage of total household income received by various deciles of the households ranked by income levels for 2013 for both Nyeri and Kakamega.

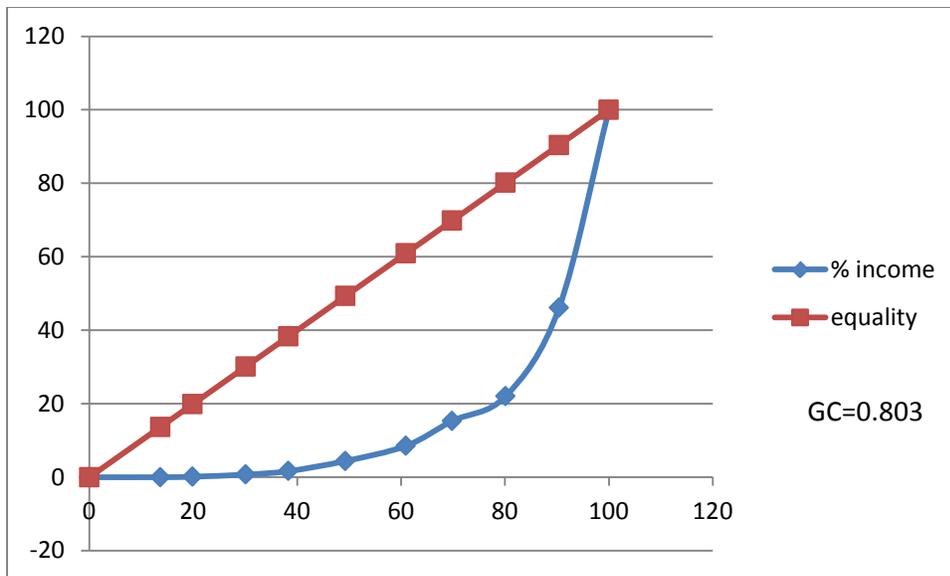
Table 3.19: Household Income Shares by Deciles

Decile	Kakamega		Nyeri	
	Share %	Cumulative	Share %	Cumulative
1	0.17	0.17	0.90	0.90
2	0.90	1.06	2.66	3.57
3	0.90	1.99	2.90	6.47
4	2.40	4.39	3.78	10.25
5	3.72	8.11	6.18	16.43
6	5.27	13.37	8.53	24.96
7	7.90	21.26	10.31	35.27
8	11.02	32.28	12.42	47.70
9	16.33	48.61	17.66	65.36
10	51.40	100.00	34.64	100.00

Source: Field Survey Data, 2013.

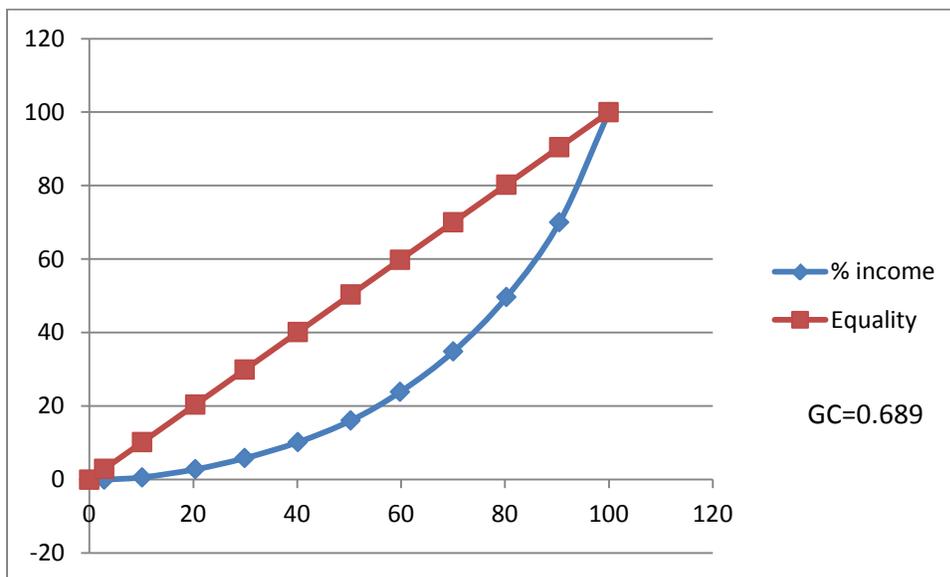
As discussed in the methodology section, (section 2.3.4) the Gini Coefficient (or index) and the associated Lorenz curve are commonly used to measure income inequalities in a country. They are also used for comparisons across counties or regions and over time. Figures 3.1 and 3.2 depict the Lorenz curves for Kakamega and Nyeri respectively for the year 2008.

Fig 3.1 Lorenz Curve for Kakamega for the year 2008



Source: Field Survey Data, 2008.

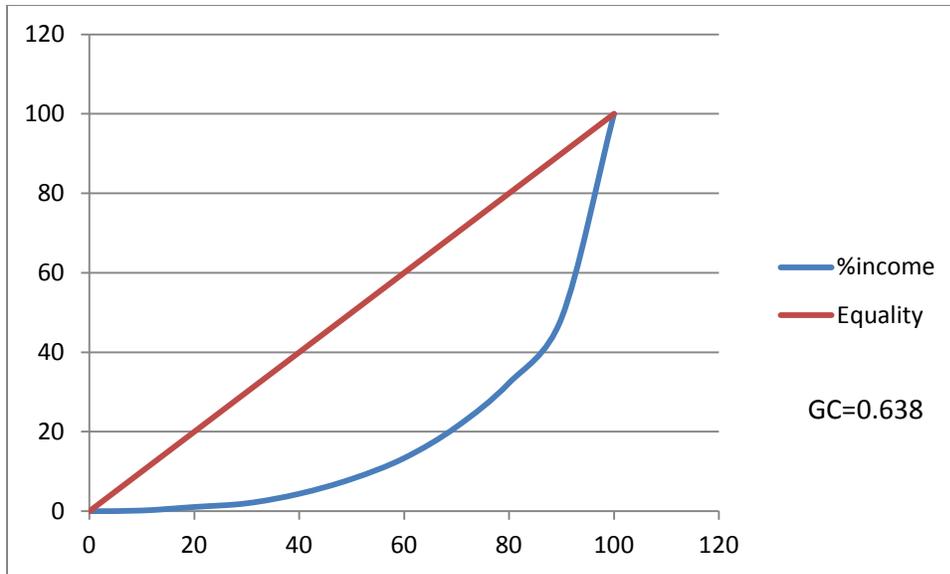
Fig 3.2 Lorenz Curve for Nyeri for the year 2008



Source: Field Survey Data, 2008.

