CONTRIBUTION OF ON-FARM DIVERSIFICATION TO INCOMES OF SMALLHOLDER
FARMERS IN KONOIN DISTRICT, BOMET COUNTY

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DECLARATION AND APPROVAL
DECLARATION

I declare that this Research Thesis is my original work and has not been submitted in this or any other university for the award of a degree.

Signature ……………………………   Date……………………….

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APPROVAL

This thesis has been presented to the Graduate School for examination with our approval as University supervisors.

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DEDICATION

I dedicate this work to my dad, Mr. J. Biwott and theentire family for all the support and motivation throughout this great achievement.

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ABSTRACT

Farm diversification is considered an optimal farm plan decision for mitigatingvarying degrees of risks and uncertainties which surround agricultural production, and also has a benefit of stabilizing or increasing income. Diversified agriculture is widely practicedin Konoin district but smallholder farmers earn low incomes asevidenced by poor living standards amongst the smallholders. The purpose of the study was to evaluate the role of on-farm diversification in poverty alleviation among the smallholder farmers. To achieve this purpose, the study measured the contribution of on-farm diversification to incomes of smallholder farmers and then characterized smallholder farmers based on diversification.In this study an empirical examination of on-farm diversification was carried out by use of cluster sampling and simple random sampling procedures which were employed to sample 154 small-scale farmers in Konoin District.The herfindahl indexand t-tests were usedto measure the contribution of on-farm diversification to farm incomes and to characterize smallholder farmers based on diversificationwhile the Tobit model was usedto identify the factors influencing on-farm diversification.The study obtained a herfindahl index of 0.39 in a continuum of zero (0) to one (1).Out of all the sampled farms, 30.5 percent of them were found to be highly diversified while 69.5 percent were less diversified. This shows that the smallholder farmers in Konoin District are considered less diversified for purposes of income generation given that the index is lessthan 0.5. On-farm diversification was found to have positive relationship with income given that the highly diversified farms had bigger gross margins than the less diversified farms. Access to the extension services positively influenced farm diversification. Market prices for the farm produce and the distance to the product markets negatively influenced on-farm diversification.

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LIST OF ACRONYMS AND ABBREVIATIONS

AAAE	African Association of Agricultural Economists
AERC	African Economics and Research Consortium
BDSP	Bureti District strategic Plan
CMAAE	Collaborative Master of Science in Agricultural and Applied Economics
DEFRA	Department of Environment, Food and Rural Affairs, London
DMU	Decision Making Unit
FAO	Food Agricultural Organization
RoK	Republic of Kenya
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
KCC	Kenya Cooperative Creameries
KTDA	Kenya Tea Development Agency
LADDER	Livelihood and Diversification Directions Explored by Research
MPT	Modern Portfolio Theory
MTP	Medium Term Plan
SPSS	Statistical Packages for Social Sciences

CHAPTER ONE

INTRODUCTION

1.1 Background

More than half of the human population in developing countries live in rural areas where poverty is most extreme (World Bank, 2008). In Kenya, more than 80% of the citizens live in rural areas where agriculture is their main occupation. In these rural areas, the prevalence of poverty in absolute terms is 49.1% (RoK, 2007). Achieving stable and secure household incomes is generally assumed to be a fundamental step out of poverty and food insecurity (Henriette, 2007). Agriculture sector which employs most of the rural poor contributes over 24% of Kenya's Gross Domestic Product (GDP) thus making it the backbone of the country's economy (RoK, 2007). There is need for ways and measures to help smallholder farmers to achieve sustainable increase in their on-farm income.

While uncertainty and risk to varying degrees surround all forms of activity, Kimenju and Tschirley, (2008) in their study found that it is more of a problem to agricultural production than for industrial production. This is because the sector in general is faced with different types of uncertainties such as; climatic factors, crop or animal diseases, price fluctuations and policies related to agricultural production, marketing and trade. To mitigate such uncertainties, farmers in developed countries use private risk management strategies such as insurance, production and marketing contracts to reduce financial risk and variability in production. According to Mathenge and Tschirley, (2008) the crop and livestock insurance in Kenya and other developing countries is not yet fully developed. This therefore calls for the alternative measures to curb these risks. On-farm diversification may be considered as a spontaneous response to avoid many of these uncertainties (Mahendrarajah, 2005).It involves rural households engaging in multiple agricultural activities within their farms and maintaining such portfolios as a measure to mitigate against risks and increase income (Frank, 2004). Normal recurrent and abnormal periodic risks are most easily weathered by those households which have access to two or more economic activities. According to RoK (2008) theidea ofthe specializing in two or three cash crops per plot is proposed in order for agricultureto contribute to the increase inKenya's GDP by six to eight percent.

Tea farming in areas designated as having potential fortea growing is a major enterprise and a core source of income to residents. A large proportion (60 percent) of tea growers in Kenya have diversified to other farm enterprises including dairy, maize and horticultural crops. Tea was the leading family enterprise among three quarters of all farmers (Mwaura and Ogise, 2007).

Konoin District is endowed with suitable ecological conditions for agriculture and most of the farmers engage in variety of farm activities. However, this was not the case in about 10 to 15 years ago when tea was the only cash crop for most of the farmers. Land sizes have also been declining due to the population pressure and fragmentation as a result of the culture of inheritance (RoK, 2005). The main farm activities in the district are small scale tea farming and small scale dairy farming, and food crop production. Food crops grown include; maize, beans, Irish potatoes and vegetables. Dairy farming is largely for subsistence with excess milk being sold. This surplus of milk is sold to the residents of the nearest trading centres or milk processors such as Kenya Cooperative Creameries (KCC) and Brookside Dairy Limited. The green tea produced by these farmers is sold to Kenya Tea Development Agency (KTDA) which has factories within the district.

1.2 Statement of the problem

On-farm diversification is considered as a mitigation strategy against risks related to agriculture and thereby increases farm incomes (Mahendrarajah, 2005). Although literature has it that farm diversification reduces uncertainties and improve agricultural incomes, the effect of diversification has not been establishedin Konoin district. According to evidence from RoK(2005), thesmallholder farmers in the district are dependent on diversified farmingfor their livelihoods.However, the extent of diversification and the subsequent income generated has not been established. Further, the factors influencing current diversification are not known. The study therefore aimed at filling this knowledge gap.

1.3 Objectives of the study

1.3.1 General objective

The general objective of the study was to evaluate the role of on-farm diversification in poverty alleviation among the smallholder farmers in Konoin District.

1.3.2 Specific objectives

The specific objectives of the study were;

i) To characterize smallholder farmers in Konoin District based on diversification.

ii) To measurethe contribution of on-farm diversification to incomes of smallholder farmers in Konoin District.

iii) To determine the factors influencing on-farm diversification in Konoin District

1.4 Hypotheses of the study

The following were the hypotheses of the study;

i) The agricultural income of the less diversified farms is not significantly different from that of the highly diversified farms; $\overline{GM}_2$ and the highly diversified; $\overline{GM}_1$.

ii) On-farm diversification does not significantly contribute to overall farm income.

iii) The socio-economic characteristics of the highly diversified farmers are not statistically different from the less or non-diversified farmers.

1.5 Justification

A rich related literature suggests that rural households adjust their activities either to exploit new opportunities created by market liberalization or to cope with livelihood risks (Weiyong *et al*., 2010).Motivation for this study came from the idea that having various enterprises within a farm leads to stability in income. This is because returns from different enterprises since returns do not all rise or fall in unison, so that if income falls in one part of the business, this will be offset by rises elsewhere (Mitchell and Marsaili, 2006). Over the past decades, there has been an outstanding trend of activity diversification in rural areas in developing countries. Konoin District is endowed with suitable ecological conditions for agriculture(Mwaura and Ogise, 2007). This therefore implies that on-farm diversification and subsequent commercialization of the same could boost their incomes and food security.The study is therefore necessary to guide the farmers on how to do farming in order to boost their income. This idea is in line with Eradication of extreme poverty and hunger which is one of the most important Millennium Development Goals (MDGs).

1.6 Scope and limitations of the study

The study was confined to Konoin District in Bomet County with the sample drawn from the smallholder tea farmers who own 2.0hectares or less. The fact that the study focused on the level diversification for income expansion by smallholder farmers was the major limitation of the study. This was because it did not look at other constraints which farmers face. The study only targeted one calendaryear (2009).

1.7 Definition of terms

Diversification: On-farm diversification is the practice whereby rural households engage in multiple agricultural activities within their farms and rely on such portfolios for income. Within the context of the study, it refers to undertaking of tea, dairy and food crop enterprises within the farm firm.

Factory catchment area: It refers to the total area with smallholder farmers who aresupplying tea leaves to a particular factory.

Hectare: This is equivalent to2.47 acres of land

On-farm activity: Agricultural practice done within the farm.

Poverty: This refers to a situation whereby a household survives with less than a dollarperday(Henriette, 2007).

Smallholder farmers: Farmers who usually cultivate less thanone hectare of land, which may increase up to 10 hectares in sparsely populatedareas, but less than 2 hectares in densely populated areas with high agricultural potential.(Adeleke *et al*., 2010).

CHAPTER TWO

LITERATURE REVIEW

2.1 Concept of on-farm diversification

This section presents a review of some studies which have been done on on-farm diversification. Diversifying an existing farm business entails incorporation of alternative enterprises (Mitchell and Marsaili, 2006).This entails both animal and crop production within the farm and this is practiced for purposes of increasing income and food availability (Mahendrarajah *et al*., 2005).Because land use change is fundamentally a spatial phenomenon, there should be the incorporation of space as an explanatory variable in land use decision-making (Colin, 2010). A key element in this regard relates to the interdependencies between aggregate patterns of land use and the individual choices that give rise to these patterns, where a given land use conversion is determined by the returns or utility generated by that use at that particular location, and these returns, in turn, are largely determined by the existing spatial distribution of surrounding land uses (Geoghegan and Bockstael, 1996; Colin, 2010). While the linkages between the spatial arrangement of land use and diversification are receiving increased attention within the economics literature on the subject, few existing empirical studies investigate these linkages using individual decision-makers' (DMUs) data.

