SOCIO-ECONOMIC FACTORS INFLUENCING SMALLHOLDER MAIZE PRODUCTION IN TOBACCO GROWING ZONES OF MIGORI COUNTY, KENYA

DAPHEN OTIENO OJALA
B.ED (ARTS)

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DECLARATION

Declaration by the Candidate

This thesis is my original work and has not been presented for examination to any other university. No part of this work should be reproduced manually, electronically, or otherwise without my prior consent and/ or Moi University.

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DAPHEN OTIENO OJALA **DATE**

SBE/PGE/002/010

Declaration by the Supervisors

This thesis has been submitted with our approval as the University Supervisors.

…… ……..……..…….

PROF PHILIP M. NYANGWESO **DATE**

School of Business and Economics

Moi University

..... …….…….....

MR JOHN S. MUDAKI **DATE**

School of Business and Economics

Moi University

DEDICATION

To my family

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ABSTRACT

Maize is the main staple food crop in Kenya and is of vital concern to agricultural policy decisions, food security and overall development of the sector and the economy. It is also the dominant staple food crop in Migori County. However, there has been a declining trend in maize production among farmers in Migori County, a tobacco growing zone, threatening household and national food security. This study examined socio economic constraints to smallholder maize production in Tobacco growing regions of Migori County. Specific objectives were; first, to examine how economic factors such as area under tobacco production, total cropped area, labour, fertilizers, capital, cattle and poultry influence maize production. Secondly, to determine the effect of social factors such as gender of household head, household size, education level, age and occupation of household head on maize production and lastly, to investigate the effect of geographical location of farmers on maize production. A survey was conducted and data gathered through questionnaires where the target population included all smallholder maize farmers in tobacco growing zones of Migori County. A multistage sampling technique was used and a sample of 165 maize farmers was selected using systematic random sampling. Descriptive statistics such as measures of central tendency, cross tabulation, tables, and bar graphs as well as regression were used to analyze data. Results show that farmer's age, resource base, total cropped area and competition from tobacco production influence maize production. Efforts to improve maize production in Migori County should improve resource base of farmers, pay attention to their experience and consider competition for scarce production resources. However, gender, geographical location, education and occupation were not critical determinants of maize production in the county hence little attention should be paid to aforementioned variables. Similarly, an increasing number of maize farmers use either local maize varieties or retained hybrid maize despite the increase in the number of hybrid maize varieties released by the seed companies. This explained their low productivity and therefore calls for awareness campaigns on the merits and demerits of using certified seeds backed with incentives to encourage its use.

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ABBREVIATIONS

BAT	British American Tobacco Company
CDD	Crop Development Division

CIMMYT	International Maize and Wheat Improvement Centre
COMESA	Common Market for Eastern & Southern Africa
EAC	East African Community
EPC	Export Promotion Council
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GM	Genetically Modified
KARI	Kenya Agricultural Research Institute
KBS	Kenya Bureau of Standards
KEPHIS	Kenya Plant Health Inspectorate Service
Ksh	Kenya Shillings
MOA	Ministry of Agriculture
MT	Metric Tonnes
NBC	National Bio-safety Committee
NCPB	National Cereals and Produce Board
PCPB	Pest Control Products Board
UPOV	International Union of the Protection of New Varieties and Plants
VAT	Value Added Tax
KSC	Kenya Seed Company

CHAPTER ONE

INTRODUCTION

1.1 Background

Maize is the main staple food crop in Kenya and is of vital concern to agricultural policy decisions, food security and overall development of the sector and the economy (Mantel & Van Engelen, 1997). Maize production in Kenya is a highly relevant activity due to its importance as it is a dominant food crop. The maize subsector is faced by four main challenges namely: low productivity; low value addition; under developed and inefficient factor and product markets and inefficient land use (Olwande, 2012). Efforts to increase maize production must take note of these challenges and endeavor to institute mitigating measures.

Hazell (2006) believes that food security is access by all people at all times enough food for an active healthy life. The World Food Summit in 1996 reaffirmed that food security can only exist when all people, at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. In his study from a time series data, he noted that at the macro level, it implies adequate supply of food are available through domestic production or through imports to meet the consumption needs of all people in a country. At the micro level, household or individual, food security depends on a number of factors which are related for most part to various forms of entitlements to income and food producing assets as well as the links between domestic and external markets and the transmission effects, from the latter, on small, low income and resource poor producers and consumers.

Food security is not just a supply issue but also a function of income and purchasing power and hence it has a strong relationship with poverty (Mrema, 2007). Kenya for a long period pursued the goal of attaining self sufficiency in key food commodities that included maize, wheat, rice, milk and meat. Self-sufficiency in maize was achieved in very few years during the 1970's when production was high to the extent that some was exported. Unfortunately, attainment of self-sufficiency did not automatically imply that household food security was achieved. Evidence shows that solving the food security issue from the production supply side point of view, which overlooks the demand side, does not solve the food security problem particularly the access of vulnerable groups to enough food. This study was relevant to the current study because it appreciates that production of food crop such as maize was sufficient in 1970s but this did not imply that household food security was achieved. The situation of food sufficiency has worsened among the poor households in Kenya over the years and this must be addressed with speed.

Moreover, Kibwage *et al.* (2002) established that Kenya like other African countries is faced with hunger and poverty and these problems are getting worse. It is estimated that more than 14.3 million people of the population live below the poverty line in Kenya. About 52.9 percent of the population in the rural areas and about 34.8 percent of the urban population is poor. It is also estimated that about 34.8 percent of the rural population and 7.6 percent of the urban population live in extreme poverty, so much that they cannot meet their food needs. Even with a relatively liberalized agricultural sector, recent statistics indicate that Kenya's agricultural production and productivity remain

inadequate and have not made any progress on the food security front. Yields have not improved and as a consequence, Kenya remains food insecure and is increasingly relying on emergency food supplies and commercial food imports for a significant portion of her domestic food requirements. The current and previous governments have been accused of neglecting agriculture and food production and especially after the advent of structural adjustment programs. Kenya has invested very little in order to promote and enhance important ingredients for agricultural developments including rural infrastructure and services, agricultural research and extension, and in the institutions that shape the governance of agriculture. This study did not address the socio economic constraints to the production of major staple food crop.

Beresh *et al.* (2009) believed that Kenya has over taxed farmers and subsidized urban consumers while at the same time under invested in rural areas. Kenya's growth of the nation's capital stock fell to 2.7 percent in 1980's compared to an average of 7.1 percent in the 1970's. By early 1990's, the growth of gross investment was just sufficient to maintain capital stock at constant level. Gross Fixed Capital Formation (GFCF) still remain low at an annual average of 17 percent of GDP in the year 2008 compared to 31 percent and 21 percent in the 1970's and 1980's respectively. Recurrent food shortages especially before grain marketing was liberalized in Kenya have been blamed on the abandonment of indigenous drought resistant crops and soil conservation methods. However, initiatives being made to assist rural communities to revert to these practices are beset with obvious inherent contradictions. A part from changes in feeding habits and tastes over time, the market has not been overly receptive to these changes particularly

with regard to indigenous crop varieties like millet, cassava, sorghum and cowpeas. It has also become increasingly difficult to convince consumers that their traditional crops and vegetables are not only well suited to the local climatic conditions but they are also nutritious. As a result, there is dire need for a concerted and a participatory effort aimed at sustainable co existence between ‘new’ technologies in agriculture and the traditional farming practices. Their study also acknowledged shortage in grain production as result of abandoning indigenous drought resistant crops and soil conservation methods but failed to pay attention to the socio economic constraints to smallholder production of maize except the feeding habits and tastes over time.

Nyoro (2002) established that the incidence and intensity of hunger and malnutrition has increased significantly and per capita supply of the main staples has been declining since the early 1980s. Chronic under-nutrition is the most common form of malnutrition in Kenya and is mainly associated with insufficient dietary intake because households lack adequate resources (income) to secure basic food requirements. In 1994, the prevalence of chronic under nutrition among children under five years had risen to 34 percent a level that is 15 times higher than that expected in a healthy, well- nourished population. The observed trend of under-nutrition at the national level corresponds with the decline in per capita food availability, declining economic performance especially in small-scale agriculture, and rising levels of poverty. Chronic under-nutrition does not affect all children uniformly in the country and the national estimates shows regional variations.

According to Kodhek (2004), agriculture mirrors the economic

performance and has also grown from 0.8 percent in 2002 to 1.5 percent in 2003. However, the growth in Kenyan agriculture is considered relatively low in comparison to the 4.8 percent growth in 1994. Further growth in agriculture could be improved if the following factors were addressed: farm productivity, access to credit for rural farmers, market efficiency, improved farm policies and the socio economic constraints to agricultural production. For example, in the early 1960's, private commercial banks were required by law to disburse 17 percent of loans to agriculture (Gitau and Kinyua, 2003). Currently agricultural lending by commercial banks is only 5.35 percent of the lending portfolio. Kenyan farming credit system collapsed in the early 1990's following the wave of liberalization, where farmers who had been given credit sold their produce to new entrants, and thus advanced loans were never recovered. In addition, there was a collapse of the Agricultural Finance Corporation (AFC), the body mandated to provide credit. The main deterrent to borrowing credit is high interest rates with annual percent rate between 12 percent for commercial banks to 65 percent for village banks.

Kilungo (2002) noted that to most Kenyans, food security is tantamount to having 'Ugali' made of white maize flour. He established that food insecurity is synonymous with eating 'Ugali' made of yellow maize flour. The country imports wheat, rice, maize, powder milk and sugar and receives food aid from various donor agencies mainly from the United

States of America and European Union as a form of development assistance and at times as relief for emergencies during short falls of production.

The level of food imports for most commodities was relatively low between 1987 and 1991 because of food availability from domestic production (Mbovu, 2006). However, from 1992 imports have been high (with the exception of 1994 and 1995) because of the decline in domestic production. The fluctuations in imports levels are a reflection of the fluctuations in domestic production. The largest amounts of food imports are from the developed countries (EU, USA and Australia). These are countries where food production is highly subsidized which pose a threat to domestic production of food commodities. Food insecurity in Kenya occurs both in urban and rural areas and in both high potential and the Arid and Semi Arid Lands (ASAL) areas. About 51% and 38% of the rural and urban populations respectively are food insecure (Eboji, 2012). The insecurity has been attributed to many factors including: decline in agricultural productivity; inefficient food distribution system; population growth; unemployment; access to income and high incidence of HIV/AIDs among others.