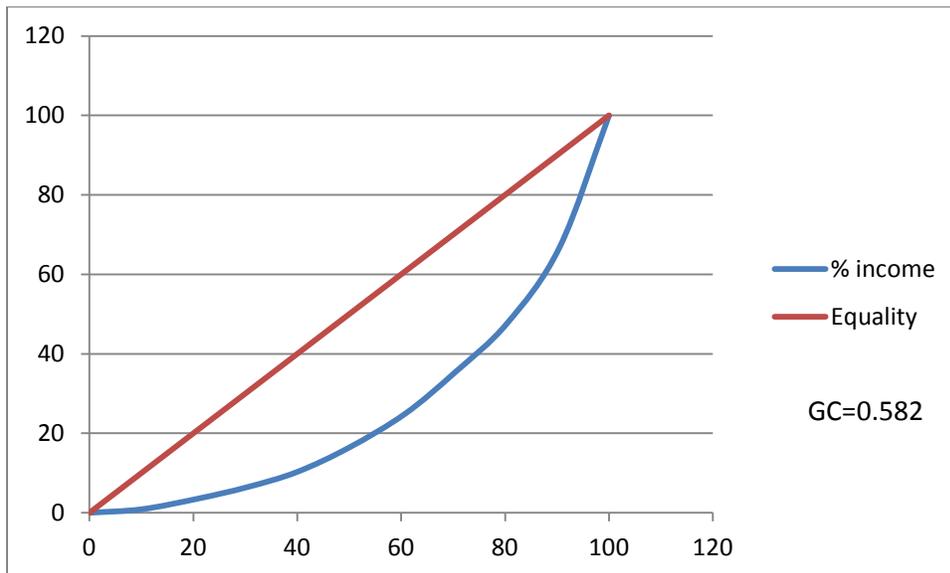
The Lorenz curves for the two counties for the year 2013 are depicted in figures 3.3 and 3.4. Table 3.20 shows the respective Gini coefficients for the same period.

Figure 3.3: Lorenz Curve for Kakamega for the year 2013



Source: Field Survey Data, 2013.

Figure 3.4: Lorenz Curve for Nyeri for the year 2013.



Source: Field Survey Data, 2013.

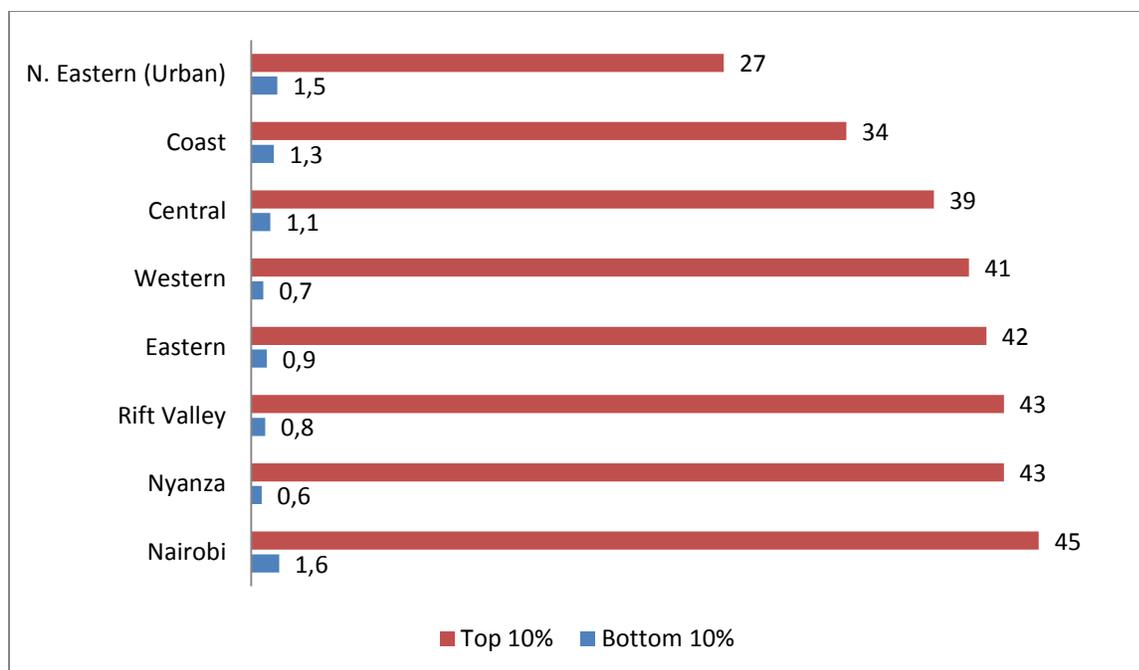
Table 3.20: Gini Coefficients for Kakamega and Nyeri, 2013

County	Male	Female	Combined
Nyeri	0.632	0.617	0.582
Kakamega	0.766	0.806	0.638

Source: Field Survey Data, 2013.

The figures and the table show that Kakamega has a higher income inequality than Nyeri. In Kenya just like in other countries inequalities in well being often take a regional dimension. In Kenya regional or geographic differences in well being may mean ethnic differences as ethnic groups often reside in given geographical regions. There are stark differences in Kenya's rural-urban divide and other regions too. The two study sites (Nyeri and Kakamega), mirror income, regional and county disparities characteristic of Kenya. A cursory look at the regional and county disparities in Kenya (KNBS, 1999) reveals that the distribution of incomes is skewed in favour of the higher wealth groups across Kenya's eight regions (formerly provinces). In the western region (where Kakamega is located) for example, the top 10% of the households command about 41% of the total income while the bottom 10% command less than 1%. In the Central region (where Nyeri is located), the top 10% of the households command about 39% of the total income while the bottom 10% command slightly over 1%. The distribution of income by regions is shown in Figure 3.5. Comparing 2008 and 2013 (Figs. 3.1 vis-a vis 3.3 and figs.3.2 vis a -vis 3.4) it can be observed that income inequality decreased in the two counties with Kakamega still having a higher income inequality. This decreasing income inequality trend can be attributed to the various Governmental and other developmental agencies' efforts aimed at reducing regional inequalities in welfare specifically and poverty in general.

Fig 3.5: Income Distribution by Regions (Formerly Provinces) %



Source: SID and KNBS 2004

The above observed regional/county disparities in income can be attributed to a number of factors/forces such as availability of employment opportunities, access to productive resources such as land, water, electricity, education, prevalence of HIV/Aids, security and political representation. Employment is a major source of income and an important determinant of socio-economic outcomes. From figure 3.6 it can be seen that the rate of unemployment is higher in the Western region (where Kakamega County is located) than in the Central region (where Nyeri County is located).

Land is an important productive resource in Kenya and can be a major cause of inequality. While villages in Kakamega County generally have a higher mean cultivated area (Table 3.5) and higher agricultural potential than Nyeri County other factors such as market access and degree of commercialization may play out to make Kakamega to have a higher index of inequality. Table 3.21 presents information on selected land types. It can be seen that there is a large discrepancy in the share of high and low potential land by regions.