Diversification is an important way of promoting flexibility and countering risk and uncertainty. Normal recurrent and abnormal periodic risks are most easily weathered by those households which have access to two or more economic activities. Effective management of multiple activities can help smooth seasonal peaks and troughs and it can even promote new peaks. It is therefore, a key dimension of most household livelihood systems since it can help in boosting farm incomes (Martha and Elizabeth, 1996). According to the farm diversification research done by DEFRA (2007), reports on a wide range of issues that can affect both decisions to undertake diversification projects and the future success of those projects were brought up. These include validity of market research, capacity to develop a considered business case, quality of business skills and training, availability of appropriately skilled personnel, and regulatory controls, access to information, availability of specialists' business advice and access to finance. These were identified as the major driving forces boosting diversification.

Since agribusinesses are like others forms of businesses, the factors favouring diversification as brought up by DEFRA, (2007) are worthwhile because suitable environment encompassing finances, expertise, skills and relevant policies are required. Grant funding and schemes such as the small firms loan guarantee schemes are of assistance to many farmers but not all are able to take advantage. Tenant farmers as a group have a range of issues specific to their particular circumstances. They often find accessing capital difficult as they do not have the collateral available to farmers who own their own land. Tenant farmers also can have problems with their tenancy agreements, some of which may not allow particular kinds of, or in some cases any, diversification activity (DEFRA, 2007). Diversification activities which change the use of land to a non-agricultural purpose can also have tax and inheritance implications for the landowner.

2.2 Role of on-farm diversification

Diversification involves a tradeoff between existing and expected profitsand this decision is made easier if spare capacityexists within the business. According to Mitchell and Marsailli (2006) the expected profits must also be weighed against the investments required to establish an alternative enterprise. Previous studies have found that people are willing to reduce risk through diversification even though risk reducing activities lead to lower gross incomes. This section reviews some of the reasons which make the smallholders to opt for on-farm diversification.

While uncertainty and risk to varying degrees surround all forms of activity, it is considered more of a problem to agricultural production than for industrial production due to the influence of climate and other natural factors on the agricultural output and the length of agricultural production cycle (Mahendrarajah and Culas, 2005). The finding further pointed out that the different types of uncertainties that most farmers face emanate from climatic factors, pests and diseases, price uncertainties and policies related to agricultural production, marketing and trade. When making a decision to diversify, a farmer must make a trade-off between existing and expected profits. This decision is made easier if spare capacity in whatever form exists within the business. However, any expected profits must also be weighed against the investments required to establish an alternative enterprise. Previous studies by Mitchell and Marsaili, (2006) have found that diversified farmers tend to be older and have larger farms, indicating that experience and business growth encourages the willingness to diversify. Interestingly, it has also been found that people are willing to reduce risk through diversification even though risk reducing activities lead to lower gross incomes.

Another well documented fact on diversification by Mathenge and Shirley, (2009) is the risk averse nature of most rural decision makers in developing countries because increased use of modern inputs is likely not only to increase the expected returns, but the accompanying risks as well. Further, it has been pointed out that agricultural credit for smallholder farmers is severely lacking in most countries in Sub Saharan Africa making it difficult for poor farmers to finance the inputs typically needed for increased productivity. This difficulty is especially great for food crops which lack institutional arrangements that sometimes relieve credit constraints for cash crops such as tea and coffee and cotton (Carter *et al*., 2004; Mathenge *et al*., 2009).

According to Hardaker *et al*., (2004), most of the farm plans intended to maximize expected returns will often be reasonably diversified before risk aversion is considered. With risk concern aside, the mixtures of activities will typically make best use of resources and subsequently raise income. Diversification can involve a number of things and the type of diversification that best fits a situation depends very much on the nature of poverty issues in that particular region. Maman *et al*., (2008) pointed out that farms tend to be more diversified in the land in which water is relatively available and when income is low. Also diversification positively influences income and food security. This is because many households use diversification to avoid income fluctuation. It is therefore necessary to integrate diversification with market development. This makes sense because farmers in the rural areas are faced with market problems especially the weak bargaining position for their farm produce.

Motivation for diversification comes from the idea that the returns from different enterprises do not all rise or fall in unison, so that if income falls in one part of the business, this will be offset by rises elsewhere. The new merit of diversifying needs to be considered in terms of the perceived multiple risks (financial, legal, personal, price and market) associated with an alternative enterprise, and considered within the whole portfolio of farm activities, (Mitchell and Marsaili, 2006).

Farmers may adopt diversification strategies as a way to reduce the financial risks inherent in their farm business because they (financial risks) increase with higher levels of leverage. One might expect a positive association between leverage and on-farm enterprise diversification(Mishra and El-Osta, 2002).Farmers should attain income levels similar to the industry workers (and others) and the ability to attain the same income level should be based on the assumption of effective labour use and other factors of production, all of which are possible through farm diversification (Mahendrarajah, 2005). Furthermore, Adam, (2010)

pointed out that by diversifying farms into rural enterprises, farmers are likely to grasp a range of benefits which they do not often find in traditional farms. A greater stability in income is achieved by branching out because this will increase the number of sources of revenue to the farm thus ensuring that one is less susceptible to failure by any income source. The annual returns show that tea enterprise enjoys better returns and may have a comparative advantage in Kenyan highlands.

In Sub-Saharan Africa, on-farm diversification has been accentuated by the wave of liberalization that swept the continent starting in the early 1990s, which has driven concerns that heavy reliance on a few crops for cash income can, in an open market economy with widely fluctuating prices, lead to instability in income that threatens rural livelihoods. It is also true that, for many households that produce primarily for their own consumption with small surpluses for sale, diversifying by adding cash crops (cotton, tea, coffee, fresh produce) while continuing to produce for their own consumption can lead to greater incomes; diversification into salaried wage labor and remunerative non-farm businesses 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 sense as a policy goal (Kimenju and Tschirley, 2008). Markets for staple foods develop more slowly than those for cash crops for three reasons. Many households practice tea farming more than any other farm enterprise. This is because 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. Staples in developing country like Kenya 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.

Governments in Sub-Saharan Africa 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 price rises, and 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 (Kimenju and Tschirley, 2008). Successful diversification will often result in a more varied mix of activities—at the regional

level of farm enterprises and the vertical level of economic sectors, including new input markets and emerging processing industries. This will reduce community dependency on a narrow range of outputs and, as a result, will reduce vulnerability to shocks from climatic variability and volatility of commodity prices. One of the most common rationales for diversification of (national or farm) output mix is to reduce environmental (climate shocks), ecological (pest and diseases) and economic risk associated with uncertainty and variations of net (aggregate or farm) income (Shawki *et al.,* 2004).

Diversification encourages farmers to be willing to change and look out for other opportunities. By adding new activities, they will learn what works for them and their farms and thus will be able to make further changes in the future and respond to new opportunities as they arise. The Northern Ireland Business, (2010) also hinted out that running a new venture will provide the opportunity to increase skills and develop business style. This line of thought makes sense because farmers may tend to gain experience on how to practice different enterprises due to repeated venture into various farm activities. Furthermore, the smallholder farmers could find the best combination of farm enterprises which may help them fetch greater revenue.

Farm risk is also managed by being flexible in the short-term and having an ability to maneuver in the long-term. In general farmers will diversify more with increasing degree of risk aversion. Increasingly diversification can be costly if it means forgoing the advantages that specialisation confers through better command of superior technologies and closer attention to the special needs of one particular market (Hardaker *et al*., 2004).A good decision certainly does not guarantee a good outcome. In this risky or real world, the correct or right choice is not known. Most farmers are risk averse and will be willing to forego some expected future income for a reduction in risk. The rate of acceptable trade-off depends on how risk averse that individual farmer is. Evidence of farmers' risk aversion according to Hardaker *et al*., (2004) is portrayed by the scenario in which they buy insurance and adopt on-farm diversification. Farmers as risk averters will not wish to make choices based on what will pay best in the long run if that choice means exposing themselves to unacceptable chance of loss.

Flexibility refers to the ease and economy with which the farming business can adjust to changed circumstances. Hardaker *et al*., (2004) believes that flexible strategy maintains or increases options that help a farmer accommodate risk aversion, manage downside risk and increase expected returns. Greater flexibility implies better possibility to respond to unfavourable events and to benefit from opportunities that crop up (Hardaker *et al*., 2004)

and puts across different types of flexibility which are brought up by diversification; that is asset flexibility which refers to assets with more than one uses such as land, buildings, cash and fodder reserve. There is also product flexibility such as dual purpose sheep: wool and mutton, market flexibility, that is products that can be sold in different markets that may not be subject to the same risks such as domestic versus export market; fresh versus process market, cost flexibility which is the ability toorganise production process to keep fixed cost low in relation to variable costs such as contract workers versus full time workers. There is also time flexibility that isthe speed with which adjustments to the farming operations can be made. Systems with short production cycles are more flexible than those with long cycles.

2.3 Review of models addressing diversification

Farm planning models generally focus on theoretical issues of optimal diversification under uncertainty (Mahendrarajah *et al*., 2005). In their study, an empirical examination of farm diversification was carried out for a sample of farms under the assumptions of pooled (classical), fixed-effects and random-effects regression models. The dependent variable of the empirical model was split into four alternative measures of diversification (indices), and they were defined over farm production (total) income. The micro level explanatory variables which were considered to have influence on-farm diversification are farm organisation (with respect to labour), location, time, access to forestry, farm size, experience of farmer, wealth of farmer, farm labour and agricultural insurance. Farm diversification has, in principle, been considered as a way to spread the different kinds of risk that farmers might confront. In general, farm risk management strategies may incorporate a combination of production, marketing, financial and environmental responses. Mahendrarajah *et al*., (2005)proposed four measures of diversification (indices) which were assumed to incorporate the combination of these responses with respect to the variable farm production (total) income. These indices are; the index of maximum proportion which is defined as the ratio (proportion) of the farm's primary activity to its total activities. Thus, if the farm's activities are ranked from largest to smallest to its total activities, the index of maximum proportion should be the farm's largest activity. Thus, for increasing diversification the index of maximum proportion should decrease.

The second one is number of enterprises index and this is the simplest index in which we count the number of activities the farm operates. If the farm has no any activity, then the number of enterprises index will zero. But, when the farm has nactivities, say $i = 1... n,$ then i (P_i) will assign the value of 1 for each of those n activities and that the number of enterprises

index is *n*.Thus, for increasing diversification number of enterprises index should increase. The weakness of this index is that it gives no weight at all to the distribution of the farm's employment over the activities.