Nyoro (2009) classified food insecurity in Kenya as either chronic or transitory. Chronic food security results from a continuous inadequate access to food and is caused by the chronic inability of households to either produce or purchase sufficient food, whereas transitory food insecurity is the inadequate access to food due to instability in food production, food supplies and income. Food problem in Kenya is mainly of transitory nature. This has been exemplified by: periodic droughts over the years, institutional

failure and poor policies which cause food crop and livestock production to decline forcing the country to import substantial food stuffs. While food crisis in the ASAL has always been attributed to climatic and environmental conditions other equally important factors have been documented. These include limited alternative sources of income, exploitative cereal marketing channels, unavailability of drought and disease resistant crop varieties, low limited crop diversification, poor storage methods, lack of credit services, inaccessibility to agricultural services, illiteracy and poverty. Food insecurity has also been viewed as a question of entitlements where, not all can have a fair share of the food available or produced.

This was in line with the findings of Sen (2000) who argued that some people are deprived of food due to a breakdown in the ‘means’ of accessing food. As evident in Kenya, food insecurity has occurred without any decline in the general supply of food. In other words, food production per person can increase and yet more people still go hungry. This is basically due to the other intervening variables like food distribution patterns as well as national policies and subsidies. Furthermore, food shortages are not experienced uniformly even in the same food deficit zone. Recurrent food shortages especially before grain marketing was liberalized in Kenya have been blamed on the abandonment of indigenous drought resistant crops and soil conservation methods. However, initiatives being made to assist rural communities to revert to these practices are beset with obvious inherent contradictions. Apart from changes in feeding habits and tastes over time, the market has not been overly receptive to these changes particularly with regard to indigenous crop varieties like millet, cassava, sorghum and cowpeas. It has also become

increasingly difficult to convince consumers that their traditional crops and vegetables are not only well suited to the local climatic conditions but they are also nutritious. As a result, there is dire need for a concerted and a participatory effort aimed at sustainable co-existence between 'new' technologies in agriculture and the traditional farming practices.

Food insecurity has also been caused by land fragmentation, as most of the original large-scale farms have been sub divided beyond economically sustainable production capacity.

According to Gitau (2003), Kenya shifted from a food self sufficiency goal to an outward strategy by identifying seven commodities that form the core of its current food and agricultural policy: maize, wheat, meat, milk and horticultural crops for both home consumption and for export markets and coffee and tea for raising farm income and earning foreign exchange. The strategy was aimed at achieving multiple objectives, including family and national food security, foreign exchange, government revenue, employment, regional balance and generating new incomes streams for the rural people. This strategy continues to be valid. It can thus be concluded that self-sufficiency and expansions of exports are the main objectives of the government in agricultural sector. On the average 30% of the food consumed by rural households is purchased while 70% is derived from own farm production. This shows that rural households purely depend on subsistence agriculture and therefore effort must be made to enhance their productivity.

Maize production during the long rains ranges from 26 to 30 million 90 kg bags out of which smallholder farms produce 75 percent (Kibaara, 2005). The average maize yield is

2 metric tonnes per hectare, but potential exists to increase yield to over 6 metric tonnes per hectare. Wheat production has stagnated at just 270,000 tonnes against a rising demand currently estimated at 720,000 tonnes. Rice production is mainly through irrigation in irrigation schemes (Mwea, Ahero, West Kano and Bunyala) that are managed by the National Irrigation Board. A small amount (13 percent) is from rain-fed paddies. The average annual production, estimated at 52,000 tonnes, is only about 34 percent of national consumption (Buresh, 2009). In spite of the different efforts in developing sorghum and millet, mainly because of their significance in drought prone areas, there has been a notable decrease in hectarage over the last few years from 300,000 hectares in 2002 to 260,000 hectares in 2006 (REPUBLIC OF KENYA, 2005). Pulses, a cheap source of protein, are planted in most parts of the country. Their performance have been mixed, but generally showed a declining trend, because of bad weather, low quality seeds, high cost of inputs and lack of suitable varieties for marginal areas. Roots and tubers, high in calorific value, are important food security crops but their production has been constrained by lack of clean planting materials. He was able to show that the bulk of production of food crop is done by smallholder farmers in rural areas but failed to highlight challenges facing those farmers.

Shortage of maize has led to food imports and aid which has been used in Kenya for a long time with trends showing a tendency towards increased dependence on it in the recent past (Hazell, 2006). This contravenes the government’s objective of food self sufficiency. The share of cereal import (both commercial import and food aid) in total cereal supply rose to over 45% in 1997 after declining to 10% in 1995 and 16% in 1996

(Barnes, 2008). Cereal import has fluctuated between 20 and 33% during the period 1998 and 2001. This requires a ready foreign exchange reserve so that food imports can be made when they are needed. However, Kenya like other developing countries is constrained by the level of foreign exchange reserves, mainly due to the nature of her export. Thus, food importation is dependent on foreign exchange reserve availability. The ability to import is also constrained by the nature of imported food, which may not be acceptable to Kenyan consumers. For example, many Kenyans do not like yellow maize and for whatever reason, have continued to regard yellow maize as ‘animal food’ (Gitau and Kanyua, 2003).

Transition of maize to a major crop occurred in Kenya during World War 1, when the colonial government encouraged farmers to plant maize for the war effort (Gerhart, 1975). At the same time, a serious disease epidemic in the traditional food crop, millet, led to famine and stocks of millet seed were consumed rather than saved for planting. By providing farmers with seed of a late maturing white maize variety, the colonial government sped the transition from millet to a maize based food economy. After the war, the development of export markets encouraged maize production and by 1930s, maize was established as the dominant food crop in much of Kenya and Tanzania. As the importance of maize increased, the government intervened more heavily to control production, prices and imports. However, since the 1980s, there has been an advent of structural adjustment programs

aimed at removing policy distortions through liberalized trade and reforms of agricultural inputs and product markets.

Maize accounts for about 40 percent of daily calories and per capita consumption is 98 kilograms (Nyoro, 2002). The poorest households spend 28 percent of the annual household income on maize purchase. Because of this importance, improvement in maize production will be crucial to solving Africa's food security problems and alleviating poverty. Maize is the main staple food for rural households in Kenya. It is associated with household food security such that a low-income household is considered food insecure if it has no maize stock in store, regardless of other foods the household has at its disposal.

A study by Jayne, *et al.* (2001) established that maize doubles as a main source of income for the producers in the maize surplus regions. Maize is produced in almost all the agro-ecological zones either under mono-crop or an intercrop system. It is grown on 1.5 million hectares and has an annual production of 28 million bags. However, domestic production has stagnated to between 24 and 30 million bags over the last 10 years (Nyoro, *et al.* 2009). Maize is important in Kenya's crop production patterns, accounting for roughly 20 percent of gross farm output for the small-scale farming sector. It is grown for commercial, subsistence or dual purposes. Maize yields during favorable condition

ranges from 2.0 to 5.4 metric tonnes per hectare. The annual maize consumption in Kenya is approximated at 30 to 34 million bags (2.7 to 3.1 million metric tonnes). This outweighs production and the deficit is imported mainly from Uganda, Tanzania, Brazil, South Africa and Mozambique at lower prices than that of domestic production.

Maize is a dominant staple food crop in South Nyanza district (Karanja and Oketch, 1992)**.** However, there has been a declining trend in maize production among farmers in this region, a tobacco growing zone, threatening household and national food security. To make matters worse, almost all the arable land is under cultivation in Migori County making future increase in maize production to depend on yield improvement rather than expansion in area under production. Similarly, although Migori County is home to tobacco production, many farmers live in abject poverty and are vulnerable to food insecurity thus making many to question whether switching from maize to tobacco is worthwhile. In addition, children in Migori County were the most vulnerable to malnutrition with half of them suffering from chronic under nutrition. Therefore, the purpose of this study was to investigate socio economic factors constraining smallholder maize production in the tobacco growing regions of Migori County. More specifically the study examined the effect of social, economic and physical factors on maize production.

1.2 Statement of the Problem

There was tremendous growth in maize production between 1964 and 1997, fueled by the introduction of hybrid maize and related

technologies often dubbed Kenya's green revolution (Karanja and Oketch, 1992). However, there has been a marked decline in yield since 1997. Maize yield has declined from 1.85 metric tonnes per hectare in the period 1985-2007 to the current yield of 1.57 metric tonnes per hectare. Shortage of maize in Kenya results in famine among the poor urban and rural households. Since almost all the arable land is under cultivation in Kenya, future increase in maize production will heavily depend on yield improvement rather than expansion in area under production.

Kibaara (2005) established that Maize is Kenya's most important staple food crop, but its production has fallen short of demand. The area under maize has stabilized at around 1.5 million hectares and the potential for further expansion is limited, given the competition from other crops.

Maize produced in Migori County is not enough to sustain the surging population. Only 431,267 bags of maize were produced in Migori County against the projected 742,265 bags for consumption in the year 2012 yet the Kenyan government policy objective for the maize sub sector is to encourage increased production so that self sufficiency and food security can be achieved (Wanzala *et al.* 2009). However, the production of the crop has fluctuated over the years, partly due to climatic conditions and socio economic constraints. Some of the main

reasons for the dwindling performance of maize production in Migori County are associated with the following challenges: poor access to credit after the collapse of the Agricultural Finance Corporation and Cooperative Societies that had been mandated to give inputs on credit, inadequate use of recommended technologies, high costs of inputs, lack of agricultural extension services, poor flow of information from the research stations to farmers, limitations in the development of infrastructure, low prices from the maize market reforms resulting in lower input use, a general decline in performance of the economy among others. Lack of credit translates into inadequate working capital, and therefore, farmers are unable to purchase productivity enhancing inputs such as seeds, fertilizers, pesticides and land preparation. One way of reducing the cost of production is to increase farm output. This study has reviewed some of the socio economic constraints to maize production among smallholder farmers in bid to enhance productivity.

1.3 Objectives of the Study

1.3.1 General Objective

To investigate the socio economic factors that influence smallholder maize production in the tobacco growing regions.