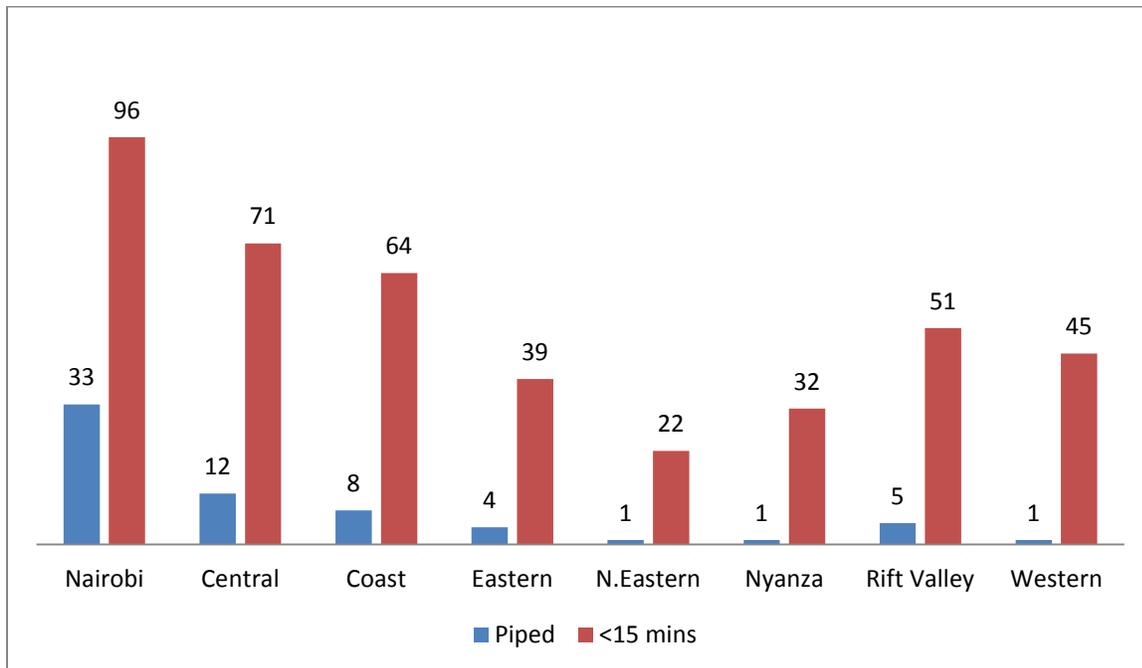
Table 3.21: Selected Land Types by Region ('000 ha), 1998

Province (Region)	High Potential		Low Potential	
	Area	%	Area	%
Nairobi	16	24	38	56
Central	909	69	41	3
Coast	373	5	5663	68
Eastern	503	3	11453	74
N.Eastern (Urban)	-	-	12690	100
Nyanza	1218	97	-	-
Rift Valley	3025	18	12230	72
Western	741	90	-	-
Kenya	6785	12	42115	74

Source: Statistical Abstract, 2003

Access to water is another important factor contributing to inequality. In Kenya wide disparities are evident in access to water. As figure 3.6 shows the Central region has better access to water than the Western region. Only about 1% of the households in the Western region have piped water compared to about 12% in the Central region. On the overall, water access is low in Kenya with only about 7.6% of the households having access to piped water. The proportion of people having access to water in less than 15 minutes is high in all regions but wide regional disparities are evident (Figure 3.6).

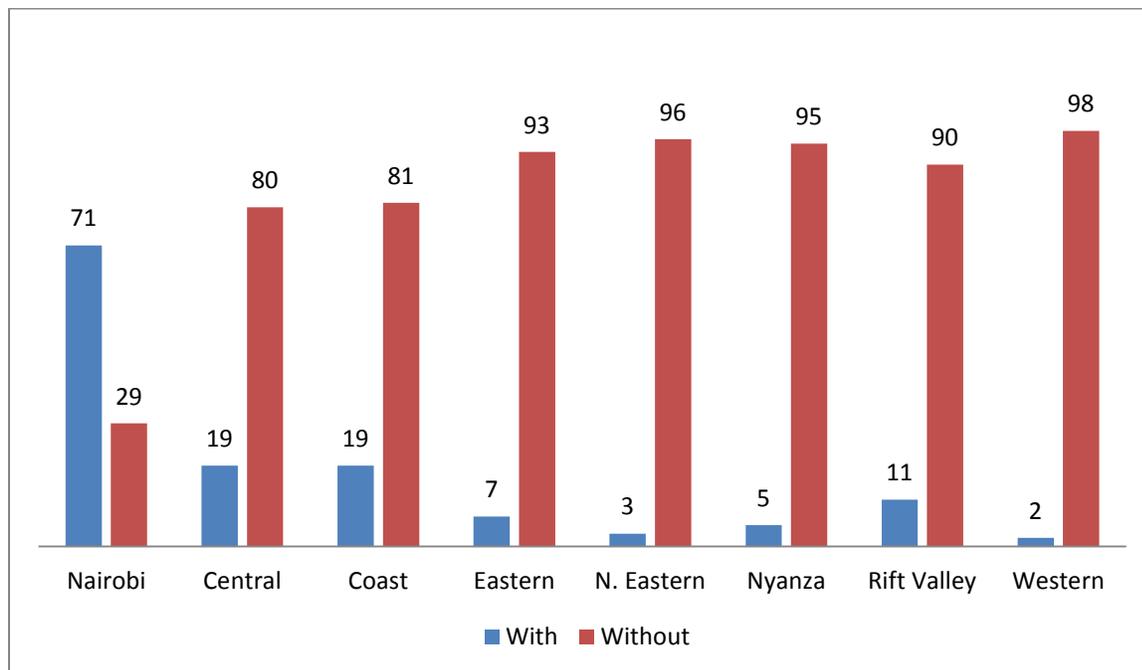
Figure 3.6: Access to Water, %



Source: SID and KNBS 2004

Access to electricity is another factor that determines the level of inequality. Electricity access just like access to water has a wide urban-rural and regional gap despite the country having had a rural electrification programme for many years. The Central region (where Nyeri is located) has better access to electricity than the Western region (where Kakamega County is located). The regional disparities in electricity access are depicted in Figure 3.7.

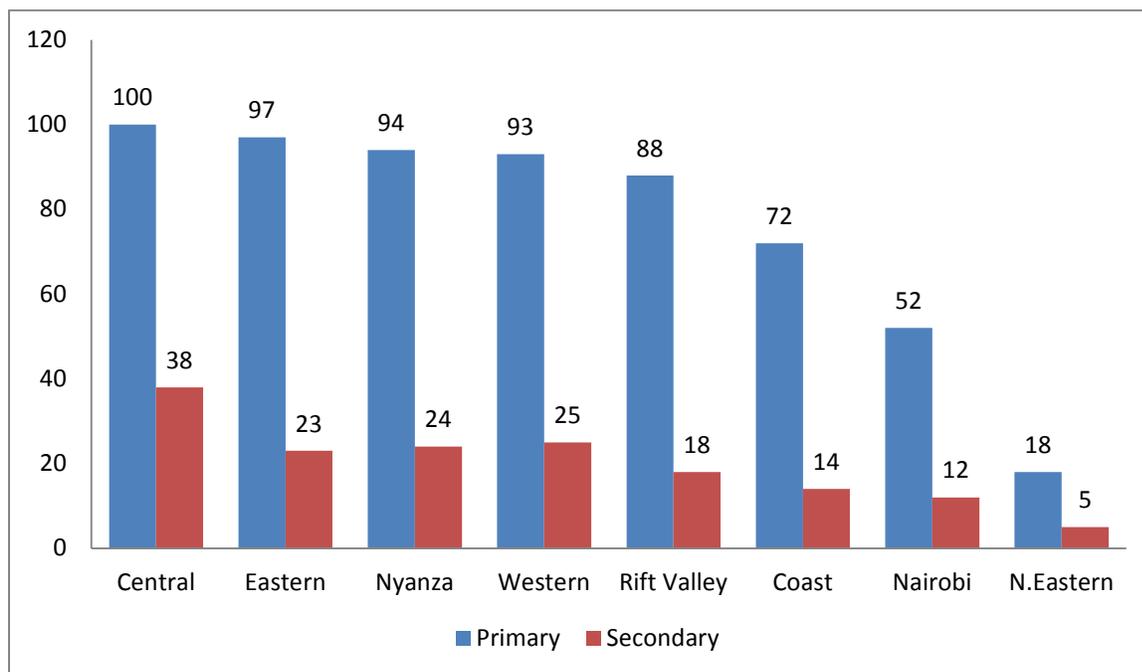
Figure 3.7: Regional Access to Electricity, %