The third one is the Herfindahl index in which by squaring the shares of a farm's activities, gives particular weight to the farm's principal activities. It means that a farm's secondary activities are given only limited weight in calculating the index. This index is insensitive to minor secondary activities. This is desirable since it focuses attention on the major activities of the farm. This index takes the value of one, when a farm is completely specialized in its primary activity, and should approach zero as N gets large. Thus, for increasing diversification Herfindahl index should decrease.

The fourth one is the Entropy index which weighs the shares of a farm's activity by a log term of the inverse of the respective shares. It takes then the value of zero when the farm is completely specialized, and it will approach its maximum when diversification is perfect. Thus, for increasing diversification Entropy index should increase.

2.4 Critique of models addressing diversification

The distribution of the dependent variable is censored at its minimum and maximum limit values, which has to be accounted for by the regression model employed. Due to the censored nature of the dependent variable an ordinary least squares (OLS) regression would yield biased estimates. Tobit model therefore provides a better measure because it accounts for the qualitative difference between limit and non-limit observations and uses the maximumlikelihood (ML) method for parameter estimation. This is desirable since it focuses attention on the major activities of the farm. This index takes the value of one, when a farm is completely specialized in its primary activity, and should approach zero as N gets large. The Entropy index which weighs the shares of a farm's activity by a log term of the inverse of the respective shares gives less weight to larger activities than the Herfindahl index. For this reason therefore, the Herfindahl index has an upper hand over the rest of the indices

2.5 Theoretical Framework

The expected mean-variance (E-V) approach which is an extension of consumertheory underlies this study. Expected utility maximization applies usually to situations in which people can choose between several economic or financial decisions that entail possible monetary gains and risks. In those cases, they are supposed to maximize **t**heir

expected utility (choosing the solution that gives the highest expected utility) taking into account their risk attitude(His ham *et al*., 2002).

Under the assumptions of an E-V approach, an individual's preference ordering depends solely on mean variance of returns (His ham*et al*., 2002).An uncertain prospect can be represented fully by its mean and variance. The decision rule by the farmer is to choose the appropriate mix of enterprises from the unlimited possibilities in order to maximize the utility of income derived from the possible enterprise portfolios. The assumption here is that the farmer's preference function can be described approximately in terms of the mean and the variance of returns. The households choose to adopt certain farm enterprise in combination with other farm enterprises if utility with such an enterprise (U_E) is greater than the utility without (U_{WE}).

Max U_i=f (U_E, U_{WE})... (1)

Subject to resource constraints and

U_E-U_{WE} >0... (2)

Where$U_i$is household *i*utility function, U_E is total utility to the household derived after adoption of certain enterprise to complement other farm enterprises and U_{WE} is the utility from other farm enterprises without the enterprise in question.

The assumption here is that the farmer's preference function can be described, approximately at least, in terms of the mean and the variance of returns. There are several reasons why thisassumption may be valid. One is thatindividuals maximize expected utility, andeither the underlying utility function isapproximately quadratic in income or thedistribution of returns involves only the mean and variance. Hisham *et al*., (2002) also asserted the existence ofa utility function for income U (E, V).

Where;

$$\frac{du}{dv} > 0$$ ………………………………………………… (3)

and

$$\frac{du}{dv} < 0$$ ………………………………………………… (4)

The model therefore is based on the assumption that$U$ (E, V) exists. Now the utility of returns to the farm operator is adirect function of the mean and variance ofthe returns. An extension of this model can be defined so that the choice object, the maximization of utility of an enterpriseportfoliocase.

Chen and Dunn, (1996) in their review of Modern Portfolio Theory (MPT)pointed out that the whole issue of diversification is central to many models of the household portfolio.

They added that it is both a precautionary strategy against possible fluctuations or shortfalls and a response strategy to actual fluctuations or shortfalls. In other words, households diversify to protect themselves against risk and, once risk occurs, to protect them from taking more drastic, less-reversible actions. From the Modern Portfolio Theory (MPT), diversification entails investment in several market instruments with imperfectly correlated returns in order to reduce market risk. Thus in making decisions on the types farm enterprises to invest in, the conceptual model shows that farm households consider how the anticipated returns may be correlated with the chosen portfolio. Mathenge and Tschirley, (2008) pointed out that risk averse households are likely to prefer portfolios with activities whose individual returns are uncorrelated or negatively correlated. They also argue that since diversification does not eliminate all the variance, the optimal portfolio is a trade-off between expected returns and associated risk.

2.6 Conceptual Framework

Household decision making concerning investment, enterprise choice and resource allocation will depend on institutional set up available, farm enterprise factors, technology available, inputs and players in the production and marketing channels. The extent of on-farm diversification adopted by the household will determine the outcome of income earned and this will subsequently impact on the living standards of the household members. The following diagram illustrates the conceptual framework of the study.
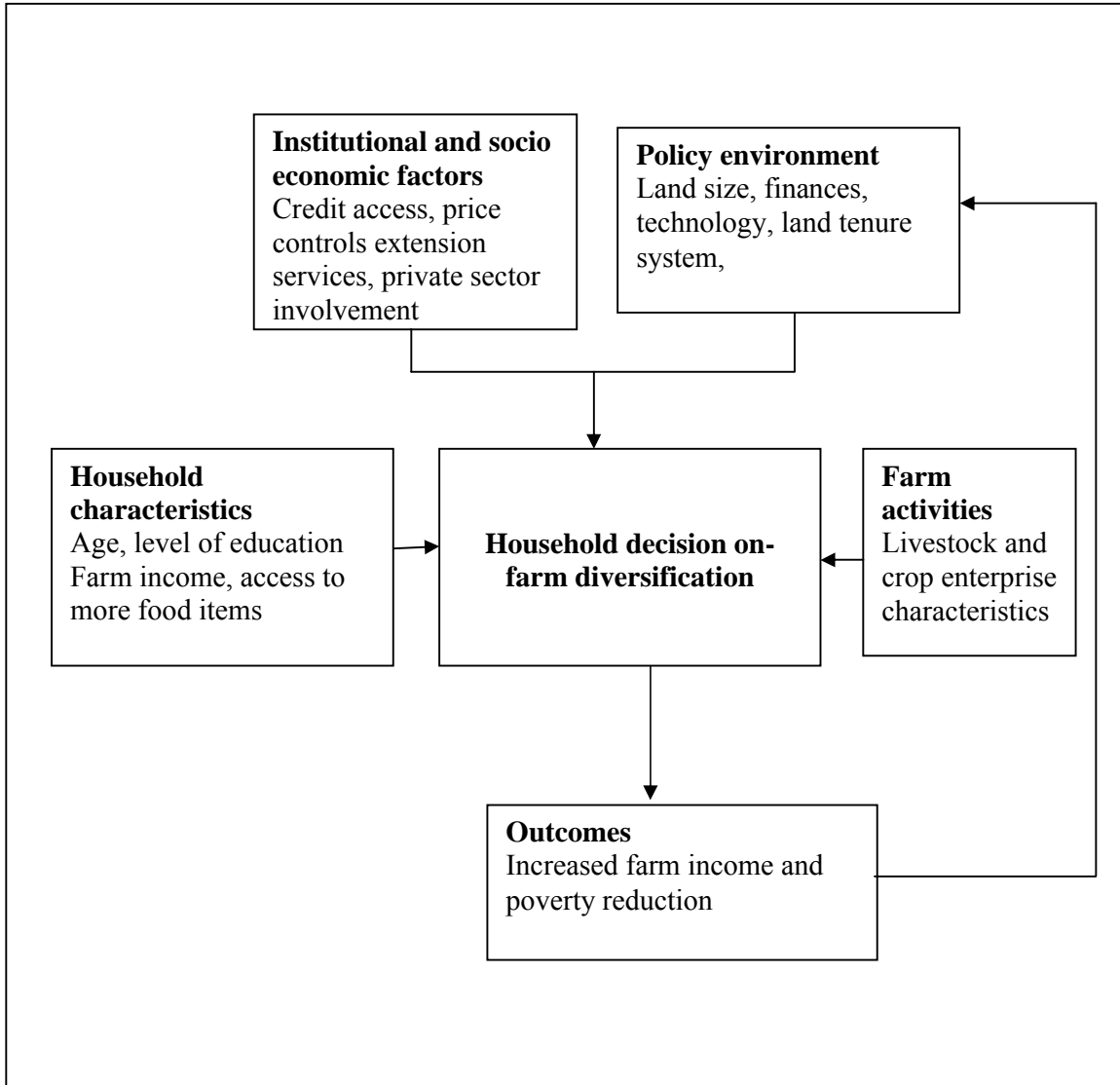
Figure 1: Conceptual framework for household diversification decision making