1.3.2 Specific Objectives

The study was guided by the following specific objectives;

1) To determine the effect of economic factors such as area under tobacco

production, total cropped area, labour, fertilizers, capital, cattle and poultry on maize production.

2) To assess the effect of social factors such as gender of household head, household size, education level, age and occupation of household head on smallholder maize production.
3) To investigate the effect of geographical location of the farmers on smallholder maize production.

1.4 Research Hypothesis

$H0_1$ Economic factors such as area under tobacco production, total cropped area, labour, fertilizers, capital, cattle and poultry have no significant effect on maize production.

$H0_2$ There is no significant effect of social factors such as gender of household head, household size, education level, age and occupation of household head on smallholder maize production in the tobacco growing Zone of Migori County.

$H0_3$ Geographical location has no significant influence on smallholder maize production in tobacco growing Zone of Migori County.

1.5 Significance of the Study

Tobacco production in Kenya has continued to grow rapidly at the expense of traditional food crops while simultaneously degrading the environment. This poses a major challenge to the achievement of the Millennium Development Goals and vision 2030 on food security and poverty reduction. There is therefore an urgent need to implement effective measures to mitigate food insecurity, poverty and environmental degradation. A number of studies have been carried out on maize, such as estimation

of cost of production and competitiveness between Uganda and Kenya, factors determining yield, impacts of adoption of hybrid maize and maize market liberalization. Although the subject of socio economic constraints to smallholder maize production is important, few studies have focused on this area if any.

1.6 Justification

Tobacco requires heavy applications of fertilizers since it depletes soil nutrients at a higher rate than many other crops. There is paucity of information on the effects of these fertilizers on soil properties related to soil fertility such as soil pH, organic C, cation exchange capacity (CEC) under tobacco farms over the years and how this is likely to impact on food crop production if farmers were to change the land use from tobacco growing to food crop production as justification. Maize is important in Kenya's crop production patterns, accounting for roughly 20 percent of gross farm output for the small scale farming sector (Nyoro *et al.* 2009). It is grown for commercial, subsistence or dual purposes. Maize yields during favorable condition ranges from 2.0 to 5.4 metric tonnes per hectare. The annual maize consumption is approximated at 30 to 34 million bags (2.7 to 3.1 million metric tonnes). This outweighs production and the deficit is imported mainly from Uganda, Tanzania, Brazil, South Africa and Mozambique at lower prices than that of domestic production. Over-dependence on imports is likely to displace the only livelihood of the local population. It is also sad to note that in the last

two decades, Kenya has undergone a transformation from a maize exporting to an importing country. Kenya has lost its competitiveness in maize production to the neighboring regions due to the high cost of maize production (Nyoro, 2002). This kind of scenario has attracted a research that can solve the problem of food insecurity, poverty and environmental degradation in the Tobacco growing regions.

1.7 Scope of the Study

The study focused on factors that constrain smallholder maize production. The study involved three districts in Migori County and total of 165 farmers from the three districts were selected through systematic random sampling. A set of questionnaires for farmers were used as primary instruments for data collection. The study was limited to socio economic factors that constrain smallholder maize production. The time scope was four months from proposal writing to data collection and report writing.

1.8 Assumptions of the Study

The producers have an identical production function. The data was analyzed on the 'largest field' in which a household planted maize. In this study, the largest field was considered a practical representation of a typical maize farm. By considering the largest field, the study captured 85 percent of the maize area cultivated by the smallholder farmers.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, literature is presented in three sections. The first section, 2.1, deals with theoretical literature on production. The second section, 2.2 deals with empirical case studies that are of particular relevance to this study commenting on their methodologies, findings and conclusions. The third section, 2.3, is a critical evaluation of the empirical works pointing out their point of departure from the present study. Missing gaps in the reviewed literature, which this study sets out to fill, were also identified. Finally the chapter concludes with a conceptual framework for the study.

2.2 Theoretical Concepts

Muchena *et al.* (2008), discovered that despite the great efforts made to increase maize production the demand has occasionally outstripped the supply requiring import of large quantities of maize grain. Total maize production and maize yield per unit area in Kenya has been affected by many different factors. Among the most important are total planted area and productivity. There is limited scope for expanding cultivated land under maize production since unused land is diminishing or is of marginal quality or just unsuitable for maize production. Producing higher maize yields on existing cultivated land is therefore the surest way of generating the extra maize grain required to feed the nation. To achieve this goal, a number of remedial factors affecting maize production must be put into consideration.

2.3 Economic Factors Affecting Maize Production

Based on the studies of Mantel and Van Engelen (1997), maize production in Kenya is a highly relevant activity due to its importance as a dominant food crop. It is wholly produced under rain fed conditions. The maize growing areas of the country are located in ecological zones that allow maize to grow irrespective of limiting temperature and rainfall environments. Traditional farming practices are no longer capable of meeting Kenya's maize production requirements. Consequently, widespread application of scientific methods is essential. Foremost, the farming community must know the potential of the land under cultivation and the essential crop husbandry measures necessary to achieve the maximum possible maize yields without compromising the land's productive sustainability. This study was relevant to the current study because it looked at some socio economic factors such as fertilizers and its influence to maize production. However, it did not show how application of fertilizers to other cash crops such as tobacco influences the production of maize.

2.3.1 Cost of Land Preparation

Mrema (2007) revealed that timely execution of agricultural tasks such as land preparation and planting is crucial in predominantly rain fed maize production, and has been observed in the last few years, rainfall tends to be unreliable and erratic in most cases. Reduction in the taxes on diesel fuel, and farm machinery and equipment could reduce production and processing costs and promote higher usage of farm machinery. Correct timing for land preparation was also considered as a major determinant of maize production in Migori County. While the current study deals with smallholder maize productivity in tobacco growing zone, her study was specifically done on determinants of

maize production.

However, according to Mati (2005), reduction in the quality of land preparation could have adversely affected maize yields and hence an increase in production costs per unit production. The extent of machinery costs particularly in seedbed preparation was corroborated by production costs data for Trans Nzoia in 1992 and 1999. Results indicate that land preparation charges increased by 30% between 1992 and 1999 after controlling for inflation. However, during the same time, the actual mechanization costs declined from 31 to 26% of the total production. This was attributed to the number of ploughs and harrows. Further, in 1992, when maize prices were about Ksh 700 at the farm gate, farmers were required to sell 0.8 bags of maize to plough one acre for planting maize. In 1999, however, they needed to sell 1.25 bags of maize to plough the same area. Most of these increases in costs are attributed to the high cost of diesel fuel and spare parts for farm machinery, which have been increasing over the past 10 years. Farmers also have to contend with poor availability of farm machinery, particularly those who rely on hired machinery. Machinery owners complained that they have been unable to replace the old tractors due to working capital constraints. These studies were relevant to the current study because both studies consider cost of land preparation as a major determinant of smallholder maize productivity. In the current study, land preparation costs included the labour requirements and their unit costs.

2.3.2 Seed Variety and Costs

Despite the liberalization of the seed industry and the introduction of Kenya Plant Health

Inspectorate Services (KEPHIS) as an independent seed inspection authority, the quality of seed, particularly that of maize and wheat, continues to be poor (Kweyuh, 1997). Inferior packaging materials are easily counterfeited where poor quality seeds are packaged and sold without any certification. At the distribution level there is widespread seed adulteration, some of which involves the sale of commercial maize seeds purported to be hybrid. KSC has exonerated itself from the blame that it had sold bad seeds to farmers and that the disease affecting maize in parts of Western Kenya was not as a result of maize seeds.

Wanzala *et al.* (2009) in their study of the diffusion of hybrid maize in western Kenya established that the institutional set up in seed development, the multiplication and distribution of seeds could have compromised the seed quality. The challenge, then, was to encourage wider use of hybrid and other certified seeds through improving its quality to gain back the farmer's confidence in the hybrid and certified seeds. This would discourage the farmers from using the local maize or retained seeds. They should also be encouraged to use optimal amounts of fertilizers with the hybrid seeds because this is the only way that the full potential for the hybrids can be tapped by making the fertilizer available at low farm gate prices. These empirical studies on seeds were relevant to the current study since it was among the economic factors expected to influence smallholder maize production. The point of departure in this study was to investigate how seeds as economic factor influenced smallholder maize production in a tobacco growing zone.

A study by Olwande (2012) on smallholder maize production efficiency in Kenya established that seed prices have been increasing and this has acted as a major

disincentive to the adoption of the high quality maize seed. This, with the decline in quality, has adversely affected the adoption of hybrid seeds. Although the adoption of hybrid seeds has remained high, particularly in the high potential maize zones, their use has not been as expected. A large proportion of farmers across all the zones used other types of seed in addition to the hybrid maize (Table 2.1).

Table 2.1: Seed variety

	Hybrid Seeds	Retained Hybrids	OPVs	Local Varieties
Northern Arid Lands	0	0	60	44
Coastal Lowlands	25	9	14	65
Eastern Lowlands	36	6	3	74
Western Lowlands	21	20	2	67
western Transition	64	5	1	34
High Maize Potential	88	8	1	25
Western Highlands	85	9	5	40
Central Highlands	87	2	5	21
Marginal Rain Shadow	37	9	9	22

Source: Republic of Kenya, 2009.

Most of these seeds were not certified neither were they cleaned nor treated. A large proportion of farmers in the western and central highlands and Western Transition used local maize varieties although these areas traditionally have high potential for hybrid maize. What is clear from these results is that the information and potential for using hybrid or certified seed exist among farmers. It is the confidence of the seed quality that affects their adoption and not entirely the lack of information of their existence. He recommended that Kenya Plant Health Inspectorate Services (KEPHIS), a seed certifying agency, should implement the law to protect farmers from exploitation by unscrupulous businessmen selling fake seeds to unsuspecting farmers in the country.

Similarly, Muchena *et al.* (2008) established that just like in maize and wheat, producers of horticultural crops suffer from poor seed quality. This is caused mainly by either poor multiplication or distribution, or because of direct adulteration of the seeds. Although imported seeds are also available, the seeds are expensive and are packaged in large amounts that the farmers cannot afford. Repackaging of the imported seeds by stockist into affordable packages has contributed to the seed adulteration. Unlike Tanzania, where farmers locally vet the local seed multipliers and distributors, there is no local vetting mechanism in Kenya. Inspection and certification are also inadequate.