Source: SID and KNBS 2004

The level and access to education is another factor that exacerbates regional inequalities. In Kenya there are wide regional disparities in education indicators. The central region has the best gross school enrolment amongst all the regions. In the Central region gross enrolment rates in primary in 2000 was 106% compared to 93% in the Western region as shown in figure 3.8

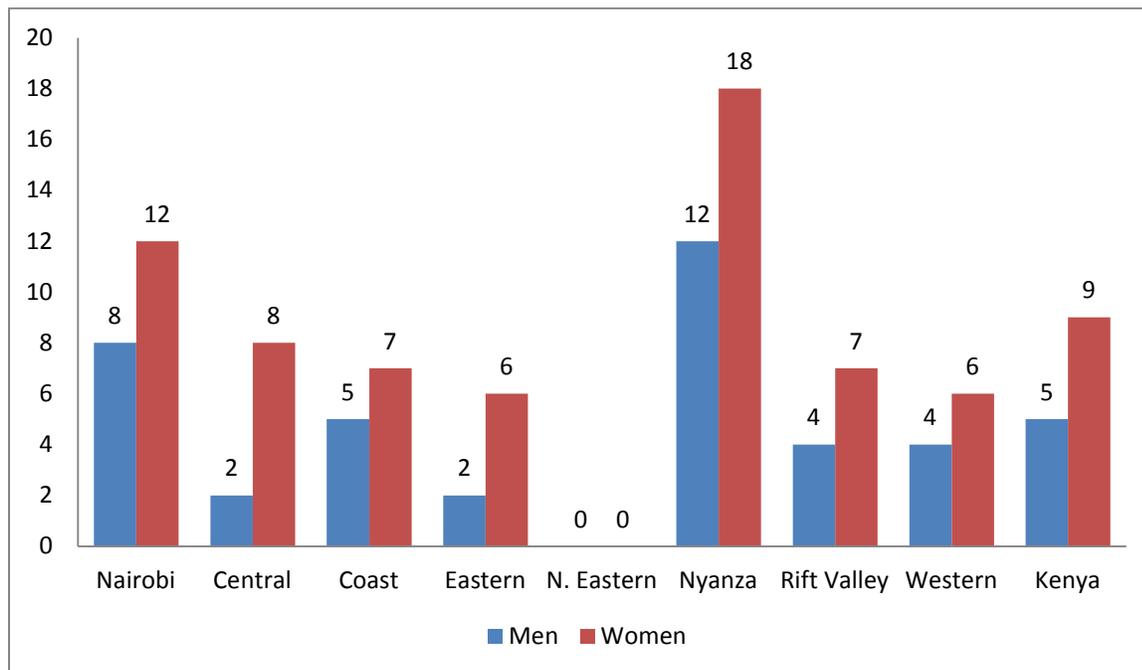
Figure 3.8: Gross School Enrolment by Region, 2000, %



Source: SID and KNBS 2004

HIV/AIDS, is one of the most serious health issues today and contributes to regional income inequalities. In Kenya the prevalence and distribution of persons infected varies across regions and genders as well. Comparing the Western and Central regions (Figure 3.9) men in the Western region have a higher infection rate than their counterparts in Central. However, women in Central have a higher infection rate than their counterparts in Western.

Figure 3.9: HIV Prevalence by Region and Gender, %



Source: SID and KNBS 2004

HIV/Aids infections also exhibit stark differences across ethnic groups. Table 3.22 shows that HIV/Aids prevalence in Kenya is heterogeneous by ethnic groups. Considering our two study regions, for example, it can be observed that it is lower among the Kikuyus (who inhabit Nyeri and the Central region) and higher among the Luhyas (who inhabit Kakamega and the Western region).

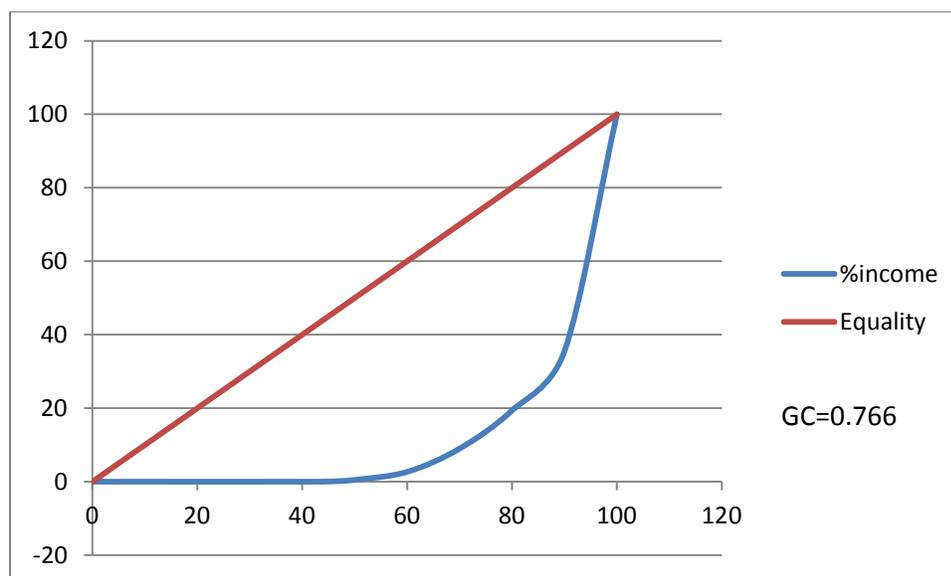
Table 3.22: HIV Prevalence Rate by Gender and Ethnic Group

Ethnic	Women	Men	Total
Embu	(2.8)	(3.7)	3.3
Kalenjin	4.9	2.0	3.4
Kamba	8.6	1.6	5.4
Kikuyu	6.6	2.8	4.9
Kisii	7.4	0.5	4.0
Luyha	7.9	5.1	6.6
Luo	25.8	17.5	21.8
Maasai	2.8	2.2	2.5
Meru	6.1	1.2	3.7
Miji Kenda/Swahili	3.8	3.0	3.5
Somali	0.9	1.8	1.3
Taita Taveta	11.7	7.1	9.7
Turkana	6.5	5.1	5.7
Kuria	-	(5.2)	2.7
Others	6.7	5.6	6.1