Source: Author's

CHAPTER THREE

METHODOLOGY

3.1 Study area

The study was done in Konoin District which is one of the districts in Bomet County. The district is bordered by Kericho to the North and Molo District to the North East, Bomet District to the South, Sotik District to the South West and Bureti District to the East. It lies between $0^0 25'$ and $0^0 43'$ South of the equator and between longitude $35^0 05'$ and $35^0 35'$ East. The district covers a total area of 486 kms^2. The District was created in the year 2009. It was curved out from Bureti District. The district is divided into 3 divisions namely Cheptalal, Konoin and Kimulot(RoK, 2005).
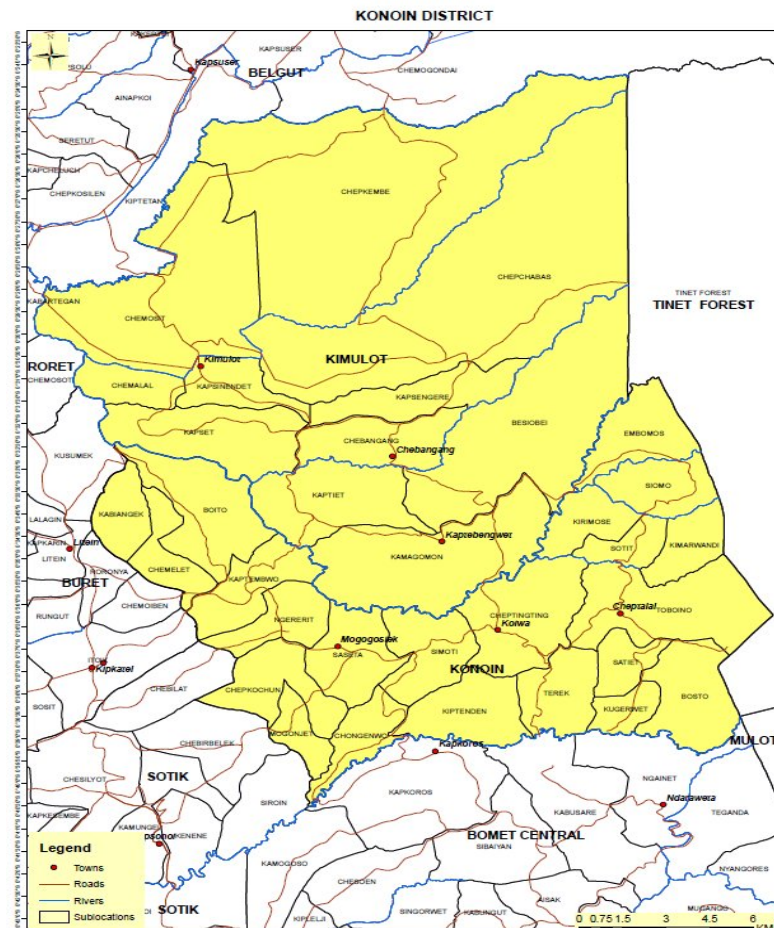
Figure 2: Map of the study area

Source: Ministry of Agriculture; Konoin District (2011)

The district altitude varies from 1800 metres to 3000 metres above the sea level and receives conventional type of rainfall. The district receives bimodal type of rainfall which Ranges between 1,600 and 2,000 millimetres. The first rainfall which ranges from 800millimetres to 1000millimetres startsin the month of Marchand ends in June while the secondrains which ranges between 600 millimetres and 700 millimetres starts in July to February. The mean monthly temperature is 18°C. The coldest months are July and August with monthly temperatures of 17.7°C and 19.9°C respectively. The cool condition favours dairy, tea, maize and pyrethrum farming in the district (MoA, 2011). The climatic conditions of this area are influenced by altitude and physical features (escarpment, forests and mountains). It is one of the districts in the tea growing region in Kenyan highlands. Most of the land is under agriculture due to the suitable ecological conditions and about 60 percent of the farmers are smallholders with less than 5 acres of land.

The major causes of poverty in the district include large families, lack of skills for self-employment or paid employment, landlessness, and the poor infrastructure (characterized by poor road networks) hampering access to markets, lack of affordable credit facilities, and high cost of basic social services (RoK,2005). There are various operational water supplies within the district, such as the Konoin water supply. However there is need to boost the plumbing capacity of the water to increase water supply that will meet the high demand of the local households. The agricultural sector in the district is characterized by availability of agricultural land and favourable weather. The soils are generally deep acidic volcanic loam which favors tea production. The rains favour crop production throughout the year (MoA, 2011). The agricultural sector is the single largest employer in the District. Over 20,000 residences are employed by this sector. Majority of the land is under cash crop (tea) with 35,994 growers' producing 52,122,680 kilograms of green leaf in 2010/2011. The livestock sub-sector is also equally important, producing 39,580,583 litres of milk and over 86,850 kg of beef annually (RoK, 2005).

The revival of the new KCC and entry of Brookside has created a ready market for milk produced in the area. Itisworth mentioning that the entire agricultural sector has been adversely affected by rising cost of inputs and the general inflation that hit the country because of the unstable shilling.

Table 1: Population distribution and density by division

Divisions		1999		2004		2009	
	Area Km^2	Population	Density /Km^2	Population	Density /Km^2)	Population	Density /Km^2)
Konoin	87.3	38,879	419	43,495	468	48762	525
Cheptalal	95.8	26,809	413	30,054	463	33693	519
Kimulot	302.9	44,830	110	50,257	124	56343	139
Total	486	110,518	942	123,806	1055	138798	

Source: Ministry of Agriculture; Konoin District (2011)

3.2 Sampling design

The study followedthe cluster sampling procedure to select the respondents. The first stage involved random selection of one factory catchment area (cluster). The total area with smallholder farmers who are supplying tea leaves to a particular factoryfrom the four factories (clusters) in the district. This was because the characteristics of the smallholder farmers in the district are assumed homogenous. Then second stage employed simplerandom sampling method to select proportionate number of farmers from each of the zones in the factory catchment area. This means that more smallholder farmers were selected from the zones with many smallholder farmers than those from the zones with a few smallholder farmers. A sample of 154 farmers from the population of the smallholder farmers in the district was interviewed. The target population was the small-scale registered tea growers from the register of Kenya Tea Development Agency (KTDA) because they are expected to be engaged on other on-farm enterprises. In the district the smallholders sell their green tea to four K.T.D.A. factories; Kapkatet, Kapset, Mogogosiek, and Litein. The following formula was used to come up with an appropriate sample for the study as per Nassiuma, (2000).

$$n = \frac{NC^2}{c^2 + (N-1)e^2}$$

Where n = sample size, N = Population, C = Coefficient of variation, e = Standard error. C=25% (acceptable according to Nassiuma), e = 0.02 and N=11300 (BDSP, 2005).

$$n = \frac{113000(.25)^2}{(0.25)^2 + (11300-1)(0.02)^2}$$

This resulted to a sample of 154 respondents.

3.3 Data collection

Primary and secondary data was used in the analysis. A semi-structured questionnaire was used to collect cross-sectional data on institutional and socio economic factors such as credit access, price controls, extension services and private sector involvement. The study also considered the household characteristics objectives such as age, level of education, farm income and finally the data on-farm activities, which included the livestock and crop enterprise characteristics. Secondary data was collected from the relevant literature from Ministry of Agriculture and publications.

3.4 Data analysis

Data was analyzed using descriptive statistics with mean taken as a main measure of central tendency. The Herfindahl index was used tomeasure the contribution of on-farm diversification to incomes of smallholder farmers while the Gross Margin Analysis was used to compute the income from the various farm enterprises. The tobit model was used toidentify the factors influencing on-farm diversification in Konoin District. T-tests were used for hypothesis testing while SPSS and STATA software were used to process data.

3.5 Empirical models

There is diverse literature on-farm diversification and some have been selected to form the basis of this study. Mathenge and Tschirley,(2008) used double-hurdle model on their study on off-farm work and farm production decisions and found households in the high potential areas have a higher probability of allocating their off-farm earnings to use hybrid seed compared to their counterparts in the lower potential areas. Agata *et al*., (2009) used Tobit model on diversification of farm households in Germany found that irrespective of a farm's characteristics, income generated in agricultural production has a highly significant influence on the household's decision towards diversification.

Diversification can be measured in a number of ways such as the Herfindahl index and the Entropy index. The Herfindahl index is desirable since it focuses attention on the major activities of the farm. This index takes the value of one when a farm is completely specialized in itsprimary activity and approaches zero as the number of activities increase. TheEntropy index, which weighs the shares of a farm's activity by a log term of the inverse of the respective shares, gives less weight to larger activities than the Herfindahl index. For this reason, the Herfindahl index has an upper hand over the rest of the indices (Clark, 1993; Mahendrarajah *et al*., 2005).They can be examined with respect to farm production depending on information available. Further, depending on limitations of data, measurements

of diversification in production can be examined using variables of area (land area under production), net income (net revenue), and/or total income(production income).Although there are different types of indices to measure diversification, Herfindahl index is quite appropriate for on-farm level measurements because it squares the shares of the farm's enterprises thus giving particular weight to the principal activities(Kimenju and Tschirley, 2008).

3.5.1 Herfindahl index and t-tests

In order to assess the effect of risk between the highly diversified (D_H) and less or non-diversified (D_L) farms, the variability in the gross margins (GMs) were computed. The two groups; D_H and D_L were separated in terms of the index. The index above0.5 is termed as highly diversified while the index below0.5 as less diversified.

The mean GM was computed by dividing the total GMs per hectare from all the farmers and then divided by the total number of sampled farmers.

First, the gross margins (GM) were calculated from the net incomes of agricultural crops and livestock products. GM is defined as revenue net off variable cost.

$$GM_i = R_i - VC_i \quad\text{(5)}$$

Where,

R_i = revenue from thei^{th}activity; while VC_i variable cost from the ith activity.

$$\text{Total GM} = GM_1 + GM_2 + GM_3 + GM_4 + GM_5 + GM_6 \quad\text{(6)}$$

$$GM/ha = \frac{\text{Total GM}}{\text{Number of Ha}} \quad\text{(7)}$$

The individual GM of all the enterprises, sum them and get the proportions (P_i) of each enterprise as percentage of total income from all enterprises, (A_i) as follows:

$$P_i = \frac{A_i}{\sum_{i=0}^{n} A_i}, \text{ denoting the proportion of each enterprise.} \quad\text{(8)}$$

Where;

A_i = total income from enterprise i, and

$\sum A_i$=total farm income;

The Second step involved squaring of the proportions and summing them to obtain *Hd* as indicated below

$$Hd = \sum_{i=1} P_i^2 \text{ (Herfindahl index)} \quad\text{(9)}$$

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By squaring the shares of the farm's enterprises, this index gives particular weight to the principal activities. This index is insensitive to minor secondary activities and this makes it desirable since it puts attention on the major activities on the farm (Mahendrarajah *et al.*, 2002). *Hd* is defined for net income, P_i is the proportion of net income from crop *i*.

$$\overline{GM} = \frac{\sum GM_i}{N} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(10)}$$

T-test was then performed to compare the mean incomes of the highly diversified and less or non-diversified farms.

The null hypothesis assumed that the mean incomes of the two groups were not different while the alternative hypothesis assumed that the mean incomes of the D_L were bigger than the variances of the D_H.

$$H_0: \overline{GM}_1 = \overline{GM}_2 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(11)}$$

$$H_1: \overline{GM}_1 > \overline{GM}_2 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(12)}$$

$\overline{GM}_1$ represented the mean income of the highly diversified farms while $\overline{GM}_2$ represented the average income of the less or non-diversified farms.