2.3.3 Capital

From the Ministry of Agriculture annual report of 2005, Agricultural input finance has been declining since the early nineties when the liberalization of the agricultural sector began leading to a decline in maize productivity (Table 2.2). Currently farmers are unable to access credit through the formal banking systems, the commodity marketing bodies, or even the producer organizations where they exist. Working capital for both long term investments in capital and the short-term needs have not been available. Agriculture has also not received its rightful share of commercial credit, despite its contribution to the economy. In 2008, for example, the lending by commercial banks to agriculture stood at a mere 5.35% of the total lending assets to the private sector. The total incremental lending to agriculture and related enterprises stood at 10.8% compared with manufacturing (17.8%), trades (16.5%), “other activities”(13.9%), and building and construction at 13.3%. Of the small proportion lent to agriculture, the actual lending directly to small-scale farmers is minimal.

Table 2.2: Maize production

	1992	1999	2000	2009
Items	**Ksh/acre**	**Ksh/acre**	**Ksh/acre**	**Ksh/acre**
Revenue	15,466	27,500	14,060	17,000
Fixed costs/acre	550	3,750	500	1,250
Total Labour inputs	1,092	1,685	1,227	1,662
Mechanization	3,813	5,200	3,304	3,425
Other non labour input	6,767	9,085	6,297	7,230
Total Costs	12,222	19,720	11,328	13,567
Total Profit	3,244	7,780	2,732	3,433
Cost per bag	556	789	566	798
Profit per bag	147	113	110	102

Source: Republic of Kenya, 2009

According to FAO (2009), the banks circumvent the statutory requirements to lend to that sector by preferring to finance commodity traders such as exporters and high value crops producers. This qualifies as agricultural lending as opposed to being reported as ‘traders’ in commercial bank returns to the Central Bank. Farmers and commodity traders are also unable to access commercial credit because of the inordinately high cost of borrowing due to high interest rates. At such a high cost of finance, investment in commodity production becomes totally unattractive. Lack of financing to farmers by the commercial banks and other organization translates inadequate working capital at the farm level where farmers are unable to finance farm operation by cash. These empirical studies on capital were relevant to the current study since it was among the economic factors expected to influence smallholder maize production. However, the point of departure in this study was to investigate how availability of enough capital as economic factor influenced smallholder maize production in a tobacco growing zone. Because tobacco farming is expensive and labour intensive, farmers could be facing the problem of allocation of resources towards tobacco production and maize farming.

Karanja (1996) observed that lack of working capital limits the farmer's ability to purchase the productivity enhancing inputs like seeds, fertilizers, pesticides, land preparation, and weeding. The rest had to depend on cash purchase of inputs. Households in the coffee and tea areas of Central Highlands (Muranga, Nyeri, and Meru districts in the sample) received most of the credit. However, the amounts received even in these areas were insufficient to cover most of the requirements. The credit received was also limited to use in certain crops only. For example, the vast majority of those receiving credit from either coffee cooperatives or the Kenya Tea Development Authority (KTDA) are often required to use it for coffee and tea respectively..

A study by Braun (1991) defined capital as capital goods, real capital, or capital assets used in the production of durable goods or any non financial asset that is used in production of goods or services. According to him, households in the coffee and tea areas of Western Highlands also received credit, and again, most of these households received credit under interlocking arrangements. This decline or lack of input finance has contributed to the reduction in yields, quality control, and investment and reduced income for small producers. Interlocking credit input with output marketing where it can be applied has enabled producers to access credit, inputs, extension services, and farm equipment without requiring collateral, as in other credit arrangements. The system of interlocking credit inputs with output marketing is also able to overcome the problem associated with credit recovery because the credit is recouped up front after sales before the small scale farmers are paid. This reduces the credit default rates and makes such

financing schemes sustainable. While his study concentrated on capital acquisition, the current study was based on the availability capital from the income sources of the farmer.

Moreover, Hazell (2006) believed that liberalization of commodity markets has undermined the interlocking system between the commodity output and the input supply by encouraging side selling of commodities following the liberalization. Side selling, thus, broke down the potential for recovering the credit advanced to small-scale farmers up-front at the marketing stage. The following are the constraints that have adversely affected agriculture-input finance. Competition among traders has also been affected by lack of adequate working capital because of lack of credit therefore reducing competitiveness in commodity trading. For example in coffee trading, although there are about 120 registered coffee traders, only about 30 of them are actively involved in active trading due to mainly working capital constraints.

Most maize in the high potential maize zones is traded mainly between December and January to meet household cash needs for school fees, uniforms, and Christmas festivities (Kilungo, 2002). The trading in maize could have been spread into more months if there were a facility to finance the working capital of traders or organized groups of farmers. Exploring the possibilities of starting a Warehousing Receipt financing instrument is, therefore, necessary.

Olwande (2012) observed that under the warehousing receipt arrangements, banks and other financial institutions could offer short-term funds against the security of the

commodity in storage. The commodity is normally stored in a warehouse under the supervision of a manager who holds the security and the full title to the goods for the bank through reputable collateral management. This system of financing could be used to improve access to short term credit to commodity traders and farmers. The development of this system of collaterised credit in Kenya is currently hampered by lack of appropriate legislative machinery that recognizes the warehousing receipts as legal documents. Also lacking is an enabling legal and regulatory framework for effective contract execution and arbitration in case of defaults. A well functioning legal and political framework for market activity reduces the risks and transactions costs of financiers. These empirical studies on capital were relevant to the current study since it was among the economic factors expected to influence smallholder maize production. The point of departure in this study was to investigate how capital as economic factor influenced smallholder maize production in a tobacco growing zone.

2.3.4 Fertilizers and Soil Fertility

The study by Mati (2005) found out that fertilizer adoption rates, quantities and types were other factors that influence domestic production costs and agricultural productivity in Kenya. To facilitate production of higher maize yields, it is necessary to carry out appropriate research and identify the short-term needs of the crop and long-term needs of the soil. To determine those needs, frequent soil analysis is necessary. Once the needs are identified, it is possible to use fertilizers appropriately to achieve the highest returns from such expensive inputs. Loss of fertilizers through leaching and P fixation can be reduced in two ways: first through enriching the soil with organic matter which increases the cation exchange capacity and reduces leaching; second through applying fertilizers

particularly N and K in split doses rather than a single dose. Another beneficial strategy is the use of a combination of fertilizing techniques with green manure fallow plus stable manure, or compost plus modest quantities of chemical fertilizers. Crop rotation, based on the inclusion of polyannual legumes, should be included in the management practices as the system maintains soil fertility.

In a recent study on fertilizer markets and agricultural production incentives by Wanzala *et al.* (2009), details have emerged on constraints to fertilizer marketing. The study has also revealed various insights on the extent of use and the incentive structure of fertilizer markets. An examination of the adoption of fertilizers in Kenya reveals a generally widespread use by farmers in most agro-ecological zones. It is probably the levels and types of fertilizer use that has had greater influence in crop productivity rather than the actual adoption of fertilizers or the knowledge of their existence. Results from the household survey data reveals that more than 70% of the sampled households used mineral fertilizers in 1997 and 1998, whereas about 57% of them used manure. The highest adoption of mineral fertilizer was in the High Potential Maize Zone, the Western Highlands and the Central Highlands where, on average, 90% of the households used fertilizer in 1997 and 1998. This study also sought to investigate the relevance of using fertilizers (economic factor) in maize productivity in tobacco growing regions of Migori County.

The use of fertilizer is also reasonably high in the Western Transitional and Eastern Lowlands (79 and 51% for 1998, respectively), but then they fall off dramatically for the

Western Lowlands; in 1998 only 13% of these households used mineral fertilizer (Oyaro, 2006). Yet the biggest disparity in fertilizer use is probably in the quantities and types used. In 1998, only households in the Central Highlands and High-Potential maize zone applied more than 30 kg of mineral fertilizers nutrient per acre (47.9 and 33.5 kg per acre, respectively). In the Western Highlands, the average dose rate was much lower than the Central Highlands and High- Potential maize zone. The difference comes from a lower number of high-end users. In the Western Highlands, only 14% of households used more than 30 Kgs of fertilizer nutrient per acre in 1997, but in 1998 that figure was 13%. More than 40% of households used more than 30 Kgs of fertilizer nutrients in the Central Highlands and High-Potential maize zone. At an aggregate level, national fertilizer consumption has increased in the post liberalization era. Annual fertilizer consumption increased by 19% between 1984/85 and 997/98. However, the aggregate increase in consumption conceals the actual usage by specific patterns of use by crops that, when done, reveals important variations. Consumption of maize fertilizer (DAP) declined from 70,182 tonnes between 1984/85 and 1992/93, to 67,636 tonnes between 1993/94 and 1997/98. So, the overall share of DAP in total fertilizer consumption declined from 30.1 to 24.4%. In contrast, the overall share of tea fertilizer increased from 18.4 to 21.2% during the same period; the share of wheat fertilizer (MAP) rose from 2.1 to 6.8%; and the share of specialty fertilizer rose from 2.1 to 4.2%.

Analysis of secondary data reveals that while nominal fertilizer prices have increased in the post liberalization era, the price of most fertilizers has declined in real terms (Kibwage *et al.* 2006). The two factors that account for this increase are the depreciation

of the Kenya shilling against the US dollar compounded by a steady upward trend in world fertilizer prices during this period. Fertilizer consumption could also have declined in maize because of unfavorable terms of trade between maize and DAP fertilizer. That is, the decline in real fertilizer prices paid by farmers has not translated into increased incentives to use fertilizer on maize, because real maize prices have fallen even faster than fertilizer prices during the 1990-2009 periods. However, the decline in fertilizer use in maize does not imply that fertilizer use on maize has become unprofitable in an absolute sense. Indeed, the mean value-cost ratio for DAP fertilizer use is calculated at 5.86. This means that for every Ksh spent on DAP fertilizer; the farmer gets 5.86 Ksh back in value of maize output. These empirical studies on fertilizers were very relevant to the current study since it was among the economic factors expected to influence smallholder maize production. The point of departure in this study was to investigate how fertilizer as economic factor influenced smallholder maize production in a tobacco growing Zone of Migori County.