Source: SID and KNBS 2004

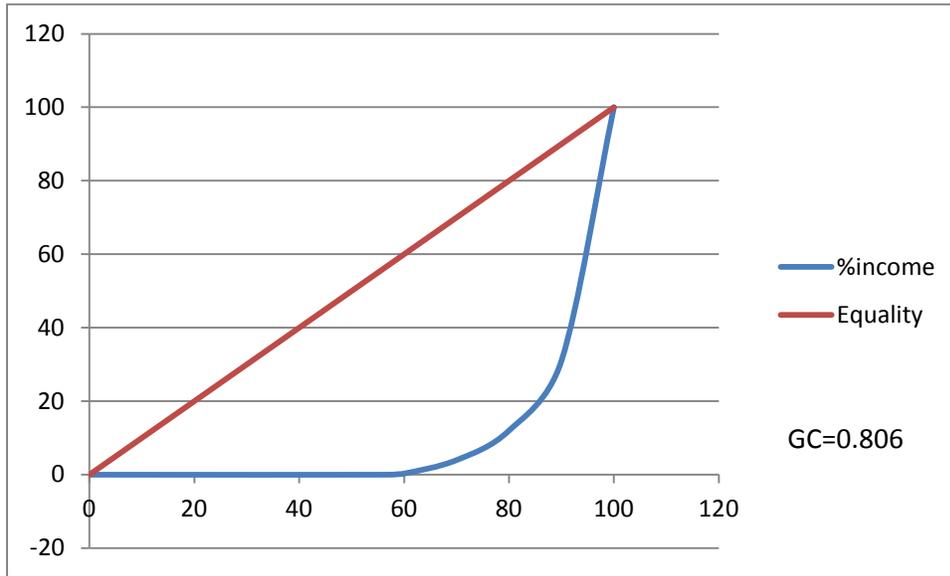
The Gini coefficients were also disaggregated by gender to try and depict the income inequalities along gender lines (Figs 3.10 through 3.11 to 3.13).

Figure 3.10: Lorenz Curve for Kakamega Males for the Year 2013.



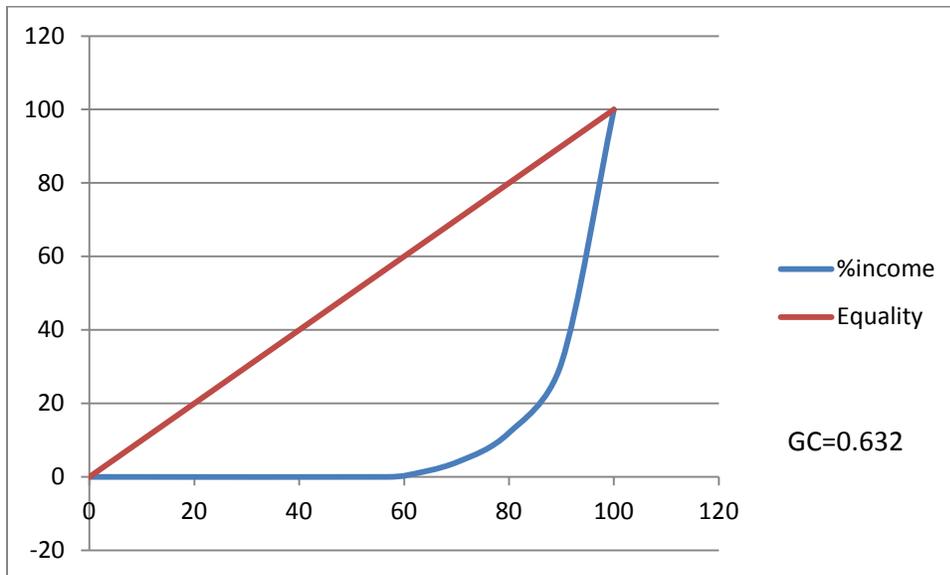
Source: Field Survey Data, 2013.

Figure 3.11: Lorenz Curve for Kakamega Females for the Year 2013.



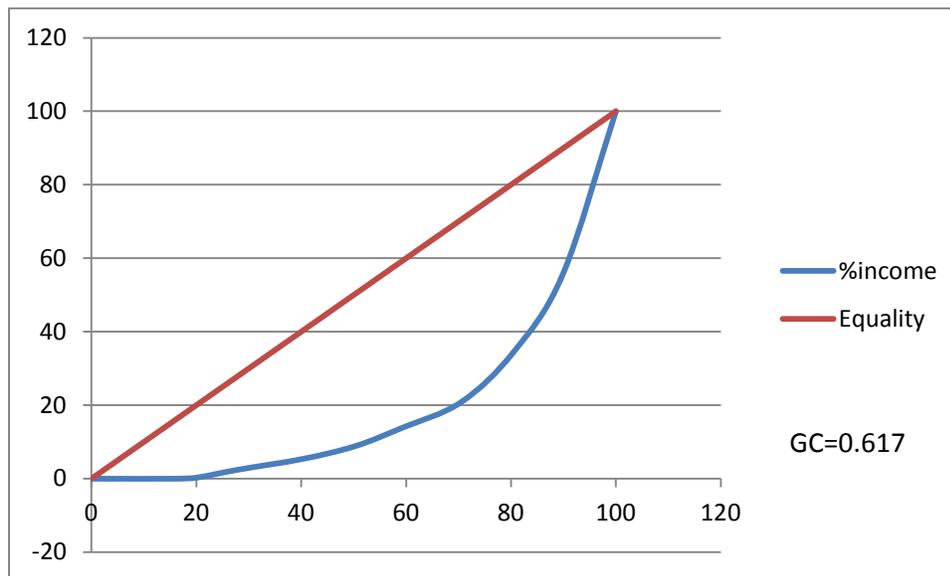
Source: Field Survey Data, 2013.

Figure 3.12: Lorenz Curve for Nyeri Males



Source: Field Survey Data, 2013.

Figure 3.13: Lorenz Curve for Nyeri Females



Source: Field Survey Data, 2013.

The estimates suggest that income inequality is higher in Kakamega than in Nyeri even after the disaggregation by gender. Though there is an increasing recognition of the significant role women play in the socio-economic and political development of a society, their full participation in development continue to be hampered by a number of obstacles. These include *inter alia* access to income/employment opportunities, access to education, higher percentage of women infected and affected by HIV/Aids, political participation and socio-cultural factors that discriminate against women. These factors essentially put women in a disadvantageous position (relative to men) in so far as realizing their full potential is concerned. Data from the Integrated Labour Force Survey show that there is a huge difference in income distribution between male and female headed households (Table 3.23).