Table 2: Description of variables included in the Herfindahl index

Variable	Description	Expected effect
Proptea	proportion of net income from tea farming	> 0.5
Propdary	proportion of net income from dairy farming	<0.5
Propmaiz	proportion of net income from maize farming	<0.5
Propveg	proportion of net income from vegetable farming	<0.5
Propbean	proportion of net income from bean farming	<0.5
Proppoltry	proportion of net income from poultry farming	<0.5

3.5.2 The Tobit model

The Tobit model was used to objective was to determine the factors influencing on-farm diversification in Konoin District. The Tobit Model proposed by James Tobin (1958) is used where dependent variable is limited. It describes the relationship between a non-negative dependent variable y_i and an independent variable (or vector) x_i.

The observations are dropped if $y^* \leq 0$

$$y_i = X_i\beta + \varepsilon_i \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (13)$$

$$y_i = \begin{pmatrix} y^* \ if \ y^* > 0 \\ 0 \ if \ y^* \leq 0 \end{pmatrix} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. \ (14)$$

X_i is the vector of variables explaining the extent of on-farm diversification and u_i refers to the respective error terms to be assumed independent and distributed as $\varepsilon_i \sim N(0, \sigma^2)$. It is well known that use of standard tools such as estimating an ordinary least squares regression

equation on the subsample of individuals above a censoring threshold producesinvalid inferences. Because of this problem, researchers often use the Tobit estimator (Tobin, 1958) with censored dependent variables. A key feature of the Tobit estimator is that it is based on two important pieces of information for each individual: the probability that an individual's score on the dependent variable is above the censoring threshold and the density of the dependent variable given that an individual scores above the censoring threshold. By explicitly incorporating both pieces of information into the likelihood function, the Tobit estimator provides consistent estimates of parameters governing the distribution of a censored normal random outcome variable (Douglas, 2003).

The estimated coefficients in the Tobit model cannot be interpreted in the same way as in a linear regression model but marginal effects have to be considered. To assess the impact of the regressors on the extent of on-farm diversification variable, it is necessary to analyze their marginal effects.

3.6 Model specification

The econometricmodel used to analyze the data was specified as:

PerHd= β_0 + β_1 Hold + β_2 Dage + β_3Edu + β_4Exp +β_5 Off-Inc + β_6Dmkttea+β_7Dmktdary+ β_8Dmktveg+ β_9Dmktmaiz + β_{10}Dmktbean+β_{11}Dmktpoltry+ β_{12}Mprtea+ β_{13}Mprdary + β_{14}Mprveg + β_{15}Mprmaiz + β_{16}Mprbean + β_{17}Mprpolty+β_{18}Ext+ε

The variables are described in Table 3.

Table 3:Description of variables usedin the Tobit model for diversification in Konoin District

Variable Code	Description	Unit of measurement	Expected effect
Dependent variable			
PerHd	Extent of on-farm diversification	Herfindahl index ranging from 0 to 1	(+)
Independent variables			
DAGE	Age of decision maker	Continuous years	(+,-)
EDUC	Formal schooling	Continuous years	(+)
EXP	Experience in farming	Continuous years	(+)
DMKT	Distance to the market	Kilometres	(-)
EXT	Extension access	The number of contacts with extension officers in previous year	(+)
HOLD	Land holding	The size of land owned in hectares	(+)
OFFINC	Off-farm income	Previous year's income from off-farm activities (KES)	(-)
MPR	Market price	Kenya shillings(KES)	(-)

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter outlines the descriptive results on socio economic characteristics and empirical results on the identified variables that influence on-farm diversification. In order to identify the characteristics of smallholder farmers and their activities in Konoin District, a comparison of the highly and the less diversified households was made.

4.2 Characterization of small holder farmers based on diversification

The descriptive statistics presented under this section are socio-economic characteristics of the respondents and their households(age, education level of the household head, farming experience,household size, land sizeand off farm income) andmarketing of farm produce.

4.2.1 Household Characteristics

Among the continuous socioeconomic characteristics, off farm income, household size and size of farm land were found to be significant (Table 4).It was found that the highly diversified farms have an average of 6 members while the less diversified farms have an average of 5 members and the difference in number of members between the two group means is significant at 1 percent. According to Hisham *et al.,* (2002), family size is an indicator of on-farm labour availability and an attribute that affects farm diversification. Larger families may have pressure to create employment opportunities on the farm, and consequently encourage the operator to adopt a land use pattern that utilizes available resources more effectively, including family labor, in an effort to increase income. Land holding in the highly diversified farms is 1.39 hectares while it is 1.02 hectares in the less diversified farms. This was significant at 1 percent level of significance. The off-farm income was higher in the highly diversified farms(KES 8651.06) than in the less diversified farms(KES 6110.00) and this was significant at 10 percent level of significance. This scenario illustrates that farmers often rely on off-farm income sources to boost their on-farm agribusinesses. This corroborates with Mathenge and Tschirley, (2008) who pointed out that in the absence of credit facilities, farm practices especially those requiring capital may be dependent on existing sources of income. Under these circumstances, it is plausible that

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earnings from off the farm may often be used to compensate for the missing and imperfect credit markets by providing ready cash for input purchases as well as other household needs. In addition, off-farm earnings could be used to spread the risk of using modern farm inputs. To the extent that farmers choose traditional over modern inputs in order to lower their risk, any mechanism that allows farmers to smooth consumption will raise the use of modern inputs and increase farm productivity.

The average age of the decision makers in both diversified and less diversified farms is about 42.2 years. The highly diversified are not different from less diversified farmers with respect to age with a P-value of 0.98 showing that there is no significant difference between them in age. Hisham *et al.*, (2002) pointed out that the age of the farm's main operator is a critical factor in on-farm diversification because the farmers tend to accumulate wealth over a lifetime. One would expect older farm operators to be less likely to engage in on-farm diversification since age and wealth are positively correlated. Based on this relationship, it is argued that wealthier farmers are less risk averse and hence less diversified. Hisham *et al.*, (2002) found that the trend of on-farm diversification declines with age of the decision maker. Since the major crop grown by 80 percent of the smallholders is tea, it comes out that tea growing is widely common in the less diversified farms which are mostly owned by the older members of the society. This observation is echoed by Tabitha and Tidsell, (2003) who established that the proportion of land used for subsistence food crops declines with the age of the respondent, as does the output of such crops as a proportion to total output of crops.

The decision makers from the highly diversified farms had more years of formal education of 10.8 years than their counterparts from the less diversified farms of 9.5 years. The t-test results indicate a P-value of 0.591 and this value is insignificant and thus education level does not affect farm decisions. Education and experience play an important role in the level of efficiency and that the effect of schooling should be positive as better educated farmers are expected to have more skills to run their farm more efficiently (Steven *et al.,* 2006). Furthermore, investment in education can be seen as a strategy to improve agricultural productivity, principally through its complementarity with inputs as fertilizers, pesticides, irrigation, high-yielding varieties, and effective research.Steven *et al.,* (2006), further argued that farmers with more years of schooling tend to be less inefficient. This supports the logic behind on-farm diversificationgiven that these results show positive correlation between diversification and farm income.

Results show that the average length of experience of the highly diversified farmers is 10.10 years, while the less diversified farms averaged 12.54 years. However, the t-test results

in Table 4 show a P-value of 0.155 from the analysis of the level of experience between farmers in the highly diversified and the less diversified farms. Therefore, the number of years in farming is insignificant with respect to the decision to farm diversification. Steven*et al*., (2008) established that farming experience comes with age of the farmer. The results indicate that the older farmers in Konoin District practice less farm diversification than the young farmers.

Table 4: Continuous socio-economic characteristics of the highly diversified and the less diversified farmers

Variable	Units	Highly diversified	Less diversified	t-stat
Off-farm income	KES	8651.06(7380.00)	6110.00(6060.00)	1.72*
Household size	Numbers	5.60 (1.50)	4.9 (1.45)	2.86***
DM's age	Years	42.23 (8.14)	42.20 (11.94)	0.02
DM's education	Years	10.8 (6.40)	9.5 (6.07)	0.54
DM's experience	Years	10.11 (6.06)	12.54 (9.97)	-1.55
Land holding	Ha	1.39 (0.53)	1.02 (0.61)	3.85***

* Significant at 10%; ** significant at 5%; *** significant at 1%
The values in brackets are the respective standard deviations

4.2.2 Market characteristics of agricultural produce in Konoin District

According to the results in table 5, the market price for tea and the distance to the market for dairy milk were the only factors found to be significantly affecting marketing of the farm produce in Konoin District. The market prices for dairy milk, vegetables, maize, beans and poultry eggs, and the distance to the market for tea, vegetables, maize, beans and poultry eggs were found be insignificantly affecting marketing.

The market price for tea per kilogram also varied between the highly diversified (KES 39.20) and the less diversified farms (KES 36.70).This shows that there is a significant difference between the highly diversified and the less diversified farms at 5 percent level of significance with respect to the price of tea. This concurs with the results from a study which was conducted by Mwaura and Ogise, (2007) who found that the highly diversified farmers have the ability to access more market information and thus they have market arrangements

with different buyers unlike the less diversified smallholders who basically rely on KTDA to buy their produce. The smallholder tea farmers at times are faced with poor prices as a result of poor supply chain linkages under which KTDA operates. The price shown is a cumulative of the average selling per kilogram of green tea delivered to the tea buying centre and accepted, plus the bonus income disbursed to the farmers at every financial year. The bonuses declared accrue from the profits made by KTDA from trading at the Mombasa auction. More than three quarters of the smallholder farmers deliver their green tea to KTDA. The other tea buyers include Finlays Limited, George Williamson Tea and Unilever Tea Kenya Limited. These companies have contracted a few farmers especially the large scale farmers from Konoin District as out-growers for the supply of green tea.