Among the other findings of the study by Mati (2005) was that most of the farm gate price is taken up in distributing DAP internally. Import prices of fertilizer in Mombasa during the survey period were roughly 45 to 55% of the farm-gate price of DAP in western Kenya. The internal costs include transportation and handling, storage, interest charges for financing the fertilizer purchases, charges for transit losses, and bagging. Most, if not all of these costs are beyond the control of fertilizer traders themselves. They hire out for these services and must simply absorb them as costs that are then passed on to the next buyer. Ultimately, farmers pay for these costs. There may be some means to

reduce these costs through procedures to improve efficiency. The traders also reported that losses of fertilizer add in transit costs, by that, increasing final price of fertilizer to the consumer. The transit losses were especially large toward the end of the marketing channel when fertilizer was transported to the smaller towns in rural areas. Retailer's transit losses were on average about three times greater per unit shipped than for importers and large wholesalers. These transit loss costs are passed on to farmers in the form of higher prices. Traders indicated that they could not transport their fertilizer directly up-country from the port of Mombasa but rather needed to transport the goods to a local warehouse near the port before securing road transport for subsequent movement up-country. This extra stage involves a 55 Ksh per bag addition to transport and handling costs.

2.3.5 Technology Development

Jayne *et al.* (2001) advanced a study of technology in agricultural production and found that generation and transfer of appropriate cost reduction and productivity enhancing technologies is a key strategy towards reducing local production costs and increased agricultural productivity, to enhance Kenya's competitiveness in agriculture. The development of the high yielding maize and wheat varieties in the early 60s, the design of measures to control the Coffee Berry Disease in late 60s and the breeding for high yielding, disease resistant coffee varieties, are among some of the examples which indicate how important agricultural research is to a country's agricultural development. Investment in Biotechnology in agriculture is now taking the center stage as the key agricultural research strategy. Providing disease-free planting materials through tissues

culture, increased yields and resistance to crop pests, poor soil fertility and soil salinity, control and eradication of livestock diseases, diagnosis and development of novel vaccines, improvement of animal pastures and fodder through gene technology, and increase genetic potential of livestock and their adaptation to different agro ecological zones are some key research agenda currently being addressed through biotechnology. This empirical study on application of technology on production was very relevant to the current study since it was amongst the major determinants expected to influence smallholder maize production. The point of departure in this study was to investigate how use of technology influenced smallholder maize production in a tobacco growing zone.

2.3.6 Extension Services

According to Nyoro *et al.* (2009), agriculture research continues to suffer from poor management, inadequate funding, manpower instability, limited research-extension farmer linkages and weak monitoring and evaluation. A National Extension Advisory Board should be established jointly between the public and private sector to enhance the linkages between research and its usage. Among the strategies is the investment in agriculture research and extension as well as control of epidemic diseases for crops and livestock because they have a large proportion of public goods components whose returns accrue to the larger society rather than individuals. Furthermore, they also require large capital investment that cannot be undertaken by individuals. Private investors in research and extension services should be encouraged through tax rebates and credit. The investors as the end users of research should be involved in research design, planning and implementation. Rules and regulations should be set up to govern those investors to avoid

exploiting farmers.

The household survey data reveals widespread adoption of fertilizers and seeds across most of the agro-ecological zones (Kinyua, 2003). Nevertheless, it is probably the quantities and the types of fertilizers used by farmers that have the biggest impacts on productivity more than information on fertilizer types and quantities to be used. Similarly, in the case of seeds, it is the availability of high quality seed, availability of working capital to buy the seeds and fertilizer and availability of reliable markets that probably has biggest impact on productivity. Arguing that extension service is necessary to raise the awareness of the farmers of new and existing technology is plausible, but not sufficient to raise agricultural productivity due to the many problems facing farmers. Nevertheless, delivery of extension service will remain in demand and will become more constraining as the productivity increases. It is also acknowledged that, whereas the funding of extension should remain the responsibility of the public sector through the ministry in charge of agriculture and livestock, the delivery of the service could best be contracted to the private sector and the NGO's. In this way the delivery of extension service could be made relevant by making it demand driven.

Most agricultural commodities that are locally produced are not graded to differentiate them by quality (Okalebo, 2002). This is because the payment systems adopted are uniform and do not recognize quality differences in the commodities. Results from a maize study in 1999 indicated that at all stages in the maize marketing chain before the milling stage; quality was distinguished by eyesight. The study reported that in all cases, traders reported depending on visually inspecting the maize before purchasing it. Maize

traders use color, size of the kernels, and amount of foreign material as the main criteria determining quality and price. There was no objective quantifiable maize or maize product differentiation. At the large-scale miller's level, quality inspection was normally enhanced by the use of moisture meters. According to the quality standards in Kenya, the maximum moisture content level should be 13.5%. Millers often reject grains with higher moisture content.

Sen (2000) established that most of the imported agricultural commodities are graded, and are differentiated by colors, size, shape, degree of ripeness, and sometimes other quantifiable criteria such as moisture and nutrient content. Some local multinational companies such as those in tea production and processing have been awarded certificates such as ISO 9001 and ISO 14000 in recognition of the quality production of the commodity. Production differentiation will be the sure way to ensure fair competition between the local and domestic production. Kenya's private sector should therefore be encouraged to establish grades and standards to be used at all stages of marketing. Establishment of grades and standards could encourage product differentiation and therefore improve returns to the farmers who produce commodities of high quality. These empirical studies on extension services were very relevant to the current study since it was among the social factors expected to influence smallholder maize production. The point of departure in this study was to investigate how extension services as a social factor influenced smallholder maize production in a tobacco growing zone considering the literacy levels of the farmers.

2.4 Other Social Factors Influencing Maize Production

Ebojei (2012) conducted a study with an aim to identify the socio-economic factors that influence farmers' decision to adopt hybrid maize in Giwa Local Government Area of Kaduna state, Nigeria using the farm household survey data collected from 160 maize farmers in October- December 2009 for the cropping year 2009-10. His findings were in conformity with Conroy (2005). The study found out that frequent contact with the nature and command of age on farmer's contribution to new technology is indecisive. Younger farmers are likely to take up new technology than older farmers being that they are of higher schooling and have more contact to innovations. On the other hand, it may be that older farmers may have extra resource that makes it more likely for them to try new technologies. The studies also suggest that open-pollinated maize production was not labour intensive unlike hybrid maize. Thus the farmers' decision to participate in hybrid maize technology and not open- pollinated maize production was not swayed by the family size. This result contradicted the findings of Karki (2004) who observed that farmers participation in maize production was positively related to family size in mid hill region of Nepal. These empirical studies on social factors that influence smallholder production was very relevant to the current study since age and household size were among the major determinants expected to influence smallholder maize production in Migori County. The point of departure in this study was to investigate how they influenced smallholder maize production in a tobacco growing zone.

2.5 Evaluation of the Literature

The foregoing literature reviewed in this study revealed that even with a relatively liberalized agricultural sector, recent statistics indicate that Kenya's agricultural production and productivity remain inadequate and have not made any progress on the

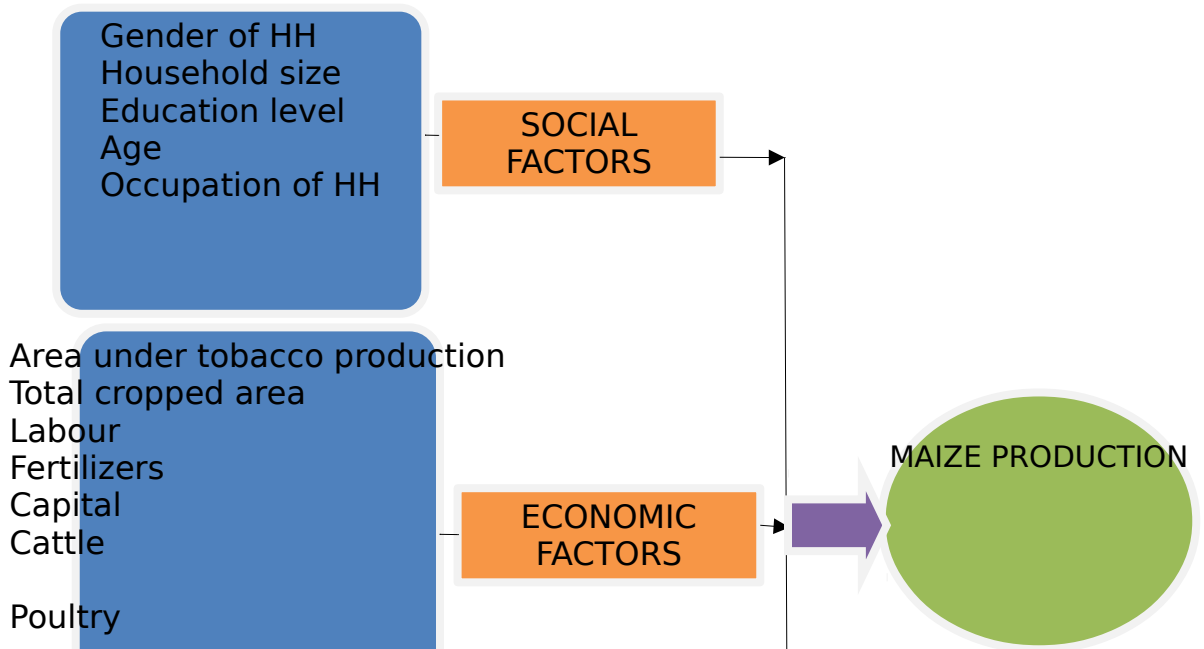
food security front. Yields have not improved and as a consequence, Kenya remains food insecure and is increasingly relying on emergency food supplies and commercial food imports for a significant portion of her domestic food requirements. This literature fails to explicitly address how tobacco farming would influence smallholder maize production yet according to World Food Summit in 1996, food security can only exist when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

However, for a long period, Kenya has pursued the goal of attaining self sufficiency in key food commodities that included maize, wheat, rice, milk and meat. Self-sufficiency in maize was achieved in very few years during the 1970's when production was high to the extent that some was exported. Unfortunately, attainment of self sufficiency did not automatically imply that household food security was achieved. The literature exposed that recurrent food shortages in Kenya have been blamed on the abandonment of indigenous drought resistant crops and soil conservation methods. However, initiatives being made to assist rural communities to revert to these practices are beset with obvious inherent contradictions. It has also become increasingly difficult to convince consumers that their traditional crops and vegetables are not only well suited to the local climatic conditions but they are also nutritious. As a result, there is dire need for a concerted and a participatory effort aimed at sustainable co-existence between 'new' technologies in agriculture and the traditional farming practices.