Table 3.23: Income distribution by household headed (1999)

	Male	Female
Lowest	15	8
Second	17	7
Third	16	10
Fourth	9	7
Fifth	10	10
Sixth	11	12
Seventh	6	9
Eighth	6	12
Ninth	5	12
Highest	4	12

Source: SID and KNBS 2004

The unemployment situation in Kenya also takes a skewed gender dimension. Disaggregating unemployment by age, gender and the rural-urban divide reveals striking bias of unemployment of women in virtually all the age cohorts (Table 3.24).

Table 3.24: Number of unemployed by gender age groups, 1999

Age group	Urban		Rural	
	Male	Female	Male	Female
15-19	52,729	87,643	60,854	68,991
20-24	72,824	274,395	98,702	87,157
25-29	32,820	165,447	36,672	56,740
30-34	20,177	83,603	21,667	60,480
35-39	15,055	53,382	27,114	44,596
40-44	13,554	27,585	37,524	34,501
45-49	18,197	26,593	11,685	32,121
50-54	9,889	24,960	14,110	17,881
55-59	18,658	13,217	15,833	16,527
60-64	6,160	11,793	8,242	20,544
Total	260,063	768,618	332,403	439,538

Source: SID and KNBS 2004

Considering the literacy rates by gender, it can be observed that it is lower for women than for men. In the central region (where Nyeri is located) and in the Western region (where Kakamega is located) female literacy stood at 91.1% and 77.4% as compared to male literacy levels that stood at 94.4% and 84.4% respectively (Table 3.25).

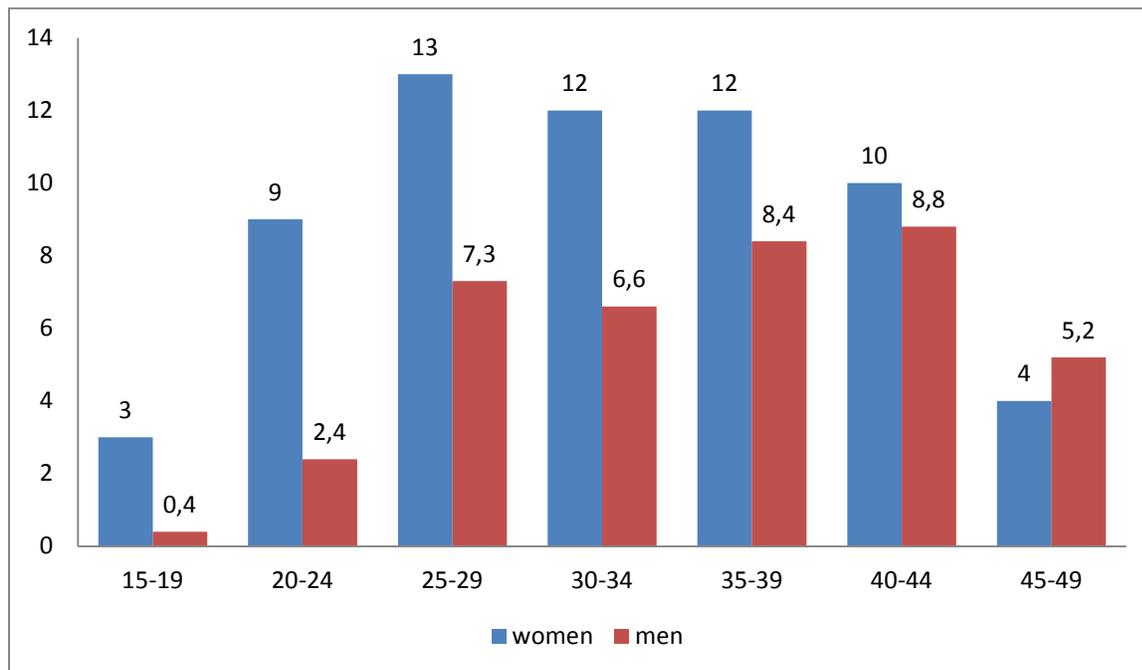
Table 3.25: Literacy by Gender and Region, %

Province	Literacy		No education at all	
	Female	Male	Female	Male
Nairobi	91.8	94.2	5.6	4.9
Central	91.1	94.4	2.6	1.5
Coast	65.6	88.2	29.6	10.0
Eastern	81.6	91.7	8.4	3.5
N. Eastern	6.4	29.5	93.4	71.1
Nyanza	79.8	89.4	7.1	1.8
Rift Valley	73.2	83.9	17.4	10.2
Western	77.4	84.4	9.0	3.4
Kenya	78.5	88.1	21.6	13.8

Source: SID and KNBS 2004

Figure 3.14 show the percentage of men and women infected by HIV/Aids. The figure depicts that a higher percentage of women are infected in all the age cohorts. This higher infection among females has implications on income and inequality.

Figure 3.14: HIV Prevalence by Age Group and Sex, 2003



Source: SID and KNBS 2004

Another important factor that contributes to gender inequality in income and welfare is political participation. Women's participation in decision making at the household level and national level is an important dimension in reducing inequalities and poverty.

Women access to productive resources is an important factor in explaining inequality. Cultural traditions especially in Kakamega and in the Western region that prohibit women from accessing productive resources (especially land) and in household decision making have exacerbated inequalities along gender lines.

Generally the following reasons can explain the causes of inequality and poverty in the two counties specifically and in Kenya in general.

- **Low agricultural productivity and poor marketing.** This can be attributed to traditional farming methods, low soil fertility, unpredictable weather conditions, poor and inadequate extension services, higher cost of inputs, low quality seeds and lack of credit facilities. These factors vary from County to County and contrib. utes to regional inequalities and poverty.

- **Insecurity:** this is often cited as another source of inequality. Some areas are more secure than others. Insecurity is manifested through robbery and looting, physical injury, murder etc. some of the villages such as Ekeru and Munyuki bore the blunt of the 2007/2008 post election violence. Gatondo was affected by the terror gangs (Mungiki specifically). The immediate consequence is loss and destruction of material property such as livestock, shelter and clothing. Insecurity is a disincentive to the operation of businesses. Many households in Kenya generally have been rendered poor as a result of insecurity in the affected areas.
- **Unemployment and low wages:** FGDs and key informant interviews conducted in the study villages revealed that although children had completed schooling many had failed to secure meaningful employment due to lack of opportunities and skills for gainful employment and lack of crucial facilities for production such as electricity. Lack of credit due to the inability to obtain collateral was mentioned as a hindrance to self-employment. In the case of women, access to credit is conditional upon their husbands' consent. Moreover, women tend not to own land or other tangible forms of security to secure a loan. Corruption and nepotism have worsened the situation as poor households are often unable to pay the bribes demanded by potential employers. Lack of employment implies lack of income necessary for meeting the basic needs such as food, shelter, clothing, education and medical services. Recent reforms, including liberalization of the economy and retrenchment in the public service, have been necessary but, in the short-term, have worsened the problem of unemployment. Increased market competition combined with the poor management has led to the collapse of sugar factories, cotton ginneries, coffee and sisal factories and livestock processing industries.
- **Bad Governance:** This was cited as another cause of poverty and inequality by the people interviewed. Bad governance manifests itself in lack of transparency and accountability in management of the resources and funds meant to benefit communities. FGDs and key informants interviews singled out mismanagement of bursary and harambee funds, mismanagement of co-operatives, relief food distribution, disbursement of funds for women, youth and the disabled as areas where bad governance play out. This has denied households and communities crucial resources and services that would improve their well-being.