The distance to the market for dairy milk was found to be longer for the highly diversified farms (1.0921 kilometres) than for the less diversified farms (0.865 kilometres) and was significant at 10 percent level of significance. The positive t-value of 1.67 implies that an increase in the distance to the market of dairy milk leads to increased diversification majorly because farmers prefer short distances so as to save on cost of transport and also to avoid the aspect of milk spoilage. The transport cost increases with distance thus making farmers opt for enterprises with shorter distances to the market (Mahendrarajah *et al*., 2005).The source of the market for dairy milk was the Brookside company

According to RoK, (2010), there is need to improve market access for smallholders through better supply chain management. Divest from all state corporations handling production, processing and marketing that can be better done by the private sector. Competition from the private firms is expected to streamline the market distance problems faced by the smallholder farmers in Konoin District. Furthermore, Alila and Atieno, (2006) found that for livestock marketing, limited cattle holding grounds and meddling with stock-routes has limited access to markets. Promoting marketing of agricultural produce will require that the livestock markets be developed; the private sector be encouraged to invest in cold storage; local authorities in collaboration with the private sector invest in storage facilities; the government provides all-weather rural access roads, improve communication facilities and market information systems among others, will lead to agricultural growth.Sylvie *et al., (*2010) has it that uneven development process has made the price risks to become a prominent risk for agricultural households.

Table 5: Continuous socio-economic characteristics of the highly diversifiedand the less diversified farmers in Konoin District

Variable	Units	Highly diversified	Less diversified	t-stat
market price for tea	KES	39.2 (6.39)	36.7 (6.51)	-2.07**
market price for dairy milk	KES	28.3 (3.08)	28.8 (6.69)	-0.53
market price for vegetables	KES	1308.70 (680.85)	870.0 (610.49)	-1.93
market price for maize	KES	1402.80 (425.89)	1491.30 (393.84)	-0.97
market price for beans	KES	4347.60 (994.29)	4740.00 (1079.30)	-1.00
market price for eggs	KES	10.00 (0.98)	10.2 (0.66)	-0.80
Distance to market for tea	Kms	3.59 (1.91)	3.57 (2.26)	0.06
Distance to market for dairy milk	Kms	1.09 (0.77)	0.87 (0.80)	1.67*
Distance to market for vegetables	Kms	1.18 (0.89)	0.83 (0.80)	2.34
Distance to market for maize	Kms	0.93 (0.86)	0.92 (0.91)	0.05
distance to market for beans	Kms	1.64 (1.20)	1.54 (1.40)	0.45
Distance to market for eggs	Kms	2.22 (2.99)	2.76 (5.15)	0.82

* Significant at 10%; ** significant at 5%; ***

 The values in brackets are the respective standard deviations while KES refers to Kenya Shillings and Kms refers to kilometres.

4.2.3 Characteristics of Household incomes

Table 6 shows that the farmers in Konoin District derive most of their income from farming. The mean monthly income is KES 8962.04 for the highly diversified farms, and KES 7046.20for the less or non-diversified farms. The results also show that the highly diversified smallholder farmers in Konoin District generate an average of KES 8651.06 per month from off farm activities while the less diversified farmers earn an average of KES 6106.65 per month. Furthermore, the highly diversified farmers received larger sums from remittances than the less diversified farmers, that is, KES 7350.00 for the highly diversified farmers and KES 1042.00 for the less diversified farmers. This shows that on-farm income, off farm income and remittances all contribute to total income. However remittances and off-farm incomes do not contribute as much as farming which is the major source of livelihood.

The results inTable 6 indicate thatthe average off-farm incomes from the highly diversified are significantly higher than those from the less diversified farms. This shows that off-farm income is significant at 10 percent level of significance and thus it is a factor promoting on-farm diversification. The finding corroborateswiththe results from the study done by Mathenge and Tshirley,(2008) who found that households with high incomes from off-farm activities are likely to have a stronger orientation towards them and a greater level of knowledge useful in such activities.Likewise, those with high cash income from agriculture are likely to have a stronger orientation towards agriculture and to have developed greater capacity for it as a result. Indeed, a household's agricultural cash income may reflect the overall strategy and orientation towards cash crops and production for the market in general.

Table 6: Sources of income in Konoin District

Monthly income (KES)	Farm income			off farm income			Remittances		
	H. Div	L.Div	t-test	H. Div	L.Div	t-test	H.Div	L. Div	t-test
	%	%		%	%		%	%	
Below 10000	74.47	76.64	0.35	59.57	77.57	0.22	100.00	100.00	0.19
10001-20000	17.02	15.89	0.43	34.04	21.50	0.21	0.00	0.00	0.24
20001-30000	2.13	7.48	0.74	6.38	0.93	0.42	0.00	0.00	0.13
30001-40000	6.38	0.00	0.68	6.38	0.00	0.30	0.00	0.00	0.56
Total	100.00	100.00		100.00	100.00		100.00	100.00	
Mean income	8962.04	7046.20	0.21	8651.06	6110.00	0.09*	7350.00	1040.00	0.44
Standard deviation	8550.00	6960.00		7380.00	6060.00		7210.00	1030.00	

* Significant at 10 percent

Where H. Div refers to the highly diversified farms while L. Div refers to less diversified farms.

4.2.4 Enterpriseallocation by small holder farmers

The district is characterized by fertile soil and good ecological conditions for a wide range of agricultural activities. Being in a tea growing region, the majority of farmers are deeply engaged in its production and sale for income (BDSP, 2005). The discussion below shows the results of land allocation to various farm enterprises, farm output, market outlets and prices, and the gross margins from the agribusinesses

Diversified smallholder farmers display a number of enterprises, the major one being tea farming. The other farm enterprises which are dominant are dairy farming, vegetable farming, maize farming, bean farming and poultry farming. Figure 3 shows the percent of farm size occupied by the enterprises and their percent contribution to gross margins.Tea takes an average of 57.2% of the farm while dairy farming takes 20.7%. The remaining food crops share the remaining portion with each enterprise taking less than 10 percent. The combined contribution of other enterprises apart from tea is also substantial at about 44 percent of gross margins indicating that the raising of other enterprises provides well

diversified sources of farm income. Wasswa *et al.*, (2006) highlighted that higher income would be realized by reallocating resources to better paying enterprises.

According to Hisham *et al.*, (2002), farming is a risky business and enterprise diversification is a risk management strategy an individual farmer can use to reduce the adverse impact of wide fluctuations in yields and/or prices of specific commodities, whether due to natural causes such as weather or the impact of uncertainties derived from business cycles, wars, or other factors. Besides its risk-reduction benefits, diversification provides an opportunity to exploit the potential complementary and/or supplementary relationships between enterprises through improved utilization of the natural resources of the farm and available operator and familylabour and management skills over the entire year.In addition, enterprise diversification may be advantageous when local demand exists for specific products.

Tabitha and Tidsell, (2003), concluded that farmers with better quality land allocate a high proportion of it to non-food cash crops, which may expose some households to greater risks of possible famine. The proportion of land allocated to food crops declines as the farm size increases while the proportion of land allocated to non-food cash crops rises as the size of farm increases. This is evident in Konoin District because the study has established that despite majority of the smallholders owning less than 5 acres of land, more than half of the available farm land is allocated to tea which is highly valued in the region. According to figure 3, the proportion allocated to dairy enterprise follows that of tea given that it generates more farm income than vegetables, maize, beans and poultry enterprises.
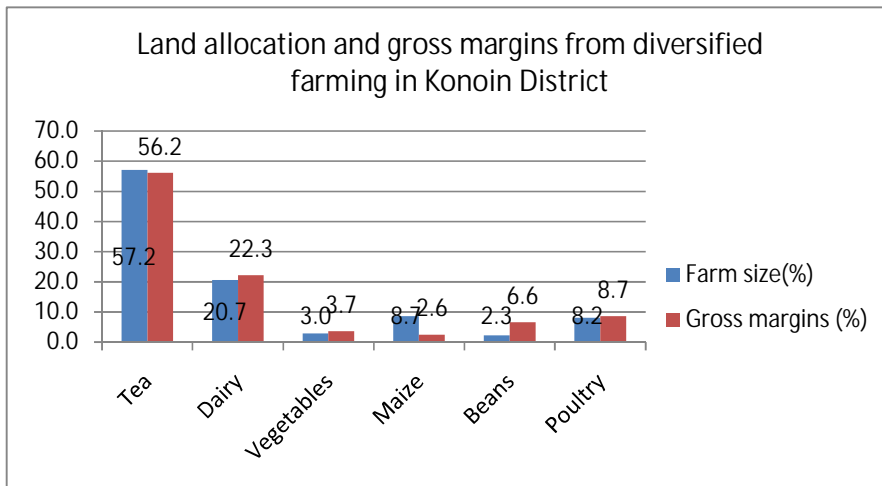
Figure 3: Land allocation and gross margins from diversified farming in Konoin District

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4.2.5 Cash versus subsistence farming in Konoin District

The diversified enterprises show interesting patterns as regards sale and retention. The enterprises showing 100 percent marketing are tea and poultry. The enterprises that suffer the greatest amount of retention are maize and beans while dairy and vegetables exhibit a high percentage of sale (Figure 4).Although dairy milk was produced by 60.4 percent of farmers, only 48.1 percent were engaged in farm sales while more the 50 percent retained their output. Maize farming recorded the biggest disparity between production and sales. Although 51.9 percent of farmers produced maize, only 11 percent sold their maize. This shows the reliance on maize as a common staple food in Konoin District. This scenario is supported by Mathenge and Tschirley, (2008) who highlighted that maize is far and away the main staple food in the country and it is majorly grown for subsistence purposes.