Most of the studies reviewed in the literature relates to factors that influence maize production. The variation in this study, however, is that it explicitly analyzed how socio

economic factors constrain smallholder maize production in tobacco growing areas because maize is Kenya's main staple crop and of vital concern to agricultural policy decisions, food security and the overall development of both the agricultural sector and the economy. The declining trend in maize production which threatens household food security and income sources in the tobacco growing regions requires greater attention. This can only be achieved when there is a close study of socio economic constraints to smallholder maize production in areas of large scale cash crop productions.

2.6 Conceptual Framework



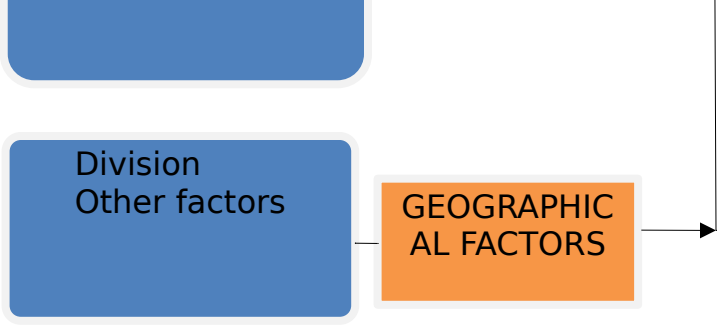


Fig 2.1: Conceptual framework
Source: Author's Compilation, 2013

Gender of household head, household size, education level, age and occupation of household head are social factors that influence smallholder maize farming in the study area. On the other side, area under tobacco production, total cropped area, labour, fertilizers, capital and the size of cattle herd were economic factors that influenced smallholder maize production. Similarly, divisional boundary was a geographical factor in determining smallholder maize productivity in Migori County.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, research methodology is presented in several sections which include; theoretical framework upon which the study was based, empirical model specification research design and methods that were used in the study to answer the research objectives. It gives the description of the sampling techniques, data collection, types and analysis, limitations of the study as well as ethical considerations.

3.2 Theoretical Framework

This study was based on the theory of production where the producer's objective in a classical sense is to maximize output so as to reap more profits (Battese and Collel, 2005). Such behavior can be modeled using a production function approach, profit function approach, cost function approach, or through mathematical optimization and dynamic programming. Given price taking, profit maximizing and a model of the physical production process, it is possible to derive a model of producer output and input decisions. However, it is important to note that some small scale farmers producing maize on a subsistence basis may be driven by other objectives other than maximization of profits. It was assumed that farmers optimized their output subject to the cost of inputs employed in the production process.

3.3 Empirical Model Specification

The functional forms that may be chosen to model producer behavior include: Cobb-Douglas (Strauss, 1986; Varian, 1992), Translog (Christiansen *et al.* 1973) and CES production functions. The Cobb-Douglas production function is given in (2.1) as: -

$$y = A \prod_{i=1}^{n} X_i^{\beta_i}$$

(2.1)

Where A is a scalar for productivity, β_i, is a parameter for each factor used and the sum of β_i is the scale parameter, s. This functional form is attractive because of the simplicity of cost shares functions *($S_i = x_i\, w_i/c(y,w) = \beta_i$)*, unit elasticity of substitution, simple estimation and embodiment of technological progress in the model(Yanikkaya, 2004). The study considered a farm that is producing a non negative output Q hence having a flow of the output being produced from the inflow of 13 variable inputs X_i (i =1, 2, 3...9 and j= 1, 2, 3 & 4). The production function which specifies the maximum output obtainable from the input mix can be written as;

$$Q = f(x_1, x_2 x_3, \ldots\ldots, x_n) \qquad (2.2)$$

The general form of the estimated Cobb-Douglas production function is given by (2.3);

$$Q = \beta_0 \prod_{i=1}^{9} X_i^{\beta_i} e^{\left(\lambda_j \sum_{j=1}^{4} Z_j + \mu\right)} \qquad (2.3)$$

Where Q is the maize production in tonnage, Xi's are the input variables in maize farming while Z_j's are the dummy variables. When the model is log transformed it becomes (2.4);

$$LNQ = LN\beta_0 + \sum_{i=1}^{9} \beta_i LNX_i + \lambda_j \sum_{j=1}^{4} Z_j + \mu \qquad (2.4)$$

Where;

X_1	=	Total Cropped Area	(Acres)
X_2	=	Labour	(Man hours)
X_3	=	Capital	(Kshs)
X_4	=	Age	(Years)
X_5	=	Fertilizers	(Tonnes)

X_6	=	Poultry	(Number)
X_7	=	Cattle	(Number)
X_8	=	Area under Tobacco Production	(Acres)
X_9	=	Household size	(Number of people)
Z_1	=	Gender of the household head	(1 if Male & 0 otherwise)
Z_2	=	Occupation of the Household Head	
Z_3	=	Division	
Z_4	=	Education level	
μ		White noise	

Area under Maize production and tobacco production were measured in acres while capital was measured in 000ksh. Fertilizers were measured in 000ksh. The proxy for age was experience and was measured in years. The gender of the household was introduced as a dummy as well as other variables defined above.

3.4 Research Design

A survey design was used in this study. The survey design was useful in this study since it enhanced investigation of the population by selecting samples to be analyzed and discovering occurrences. A survey describes the existing phenomena by assessing individuals about their perceptions, attitudes, behavior and values. It was used in exploring the existing socio economic status of the target population and enabled comparative analysis between maize and tobacco farming. This design enabled the researcher to collect original data for the purpose of description and measurement of

characteristics of a population which is too large to be observed directly.

3.5 Sampling Technique

Multistage random sampling was used within the study area and then the respondents were selected using systematic random sampling. In performing this, the researcher first identified boundaries, in this case district boundaries. The researcher then systematically selected a number of identified respondents with consideration that all the smallholder maize farmers within the study area had equal chances of selection.

3.5.1 Sample Size

The sample size was based on the formula provided by Cochran (1977). For example if the target population is greater than 50,000, then p is taken at 30% and the formula used is explained below:

Sample Size - Infinite Population (where the population is greater than 50,000)

$$SS = \frac{Z \times (p) \times (1-p)}{C^2}$$

SS = Sample Size

Z = Z-value

P = Percentage of population picking a choice, expressed as decimal

C = Confidence interval, expressed as decimal

A Z-value (Cumulative Normal Probability Table) represents the probability that a sample falls within a certain distribution.

$$SS = \frac{(1.96)*(0.3)*(0.7)}{0.0025}$$

Sample size = 165

3.6 Data Collection

3.6.1 Data Types and Sources

Both primary and secondary data were used in the study. Primary data was gathered through smallholder farmer questionnaire administered to households with information collected at household member level while secondary data was obtained from the key informants. The data collected include plot level output of maize and other food crops produced, the inputs used in the production process.

3.6.2 Data Collection Instruments and Methods

Questionnaires were administered to smallholder maize farmers. They were preferred because they can be used to gather data quickly from geographically dispersed population. They are also deemed economical in terms of time, effort and cost. The main disadvantage of questionnaires is that they are characterized by low rate of return of the duly filled in questionnaires when mailed and for this reason, the researcher with the help of research assistants administered the questionnaires. Another challenge expected with questionnaires is that it can only be used when respondents are educated and cooperating and there is also the possibility of ambiguous responses and omissions to certain questions and for this reason, research assistants were trained before going to the field to enable them explain to the respondents when interpreting and filling questionnaires.

An interview schedule was used to collect qualitative data from respondents. The

schedules provided the researcher with greater opportunity to explain the purpose of the study and the items in the interview schedule sought information on the socio economic factors that constraint maize production in the study area. Both closed and open ended questions were used in the development of the interview schedule to avoid limiting respondents' response and to facilitate guidance and probing for further clarification. This method was used because it offered the possibility of modifying one's line of inquiry allows in depth analysis and can be adapted to the ability and educational level of the respondent thus avoiding misinterpretation. Interview method has weaknesses too. It is time consuming and costly especially when large and widely spread geographical sample is taken. Only agricultural officers, research and extension agents were interviewed. Other methods of data collection used in the study include observation and focused group discussions.

3.7 Data Analysis

Two methods were used in the analysis of data that is descriptive statistics and inferential statistics. Descriptive statistics involve the comparison of means, cross tabulation, use of tables, pie charts and bar graphs. Inferential statistics involved the use of Cobb- Douglas production function estimation of its parameters. The data collected was analyzed statistically using econometric procedures. In this approach, SPSS software was used for data analysis. The study describes the data available considering its basic properties. Diagnostic test such as testing goodness of fit was carried out to ensure that the data was clean.

3.8 Ethical Considerations.

To ensure that all the research paradigms were followed, all the participants engaged in the study were asked not to include their identity during the study. Informed consent of the respondents was strictly adhered to in this study. The generalizations of the findings were based on the analysis of the study variables and comparison of the related studies made to this study.

3.9 Limitations of the Study

In this study, some respondents refused to voluntarily offer information on the questionnaires because they viewed the study with suspicion. They were assured that the information given was highly confidential and was only used for the purpose of research. Due to the vastness of the area and unreliability of means of transport, costs and time, most of the research activities were delayed. This was mitigated by providing for additional resources and time.