- **Land issues and discrimination against women:** Landlessness has been identified by many communities as a major underlying cause of inequality and poverty. Rural communities are dependent on land for production. However, many people have been rendered landless or squatters. The causes of landlessness vary from community to community. In some communities it is as a result of high population growth, while in others it is due to poor land tenure systems, such as communal land ownership. In pastoral areas, there are frequent conflicts over grazing and watering points, thereby causing poor utilization of the land resources. In some regions many households have no title deeds. Ownership and access to land in rural areas is a critical factor influenced by the interplay of the customary and civil laws. Although women can legally inherit land, African customs essentially support a patrilineal mode of inheritance and many local cultures do not guarantee a woman the right to own land or to inherit her husband's property upon his death. If a woman is divorced or separated, most assets, which were initially jointly owned, revert to the husband's possession. This makes women more vulnerable to inequality and poverty. Related landlessness is the fragmentation of land into small uneconomical units in some parts of the country. This is predominant in high and medium potential areas where there is high population.
- **Inadequate roads:** Many areas in Kenya have poor road networks. Many areas generally lack roads and the existing few are in pathetic conditions and impassable. In other areas, bridges are either not available or are on the verge of collapsing. This makes access to markets, hospitals and schools impossible or very difficult. Farmers are therefore not able to market their products and end up being exploited by middlemen. This exacerbates poverty and inequality.
- **Cost of social services:** Cost sharing in health facilities is said to have "lost meaning", as the situation in most public health facilities has become worse as reflected by lack of drugs, collapse of Maternal and Child Health (MCH) services, absence of health personnel, increased cost of drugs and general insensitivity/unfriendliness of staff coupled with corruption.
- **Cost of Education:** The cost of education especially in primary schools is a huge burden on many households. The many school requirements such as several textbooks for every subject, school uniform, school development fund, additional hiring of teachers by

Parent-Teacher Associations and other frequent and unplanned levies have all acted to deplete the meager household incomes. For many parents who cannot afford the high cost of education, their children end up dropping out of school and work to supplement households' incomes. The situation is worse for the girl child who becomes the first victim to drop out of school due to boy child preference in a situation of reduced resources. All these factors limit opportunities for employment and involvement in income generating activities by women, thus increasing their poverty.

- **HIV/AIDS:** HIV/AIDS has been identified as a development problem causing inequality and poverty. Prostitution, especially in urban areas, wife inheritance in some communities, use of communal/traditional circumcision tools, lack of awareness of the disease have been cited as some of the major causes of the disease. The disease has aggravated poverty and inequality mainly because those dying are the productive young people, leaving behind widows and orphans who become dependent on other members of the family. Those who are afflicted with AIDS also consume resources, as they require drugs and special food. Some families are forced to sell their land to take care of their expenses. Women are more susceptible to transmission of HIV/AIDS because of biological factors, illiteracy, ignorance and lack of skills for employment forcing them to be dependent on men for economic support. Women are particularly vulnerable to HIV/AIDS as they often lack the power to successfully negotiate safe sex. The situation is worsened by deteriorating economic conditions which make it difficult for women to access health and social services. Women also bear the main burden of caring for the ill.
- **Gender imbalance:** Gender imbalance has been cited as a key factor in propagating poverty and inequality. Lack of ownership and control over productive assets such as land by women has been given as a factor contributing to poverty in agriculture. In some cases, women cannot make strategic decisions like selection of the part of the land to cultivate even when the man is away. In many households property is registered in the name(s) of male(s). Traditions in many societies do not give women the right to own property or to have property registered in their names. Related to this is lack of collateral to secure credit. This makes female-headed households more vulnerable because they are the sole breadwinners. Discussions held during the FGDs and Key informants interviews indicated that men dominate the access and control of household resources/assets and

decision making patterns while women control only minor resources and assets such as chickens, furniture and utensils.

- **Disability:** Disability has also been cited as a cause of inequality and poverty. Persons with Disabilities (PWDs) were reported to be socially marginalized, neglected and intimidated in many parts of the country. PWDs are poorly represented in many decision making bodies/institutions hence their needs are not catered for. PWDs have been denied access to public utilities, good healthcare, basic education and vital information leading to lack of employment opportunities resulting from lack of relevant skills and knowledge. These factors have reduced their ability to fend for themselves and have made them dependent on other members of their households, who are forced to divert their valuable time from gainful economic activities. At the household level, their rights to inherit property are either abused or neglected. These factors combined cause poverty to both PWDs and their households.

4.0 CONCLUSIONS, POLICY RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH.

This last section of this report gives the conclusions emanating from the key findings of the study. It also highlights some salient recommendations that are of importance to policy. Finally the section gives some insights into areas that are deemed to require some further research.

4.1 Conclusions

From the findings of this study, the following three major conclusions can be drawn:-

- 1) Households in Nyeri and Kakamega counties are diversifying rather than specializing their agricultural activities. Consequently, the regions just like the rest of the country are in their very early stages of agricultural transformation as evidenced by the highly diversified, subsistence oriented production except in a few cases where some villages and households are tending towards more specialized production oriented towards the market.
- 2) Non-farm income was found to be positively correlated with area under cash crops, total farm size cultivated, farm size rented, number of grade cows and total farm income. However, the impact of off-farm earnings on input use, agricultural

specialization and intensification was found to be minimal. The tobit and double hurdle models showed that non-farm income had negative coefficients on adoption and intensity of agricultural input use.

- 3) The two regions exhibit wide inequalities in income as depicted by the Gini coefficients and the Lorenz curves. Gender income inequalities are higher in Kakamega than in Nyeri. This can be attributed to a number of factors such as lack of ownership and control over productive assets. In Kakamega, for example, some sub-tribes of the Abaluhya community do not give the women the right to own productive resources such as land.

4.2 Policy Recommendations

A number of policy recommendations can be made emanating from the findings of this research:

- 1) Policies should be made that will encourage a shift from promoting broad agricultural diversification to facilitating specialization among households that are likely to do so. Key aspects of this policy change include:-
 - More room will need to be made in the technical research portfolio for high yielding crop and livestock packages, even if they imply more risk; while not all farmers will demand such technologies, an increasing numbers of them will;
 - It will be more important for farmers to have access to the right inputs at the right time. While government input programs (e.g. for fertilizer) can provide wide access to some inputs for many farmers, private systems are likely to be better at providing the range of differentiated inputs needed by the new technologies, and to provide them on a reliable basis. It is thus important that any government input programs that does exist be modest in scope, well targeted, and that they do not interfere with the growth of private input channels;
 - The counties and the country at large will need more investment in supply chain efficiencies, including improved extension, market information, physical market places, and cold chains for perishable items like fresh produce, dairy, and meat. Many of these investments will need to be facilitated by government, but they must be conceived and implemented in a highly collaborative fashion with private sector;