It is apparent that diversification is not based on economic considerations, but the overriding factor is occasioned by food security concerns which necessitate a sizeable portion of available land to be allocated to low-value subsistence crops whose productivity is also low, to cater for household food security needs (Wasswa *et al.,* 2006). Upton, (2000), found that the bulk of the food, of both plant and animal origin, consumed in developing countries is supplied by small-scale, semi-subsistence, producer-households. The majority are small-holder mixed farmers, producing both crops and livestock. Further Upton, (2000) argued that agricultural expansion is an essential component of the development process, not only to feed the growing population but also because most of the people in developing countries make their living from the land. Improvements in agricultural productivity contribute to the alleviation of rural poverty. Despite the high rates of rural-urban migration and urban population growth, the number of people engaged in agriculture is still rising in developing countries, while the scope for further expansion of the area under cultivation is limited.
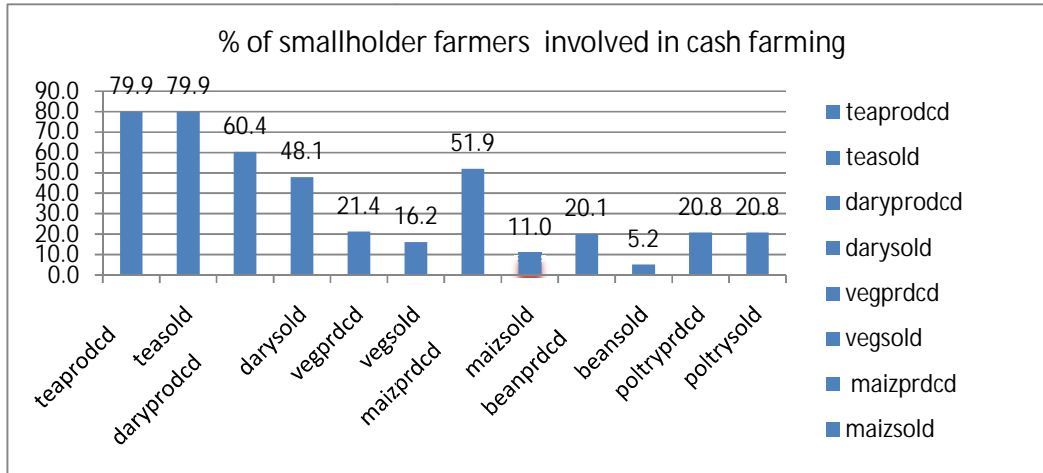
Figure 4: Cash versus subsistence farming in Konoin District

4.3 The contribution of enterprise diversification to farm incomes

The results presented in Table 7 show the proportions of farm income from different enterprises. All the resultant proportions were significant at 1 percent level of significance. Tea contributed the highest proportion (57 percent) to the total farm income followed by dairy enterprise (21 percent), vegetable enterprise (9 percent), poultry enterprise (8 percent) and bean farming (2 percent). Despite diversifying from tea farming, tea is still the major crop which generates high income. According to Mwaura and Ogise, (2007) a large proportion (60 percent) of tea growers in Kenya have diversified to other farm enterprises including dairy, maize and horticultural crops but tea is the leading family enterprise among three quarters of all farmers in Kenyan Highlands. Smallholder farming in Konoin District is diversified to a degree of 0.39 according to Herfindahl index with tea allocated the biggest share of the farm land. This implies that the level of on-farm diversification in the district is categorized as less diversified since it falls below 0.5 value in the continuum of zero (0) to one (1).

Table 7: Proportion of farm enterprise incomes

Variable	Description	Resultant proportions	Sig 2-tailed test
Proptea	proportion of net income from tea farming	0.57 (0.36)	0.00***
propdary	proportion of net income from dairy farming	0.21 (0.27)	0.00***
propmaiz	proportion of net income from vegetable farming	0.03 (0.09)	0.00***
propveg	proportion of net income from maize farming	0.09 (0.21)	0.00***
propbean	proportion of net income from bean farming	0.02 (0.08)	0.00***
proppoltry	proportion of net income from poultry farming	0.08 (0.21)	0.00***
Hd	Herfindahl index	0.39 (0.24)	0.00***

*** significant at 1%

The values in brackets are the respective standard deviations

4.4 Characteristics of farmers based on the level of diversification

From the study, it was found that the highly diversified farms had bigger gross margins than the less diversified farms from all the enterprises apart from tea.The significant variability in gross margins was found to exist between the highly diversified and less diversified farms with respect to tea, vegetable and maize farming. This finding is in line with the results from the study done by Kavoi et al., (2002) who found that tea farming becomes uneconomical at farm sizes of less than 0.10 hectares. The fact that the less diversified farmers in Konoin District earn more income from tea than the less diversified farmers implies that the issue of land fragmentation is yet to deny farmers of the benefits accruing in the tea sector.According to the results in table 8,the highly diversified farms were found to havea higher average grossmargin of KES201602.20than the less diversified farms with an average of KES 176711.90. This shows that diversification promotes generation of income and this corroborates with a study which was done by Maman *et al*., (2008) who found that besides minimizing income fluctuations, farm diversification has a potential to generate income. Despite this, the highly diversified farms arefewer than the less diversified farms. Out of all the sampledfarms it was only 30.5 percent of them which were highly diversified while 69.5 percent were less diversified.

The Levene's test was greater than 0.05 (0.163>0.05) hence the results that assume equal variances for both groups were used in the analysis. A significance value of 0.045 (less than 0.05) indicates that there is significant difference between the two group means. A value less than 0.05 means that the variability in the highly diversified and the less diversified farms is not the same. This means that the variability in the two conditions is significantly different. In a poor area, agricultural households may prefer to stick to traditional crops for which risks are known, even though expected returns associated with alternative activities are higher and a more diversified portfolio of activities would certainly reduce the expected hazard of total income (Sylvie *et al.,* 2010). Furthermore, Hisham *et al.,* (2002) pointed out that corporate farms tend to be more specialized than the smallholder farms. They also found that increased farm diversification places greater demands on management and coordination skills, improved managerial skills, education, and training better prepare the farm operator to run a farm which is more diversified.

Table 8: Independent t-test for variances in incomes of the highly and less diversified Farms

Independent Samples test				
Farm enterprise GM	Highly diversified	Less diversified	Levene's test (sig)	Significance t-test (2-tailed)
Tea	61672.77	117215.55	0.097	0.034**
Dairy	49496.89	37029.18	0.167	0.357
Vegetable	22710.22	1279.26	0.004	0.027**
Maize	10130.67	3672.71	0.526	0.006**
Poultry	19475.21	15299.89	0.655	0.721
Bean	38116.44	2215.32	0.002	0.259
Total	201602.20	176711.90	0.163	0.045**

** significant at 0.05 percent

4.5 Factors affecting farmers' decision to diversify smallholder farming

The likelihood ratio chi-square of 202.49(20 degrees of freedom) with a p-value of 0.000 explains that Tobit model as a whole fits well to the study. The Tobit results in Table 9show that the market prices of farm produce except the market price for beans significantly affect the decision to diversify.

The market price for tea had a coefficient of 0.013and a P-value of 0.016 which is significant at 5 percent. This illustrates that a one unit increase in the market price of tea, results to a 0.013decrease in on-farm diversification. This is because higher tea prices will result to farmers specializing in tea production.

The market price for dairy milk had a coefficient of 0.032and a P-value of 0.000 which is significant at 1 percent level of significance. This indicates that for one unit increase in the price of milk, there is a 0.032 point decrease in on-farm diversificationbecause higher milk prices will result to farmers specializing in milk production and likely disregard of other enterprises . Furthermore, the study established that the market price for vegetables had a coefficient of 0.007and a P-value of 0.000 which is significant at 1 percent level of significance. This illustrates that for one unit increase in the price of vegetables, there is a 0.007point decrease in on-farm diversification because higher vegetable prices will result to farmers specializing in vegetable production. The research also established that the market price for maize had a coefficient of 0.007and a P-value of 0.000 which is significant at 1 percent level of significance. This illustrates that for one unit increase in the price of maize, there is a 0.007point decrease in on-farm diversification because higher maize prices will result to farmers specializing in vegetable production.The market price for poultry eggs had a coefficient of 0.026and a P-value of 0.016 which is significant at 1 percent level of significance. This illustrates that for one unit increase in the price of poultry eggs, there is a 0.016 point decrease in on-farm diversification because higher poultry eggs' prices will result to farmers specializing in poultry production. The coefficients of prices of all the produce are negatively related to on-farm diversification as shown in Table 8. This implies that a fall in price of a certain farm produce leads to diversification into other farm enterprises with an aim of mitigating risk in income decline. Diversification is the term used to reflect traits of farm adjustment. It is construed as a means of leading farmers out of pressures on income and profitability due to increased competition and decreases in commodity prices. Furthermore, farmers have little or no control over prices they get for the commodities they produce, (Abayomi and Fadeyibi, 2009).

The results also show that the distance to the market for dairy milk has a positive coefficient of 1.826 and a P-value of 0.010 which is significant at 5 percent level of significance. This indicates that for a one unit increase in the distance to the market for dairy milk, there is a 1.826 point increase in the predicted value of on-farm diversification because farmers will prefer shifting to other enterprises than to incur increased transport charges. Concentrating on agriculture exposes farmers to risk because a sector in the agribusiness

industry stagnates or becomes competitively unprofitable, farmers' prospects dim, maintaining a livelihood is harder to achieve, and survival becomes a concern. For this reason, farmers turn to diversification to survive the combined effect of high costs and low commodity prices by adopting different enterprises so as to reduce their farm household dependence on specific crop facing market price decline (Abayomi and Fadeyibi, 2009).

The results also show that the number of extension visits has a positive coefficient of 2.591 and a P-value of 0.010 which is significant at 5 percent level of significance. This implies that for a one unit increase in the number of extension visits, there is a 2.591 point increase in the predicted value of on-farm diversification.This is in line with the guidelines from FAO, (2010) that agricultural extension services should also be reoriented to target the smallest farmers. According to Muyanga and Jayne, (2006) the private extension provision is generally skewed towards well-endowed regions and high-value crops. Remote areas and poor producers especially those growing low-value crops with little marketable surplus are poorly served. The government should therefore consider contracting the private sector to offer extension services in the disadvantaged regions. Contracting out extension services makes it possible to take advantage of all of the talent and experience existing in the field but does not eliminate a government role which, in addition to funding, ensures quality assurance, oversight, and provision of training and information to contracted services providers. It has also been noted that even where technologies are relevant and available,smallholder farmers sometimes have no access to them (Fliegel, 2001). Agricultural technologies are also rapidly changing. Farmers need to be made aware of what technologies work best, know how to use them, and generate effective demand for viable new technologies to provide signals to input distribution system to supply them. (Davidson*etal.,* 2001). Their studies concur with our results with respect to extension services and it can therefore be concluded that these services should be enhanced in order for the farmers to be trained in how to manage their scarce resources.