3.10 The Study Area

The study was carried out in Migori County. Migori County is in Nyanza Province of Kenya. It has a total population of 917,170 and covers an area of 2,597 km^2. The presence of Lake Victoria, Migori and Kuria rivers and the relatively good weather patterns in Migori County have allowed the soils in the region to be well drained making the county a conducive environment for agriculture. Agricultural produce consists of tobacco, sugarcane, maize, beans, coffee, groundnuts and vegetables. Fishing is a major economic

activity while livestock farming is undertaken on a small scale basis. Due to mineral resources available in the county, there is a nascent but growing mining industry particularly gold mining that many residents have taken up**.**

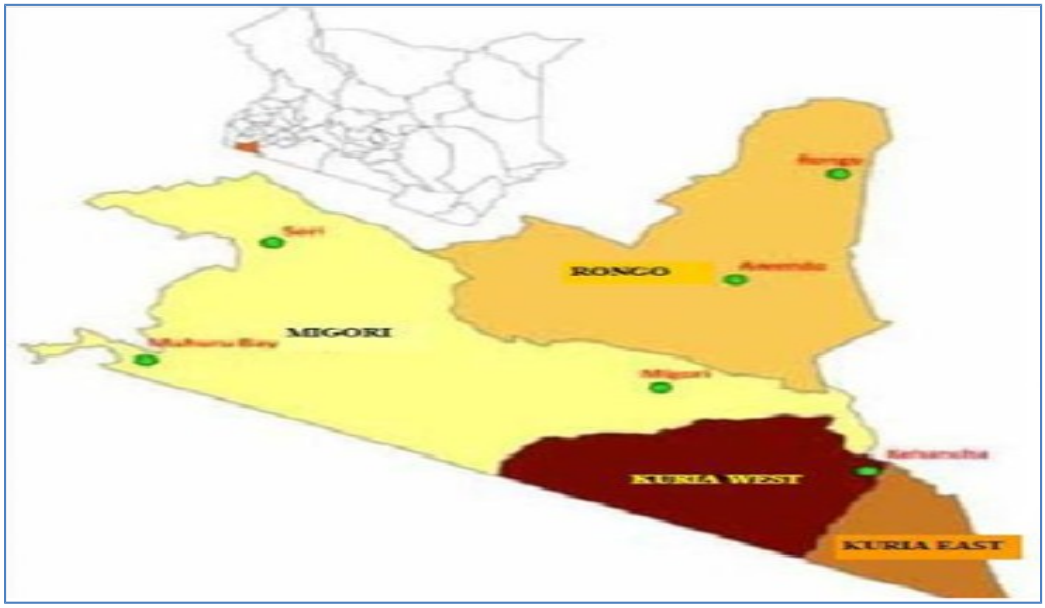


Fig 2.2: Map of Migori County
Source, Google map (http://www.flickr.com/photos/meta/ retrieved on 02/02/2012

CHAPTER FOUR

EMPERICAL RESULTS AND DISCUSSION

4.1 Introduction

This chapter is composed of four sections. Section 4.1, presents general characteristics of the sample. Section 4.2, presents aspects of tobacco farming while section three discusses maize production. Lastly, section 4.4, presents and discusses regression results from the survey data.

4.2 General Characteristics of the Sample

This section presents various indicators of the household socio economic profile of respondents. The major ones include; farm size, size of poultry, size of sheep, number of

cows, household size, age, tobacco area and maize acreage (table 4.1).

Table 4.1: Sample Characteristics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age of Respondents	165	20.0	88.0	41.4	13.0
No. of Household Members	165	1.0	18.0	5.1	3.0
Total Farm Size in Acres	165	0.3	38.3	5.0	4.4
Tobacco Area in Acres	165	0.0	5.0	1.1	0.8
Maize Area in Acres	165	0.0	37.5	2.3	3.2
Number of Bullocks	160	0.0	8.0	1.6	1.8
Number of Local Breed Sheep	165	0.0	20.0	1.1	2.6
Number of Local Breed Goat	163	0.0	20.0	1.2	2.5
Number of Cows	165	0.0	22.0	2.6	3.7
Number of Layers	165	0.0	87.0	12.4	13.1

Source: Author's Survey Data, 2013

The youngest farmer in the study area was 20 years while the oldest was 88 years with an average farmer's age being 41 years. This shows that the population of Migori County is relatively young. The average household size was 5. However, some households reported as high as 18 members which were attributed to polygamous tendencies among some families. The average farm size was 5 acres with some households owning as low as 0.3 acres and as high as 38 acres. This definitely demonstrates how land is a scarce resource in the county and continues to experience more pressure from the surging population. Despite growing tobacco on an average of 1.1 acres of land, farmers in Migori County find it necessary to allocate slightly more land area to maize on average 2.3 acres. This shows how maize is a key food security crop in the county.

The results also show that an average household in the county owns 4 heads of cattle, 1 sheep, 1 goat and 12 poultry animals. However, there were reported cases of some households who owned no livestock or owned above the average number. The general implication of this is that majority of households had a poor resource endowment which could alter acquisition of inputs.

Figure 4.1 shows the highest level of education attainment across the study area. Results show that about 89 percent of respondents did not go beyond primary school implying that they are either semi illiterate or totally illiterate. This could derail adoption of new production techniques because of poor understanding and interpretation of extension messages. This calls for adult education programmes to improve literacy level that is key for dissemination of agricultural technologies.

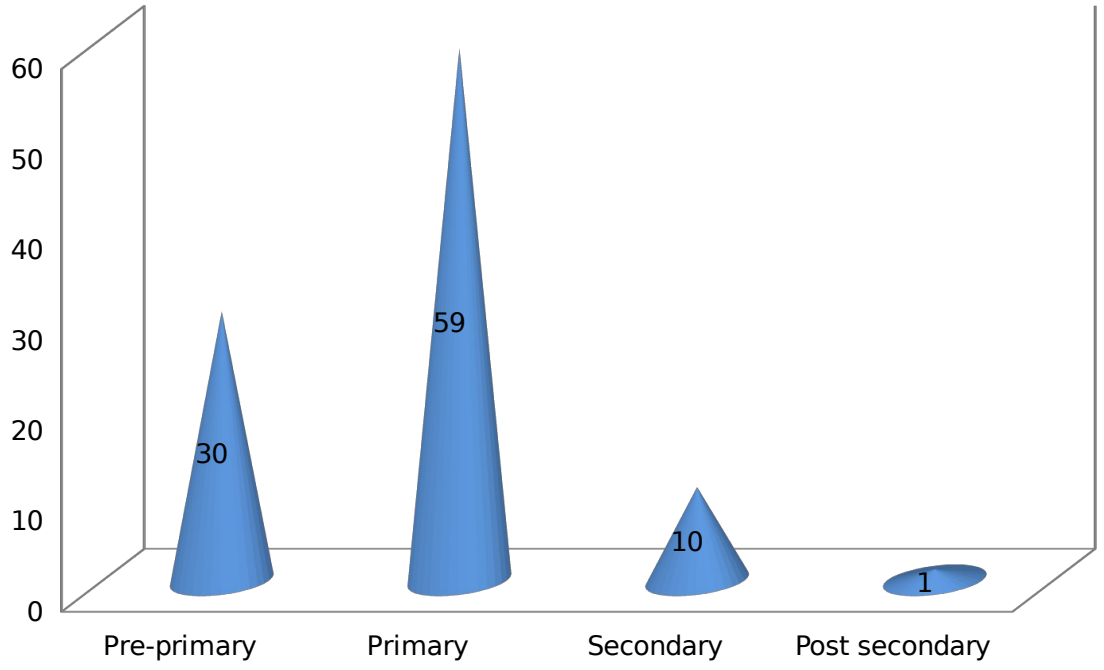


Figure 4.1: Education Level

Source: Author's Survey Data, 2013

Tobacco is a cash crop and is expected to give high returns to the farmers. Incidentally, about 83% of the farmers in the study area grew tobacco on their farms (Figure 4.2) implying that tobacco and maize have to share the available land.

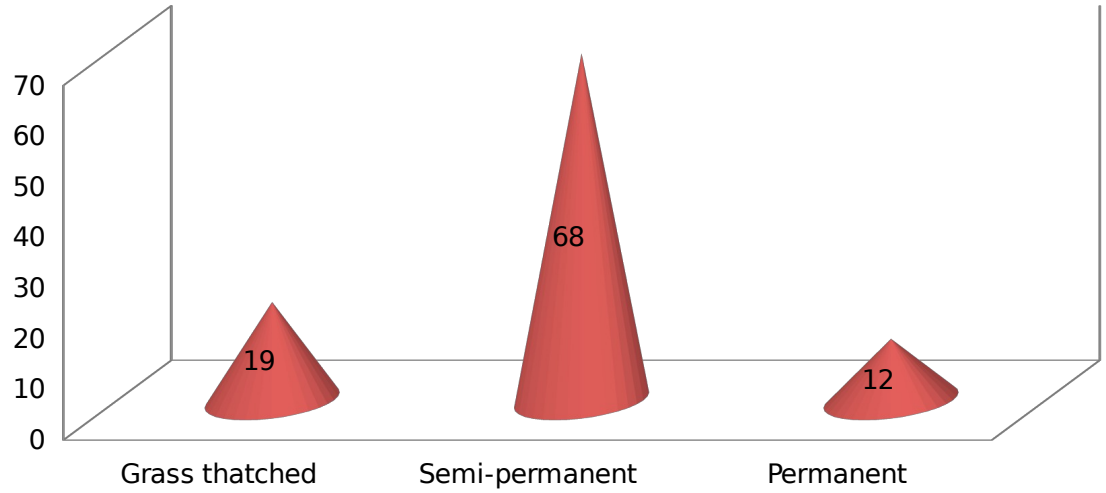


Figure 4.2: Type of Houses
Source: Author's Survey Data, 2013

However, when asked about the type of house they stayed in, a majority of respondents (68%) resided in semi permanent houses while 19% of respondents stayed in grass thatched houses (Figure 4.3) implying that despite growing tobacco they continued to wallow in poverty.