- Increased attention will need to be paid to negative environmental externalities from agriculture; though these negative externalities might be modest now, they could grow very rapidly in the absence of an appropriate policy framework, as input use grows rapidly with increased agricultural specialization;
 - Specialization will drive less efficient farmers out of agriculture. For the agricultural transformation to proceed, broader macroeconomic and investment policy must be reviewed to ensure that they encourage free investment throughout the economy so that those leaving the farm will be able to find gainful employment elsewhere;
 - Finally, the government's decision to offer free primary and now secondary education appears very well timed, as greater education will need to drive the growth of the non-farm economy and ensure that people are not just pushed off the farm by specialization but pulled off it by attractive income earning opportunities. As access to education increases, however, attention must continue to be paid to its quality.
- 2) This paper provides empirical evidence of the importance of certain types of off-farm work in relaxing the credit – and risk constraints that typically limit agricultural intensification in Kenya. As regards policy, a multifaceted approach that considers other constraints to intensification especially in regards to technology generation, returns to input use, input delivery systems and effectiveness of extension, must be considered in drawing policy recommendations.

4.3 Areas/Suggestions for Further Research

The following areas are deemed as requiring further research.

- Given the problems encountered in collecting reliable data on incomes, this study suggests that more reliable instruments be devised. Also there is need to collect and have reliable data that will enable calculation of the various measures of diversification.
- Research needs to be carried out to assess the success of the poverty/income inequalities reduction initiatives instituted by the Government and other agencies. Research is needed to ascertain whether these initiatives perpetuate, aggravate or bridge the income gap so that remedial measures can be put in place.

- Further research is also needed to explore the extent to which off farm work affects farm production decisions through re-investment in farm input use and intensification.
- Research is also necessary to ascertain the extent to which engagement in off farm work compete with farming at higher levels with households shifting their resources to other uses perhaps with higher returns than agriculture.

LIST OF REFERENCES

- Barett, C.B., M.Bezuneh, et.al. (2001). "Income diversification, poverty traps and policy shocks in Cote d'voire and Kenya." *Food Policy*, 26(4): 367-384.
- Barett, C.B., M. Bezuneh et.al (2005). "Heterogenous constraints, incentives and income diversification strategies in rural Africa." *Quarterly Journal of International Agriculture*, (1): 37-60
- Block S.A., 1994. "A New View of Agricultural Productivity in Sub-Saharan Africa." *American Journal of Agricultural Economics*, 76 (3): 619-624.
- Byerlee D, Diao X, and Jackson C, 2005. "Agriculture, Rural Development and Pro-poor Growth: County Experiences in the Post Reform Era. *Agriculture and Rural Development*. "Discussion Paper, No.21, The World Bank.
- Carter M, Waters E, Branch B, Ito L, and Ford C, 2004. "Rethinking Rural Finance." *A synthesis of the Paving the Way Forward for Rural Finance Conference*. BASIS Collaborative Research Support Program, University of Wisconsin-Madison
- Cragg J.G. (1971). Some Statistical models for Limited dependent variables with application to the demand for durable goods. *Econometrica*, 39, 829-844
- Delgado C.L, and Siamwalla A, (1997). *Rural economy and farm income diversification in developing countries*. MSSD Discussion paper no.20, International Food Policy Research Institute, Washington, D.C.
- Harris, J. M., Blank, S. C., Erickson, K. and Hallahan, C. (2010). *Off-farm income and investments in farm assets: A double-Hurdle approach*. Paper presented at the AAEA, CAES, and WAEA joint annual meeting. Denver, Colorado, July 25-27, 2010.
- Jayne T.S, and Stephen Jones, 1997. Food Marketing and pricing policy in Eastern and Southern Africa: A survey. *World Development*, 25(9), 1505-1527
- Karugia, J.T. and Wambugu S.K. (2008). *The Millenium Development Goals and the African Food Crisis: a Meso and Micro Level Analysis of the Drivers of Agricultural Intensification of Food Staples in Kenya*. Afrint II report, Lund University, Lund Sweden

- Kimenju S.C and D. Tschirley (2008). *Agriculture and Livelihood Diversification in Kenyan Rural Households*. Working Paper, WPS 29/2008, Tegemeo Institute of Agricultural Policy and Development Egerton University. Nairobi, Tegemeo Institute
- Lanjouw, P. and G. Feder (2001). *Rural non-farm activities and rural development: from experience towards strategy*. Rural Development Strategy Background Paper. Washington D C, The World Bank.
- Pingali P, (1997). From Subsistence to Commercial Production Systems: The Transformation of Asian Agriculture. *American Journal of Agricultural Economics*, 79(2), 628-634.
- Reardon T, and Taylor J.E, (1996). Agroclimatic Shock, Income Inequality and Poverty: Evidence from Burkina Faso. *World Development* 24 (5): 901-914.
- Reardon T. (1997). Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. *World Development* 25 (5): 735-747.
- Reardon T, Taylor J.E. Stamoulis K, Lanjouw P, and Balisacan A, (2000). Effects of Non-farm employment on Rural Income Inequality in Developing Countries: An Investment Perspective. *Journal of Agricultural Economics* 51 (2): 266-288
- Reinert K, (1998). Rural Non-farm Development: A Trade-Theoretic View. *Journal of International Trade and Economic Development* 7 (4): 425-437.
- Republic of Kenya (2004). *Poverty Reduction Strategy Paper*. Government Printers, Nairobi, Kenya.
- Staatz J.M. (1999). *What is Agricultural Transformation?* Paper presented at Agricultural Transformation Workshop. Tegemeo Institute/Egerton University, Eastern and Central African Programme for Agricultural Policy Analysis, Michigan State University, United States Agency for International Development. Nairobi. June 27-30
- Society for International Development. (2004). *Pulling Apart: Facts and Figures on Inequality in Kenya*. Nairobi, SID
- T, Crawford E, and Kelly V, 1994. Links between Non-farm income and farm investment in African households: adding the capital market perspective. *American Journal of Agricultural Economics*, 76 (5), 1172-1176.
- Timmer C.P. (1984). The Agricultural Transformation in: C.K. Eicher and J.M. Staartz (eds), *International Agricultural Development*. Baltimore, Maryland: The John Hopkins University Press pp. 113-135.

- Timmer C.P. (1997). Farmers and Markets: The Political Economy of New Paradigms, *American Journal of Agricultural Economics*, 79, 621-627.
- Timmer C.P. (1998). *The Agricultural Transformation. International Agricultural Development*. Baltimore, Maryland The Johns Hopkins University Press.
- Tsicherley D.L. & Benfica R, (2001). Smallholder Agriculture, Wage labour and Rural poverty Alleviation in land-abundant areas of Africa: evidence from Mozambique. *The Journal of Modern African Studies*, 39 (2) 333-358.
- Wambugu S.K. (2005). *Analysis of the nature and extent of integration of Kenya's maize markets in the post liberalization era*. PhD thesis, Kenyatta University, Nairobi, Kenya.
- World Bank, (2004). *Global poverty monitoring*.
Available at <http://www.worldbank.org/research/povmonitor/index.htm>