Table 9: Tobit regression results for factors affecting on-farm diversification

Variable	Coef	Std.err	T	P>|t|
primary occupation of the decision maker	0.009	0.012	0.75	0.453
Gender of the household head	0.184	2.178	0.08	0.933
Education level of the decision maker	-0.002	0.005	-0.48	0.63
Off farm income	0.000	0.000	0.15	0.88
Land size	-1.300	1.241	-1.05	0.297
Market price for tea	-0.013	0.005	-2.45	0.016**
Market price for dairy milk	-0.032	0.004	-7.86	0.000***
Market price for vegetables	-0.007	0.002	-4.22	0.000***
Market price for maize	-0.007	0.001	-5.26	0.000***
Market price for beans	-0.001	0.001	-1.13	0.261
Market price for eggs	-0.026	0.004	-6.33	0.000***
Distance to the market for tea	0.350	0.296	1.18	0.24
Distance to the market for milk	1.826	-1.827	-2.62	0.010**
Distance to the market for vegetables	-0.334	0.638	-0.53	0.596
Distance to the market for maize	0.867	0.713	1.22	0.226
Distance to the market for beans	-0.371	0.570	-0.65	0.516
Distance to the market for eggs	0.461	0.470	0.98	0.328
Extension visits	2.594	1.169	2.22	0.028**
Experience of the decision maker	0.215	0.225	0.96	0.34
Decision makers age	-0.080	0.192	-0.42	0.676
Cons	49.598	8.230	6.03	0.000***
Sigma	14.809	1.022		

Number of observations = 154

LR chi2 (20) = 202.49

Prob> chi2 = 0.000

Log likelihood = -493.066

Pseudo R2 = 0.1704

* Significant at 10%; ** significant at 5%; *** significant at 1%

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

From the study, it was concluded that the combined gross margin contribution from other enterprises apart from tea in Konoin District was 44 percent which indicates that practicing of other enterprises provides well diversified sources of farm income. Tea farming is highly practiced . Despite the result that the highly diversified farmers were found to earn more total farm income than less diversified farmers, tea farming proved otherwise. The less diversified tea farmers earn more income from tea than the highly diversified tea farmers. This shows that as the size of land becomes smaller, the margin between revenue generated and the cost of production narrows thus resulting in low income. It was established that the dairy, vegetable and poultry enterprises generate more farm income than tea farming as the land fragmentation from the highly diversified farms were found to be significantly higher than those from the less diversified farms. Low incomes from the commercialized farming and the small farm sizes under food production have brought uncertainties or fears among the farmers and this affects their decision making. From the study, it was concluded that the there is a negative correlation between the unit prices of agricultural produce and on-farm diversification. A decline in the price of agricultural produce tends to force the smallholders to diversify to other enterprises which are believed to have more stable prices. This decision is made with the need of generating higher and stable farm incomes in order to sustain family needs.

5.2 Recommendations and suggestions for further research

In order to further this study and hence give more advise to the policy makers, there is need for a study on the economic standards over time with respect to the less diversified and the highly diversified smallholder farmers. Time series data needs to be collected and analyzed in order to provide a clear understanding on the impacts of diversification with time. In order to advise farmers on the issue of economic land units for tea farming, more studies need to be done on the same in order to come up with the current standards given that population pressure is pushing land fragmentation to strenuous levels. The fact that the less

diversified farmers in the district earn more income from tea than the less diversified farmers implies that the issue of land fragmentation is setting. Farmers need to be enlightened on the diseconomies of land fragmentation in order to reverse the vice.

Further research study should also be done to find out how households diversify their labour to work in different sectors whether on-farm or off-farm. The recommended study on labour allocation will therefore supplement our research on how land is allocated into different enterprises in order to cope with shocks related to agribusiness. It will therefore help to boost the knowhow on allocation of factors of production within the farm in order to cope with risks and uncertainties. The government should boost extension services in order to boost agricultural performance. At present, these services have little impact on input use and land management practices. Training content, technology focus and dissemination practices should be reassessed and modified to increase their effectiveness.

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APPENDICES

Appendix1: Socio-economic and institutional characteristics of household heads

Variable		Highly diversified (%)	Less diversified (%)	Total	Chi-Square	Sig (2-tailed)
Gender of the decision maker	Male	27.9	62.3	90.3		
	Female	2.6	7.1	9.7	0.116	0.733
Occupation of the decision maker	Business	8.4	11.7	20.1		
	Employed	11.7	20.1	31.8		
	Farmer	10.4	36.4	46.8		
	Student	0	1.3	1.3	6.014	0.111
Accessed to credit	No	22.7	50	72.7		
	Yes	7.8	19.5	27.3	0.1034	0.748
Access to farmers training	No	19.5	47.4	66.9		
	Yes	11	22.1	33.1	0.2847	0.594
Access to extension	No	16.9	45.5	62.4		
	Yes	13.6	24	37.6	1.4193	0.234

Appendix 1: Questionnaire for the study on on-farm diversification of farm enterprises in Konoin District

Introduction

Although farm diversification has been documented to reduce uncertainties and improve agricultural incomes, this has not been evidenced in Bureti district where smallholder farmers have been engaging in diversified farming for over a decade and yet they still earn low incomes and are unable to meet most of their household needs, resulting in low living standards. The reasons leading to this scenario have not been understood and this study intends to fill this knowledge gap.

NB: The results of this questionnaire will be used for research purposes only. This information will be treated confidentially and the analysis of the data will ensure the anonymity of the individual cases.

Questionnaire No: _____

Name of the enumerator……………………………………………………

Date of interview……………………………………………………….

SECTION A: DEMOGRAPHIC CHARACTERISTICS

1. Respondent's name……………………………………………………

2. Respondent's sex

    Male ☐   Female ☐

3. Age of the decision maker (in years)………………………..

4. Respondent's relation to the household head (tick where appropriate)

    Head ☐   Spouse ☐   Child ☐   Worker ☐

    Other (specify)………………………..

5. Who makes the decisions on-farm activities to be practiced?

    Head ☐   Spouse ☐   Child ☐   Worker ☐

    Other (specify)………………………..

6. What is the primary occupation of the household decision maker?

    Businessman / businesswoman ☐ Employed ☐ Farmer ☐ Student ☐

Other (specify)……………………………….

7. How many years has the decision maker been in farming?_____

8. Gender of the decision maker (tick where appropriate)

    Male ☐   Female ☐

9. Years of schooling of the decision maker (years)………………………

10. Household characteristics (people living together for the last 12 months)

Code	Name	Gender 1=Male 2=Female	Education level 1=None 2=Primary 3=Secondary 4=Tertiary	Relation to the head 1=Head 2=Spouse 3=Child 4=Parent 5=Worker 6=Other
1				
2				
3				
4				
5				
6				
7				

11. Income profile (fill in the table below)

Source of income	Amount in KES per month
Farm income	
Nonfarm income	
Remittances	
Others	

SECTION B: ON-FARM DIVERSIFICATION

12. What is the size of your landholding (in acres)?

13. What is the size of your land under farming (in acres)?

14. Farm profile (provide information to fill the table below)

Code	Type of farm activity	Portion of the farm under the activity (in acres)
1	Tea	
2	Dairy	
3	Main vegetables (indicate the crop)	
4	Maize	
5	Beans	
6	Poultry	

SECTION C: COST OF PRODUCTION

15 (a). Tea

Input	Quantity	Unit	Cost per unit	Total cost

(b). Dairy

Input	Quantity	Unit	Cost per unit	Total cost

(c).Main vegetables (indicate the crop)

Material	Quantity	Unit	Cost per unit	Total cost

(d). Maize

Material	Quantity	Unit	Cost per unit	Total cost

(e).Beans

Material	Quantity	Unit	Cost per unit	Total cost

(f). Poultry

Material	Quantity	Unit	Cost per unit	Total cost

16. SECTION D: INCOME PER ENTERPRISE (FOR THE PREVIOUS YEAR)

Quantity produced	Quantity sold	Price per unit (KES)	Total (KES)
(a). Tea			
(b). Dairy			
(c).Main vegetables (indicate the crop)			
(d). Maize			
(e).Beans			
(f). Poultry			

SECTION E: INSTITUTIONAL SUPPORT

17. Please indicate the condition of the road in the region

Road conditions (Distance to the source of input)

	Distance for all weather road portion (Kms)	Distance for tarmacked portion (Kms)
Tea		
Dairy		
Main vegetables (indicate the crop)		
Maize		
Beans		
Poultry		

Road conditions(Distance to the market outlet)

	Distance for all weather road portion(Kms)	Distance for tarmacked portion(Kms)
Tea		
Dairy		
Main vegetables (indicate the crop)		
Maize		
Beans		
Poultry		

18 (a). Did you receive extension services last year?

Yes ☐   No ☐

18 (b). If yes, fill in the table below.

Extension services offered (see codes below)	Extension provider (see codes below)	Number of contact times in 2010	Did you pay for the services? 1=YES 0=NO	Cost per each visit

Extension service codes: 1=crop production(specify the crop) 2=Dairy production

Extension service provider: 1 =Government worker 2=Private extension provider 3= NGOs 4=other farmer 5=other (specify)

19. Did any household member attend farmers' training last year?

Yes [ ]   No [ ]

19 (a). If yes, how many times during the year? [ ]

19 (b). What was the training about?

    Farm management (FAM)   [ ]
    Entrepreneurship (ENTRE)   [ ]
    Production technology (TECH)   [ ]
Others specify (ETC.)   [ ]

19 (c). How else do you get information on-farm diversification and market for output?

Radio [ ]   Newspapers [ ]

Neighbors [ ]   Other [ ] (specify) _____

SECTION F: SOURCES OF CAPITAL

20. What are sources of capital used to run on-farm diversification?

Savings ☐ Loans ☐ Salary /wages from off farm employment ☐

Other ☐ (specify) _____

21 (a). Did the household try to access credit last year?

Yes ☐   No ☐

21 (b). If yes, fill in the table below

Source of credit	Granted 1=Yes 0=No	Type of Credit 1=Money 2=in kind	Amount requested (KES)	Purpose	Repayment period	Interest rate	Give reason if not granted

Source codes: 1= Commercial bank 2=AFC 3= input store 4= local money lender 5=other (specify)

Purpose codes: 1=Capital for off farm business 2= farm inputs (specify) 3= household consumption 4= medication 5= other (specify)

Not granted: 1= lack of security 2= outstanding loan 3= other (specify)

Repayment periods code: 1= weekly 2= monthly 3= quarterly 4= semiannually 5= annually 6= other (specify