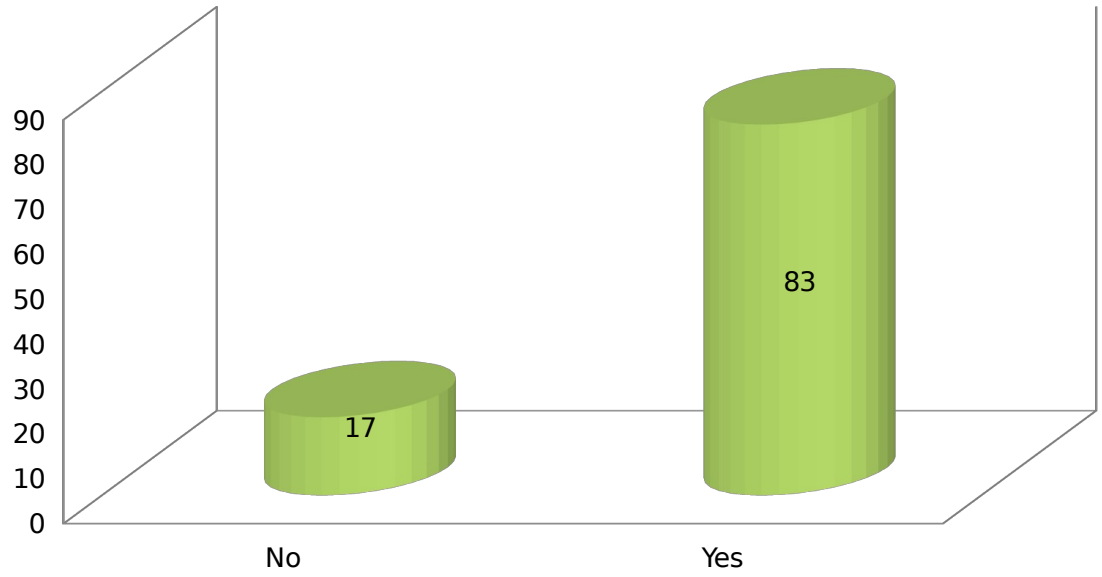


Figure 4.3: Number of Farmers who Grew Tobacco
Source: Author's Survey Data, 2013

4.3 Tobacco Farming

Table 4.2 shows results on profitability of tobacco production in Migori County. Results show that over 73% of respondents consider tobacco farming to be unprofitable. This reveals that in spite of continued pronouncements of profitability by the industry, farmers continue to hold contrary opinion.

Response	Frequency	%
No	120	73
Yes	45	27
Total	165	100

Table 4.2: Profitability of Growing Tobacco

Source: Author's Survey Data, 2013

Table 4.3 shows results on social welfare on farmers who grow tobacco in Migori County. It was established that over 61% of the farmers have realized no change in their social welfare. This reveals that returns from tobacco farming are not commensurate with the farmer's effort in its production.

Table 4.3: Social Welfare from Tobacco Production

Response	Frequency	%
Became better	42	26
No change	101	61
Worsened	19	12
Others	3	1
Total	165	100

Source: Author's Survey Data, 2013

While collecting data in the study area, the experience was not appealing. Farmers confessed why they were willing to quit tobacco farming. They got into tobacco farming with the aim of improving their economic status but as it later turned out, they were not achieving this goal but instead making losses. Tobacco farming consumed most of their time and never had any time left for them to bond with their family and concentrate on other food crop production activities. They noted that whenever they wanted to quit tobacco farming, BAT officers got wind of it and would tell farmers that the prices will be increased in the following year.

However, most of the farmers bank on their experience (figure 4.4) since the formal education they acquire is not sufficient to guarantee them adequate knowledge in farming practices. These findings imply that tobacco farming has no positive contribution to the social and economic welfare of the farmers in Migori County. However, it appeared that

tobacco firms exploit cheap labour as well as using tactics that keep farmers perpetually indebted to them.

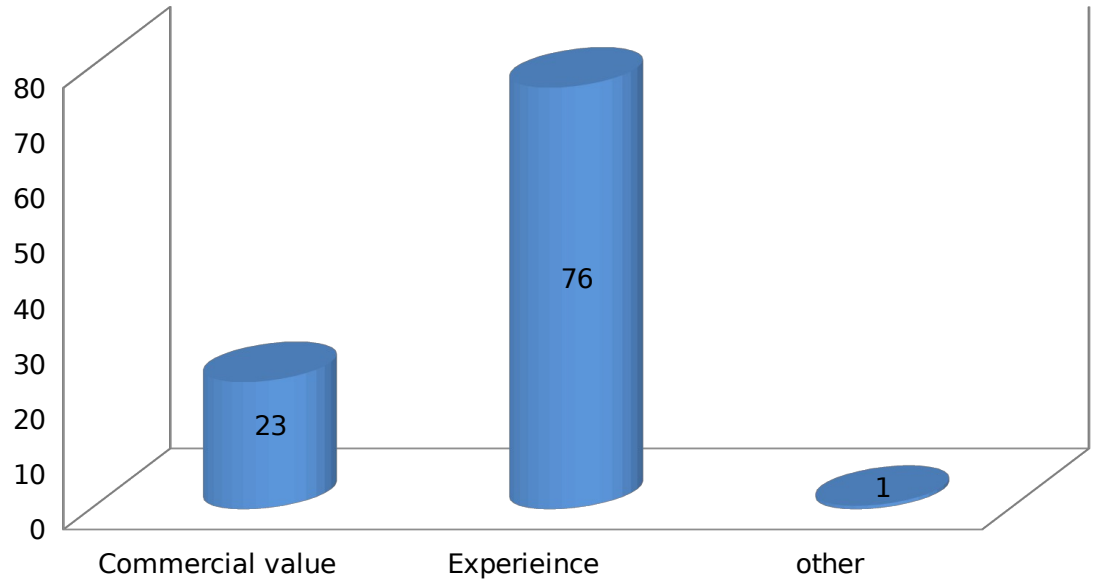


Figure 4.4: What informs Farmers Choice of Crop
Source: Author's Survey Data, 2013

4.4 Smallholder Maize Farming

Figure 4.5 below shows type of seeds used by the farmers in Migori County.

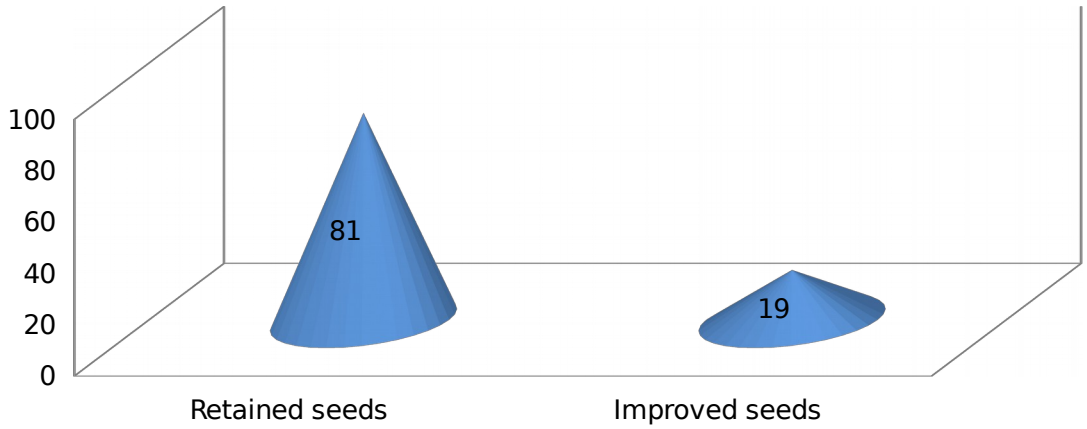


Figure 4.5: Type Seeds
Source: Author's Survey Data, 2013

About 81% of farmers used retained seeds in maize production. Most farmers, particularly in tobacco production areas, continue to rely on retained seeds because they cannot afford to buy certified seeds. Similarly, an increasing number of maize farmers use either the local maize varieties or the retained hybrid maize despite the increase in the number of hybrid maize varieties released by the seed companies. Fake seeds are sold at exorbitant prices to unsuspecting farmers. This explained their low productivity because such seeds require large amount of rainfall. This calls for awareness campaigns on the merits and demerits of using certified seeds backed with incentives to encourage its use.

4.5 Regression results

Table 4.4 shows regression results for estimated maize production function among smallholder farmers in tobacco growing area of Migori County. It indicated that the goodness of fit of the model was satisfactory. This was supported by adjusted R^2 value of 0.549 implying that 54.9% of the variation in Maize production was explained by the model.

Table 4.4: Regression Results of Cobb Douglas Production Function

Variables	Coefficients	Std. Error	t	P- Value
(Constant)	-2.795	1.825	-1.531	.129
LN $(Age)^2$	.278**	.124	2.248	.027
LN Cattle	.235**	.086	2.743	.007
LN Labour	.038	.133	.287	.775
LN Capital	-.135	.098	-1.382	.170
LN Fertilizer	.081	.096	.837	.405
LN Household Size	-.085	.095	-.890	.376
Gender of Household Head	.293	.167	1.754	.083
LN Area under Tobacco	-.262**	.130	-2.016	.047
LN Total Cropped Area	.729**	.104	6.990	.000
Residential Division	.029	.025	1.164	.247

LN Poultry	.116	.074	1.556	.123
Highest level of education	-.015	.099	-.150	.881
Occupation of Household Head	.183	.134	1.366	.175

R= 0.776; R^2 =0.602; Adjusted R^2=0.549; F= 11.290; ** Statistically Significant at 5%

Source: Author's Survey Data, 2013

Results show that age of the farmer was significant and positively influenced maize production in Migori County. The implication for this is that as farmers advance in age, they gain more experience in maize production. Efforts to increase maize production should therefore pay attention to experience of the stake holders since it informs their decision on production pattern. This is consistent with findings by Mignouna *et al.* (2010) that experience provides benefits of hindsight that is useful in decision making.

Similarly, the size of the cattle herd and total cropped area which were indicators of the asset base of the farmer were highly significant and positively affected the quantity of maize produced. This implies that better endowed farmers resource wise were likely to do better in maize production in Migori County since they can use such endowments to access essential production inputs. This is consistent with the studies of Kibwage *et al*. (2006) that farmer's resource improves productivity.

Area under tobacco (table 4.4) negatively and significantly affected smallholder maize production. This clearly indicates that tobacco production in Migori County competes for land, a scarce resource, with maize. Therefore despite misgivings by farmers, tobacco represents a big threat to maize production in Migori County. Tobacco farming seriously competes for the meager piece of land with maize production yet it degrades the environment and its returns were not commensurate with the farmer's effort. Similarly,

residents depend on wood fuel in curing tobacco despite a small proportion of land allocated to tree planting resulting to environmental degradation resulting in fluctuations in the amount of rainfall received exposing the county to crop failure. This is also consistent with the findings by Olwande (2012) who noted that commercial production competes for resources with subsistence farming. This calls for mass exodus from tobacco farming to another crop e.g. maize which doubles as both food and cash crop.

However, gender, geographical location, education and occupation were not critical determinants of maize production in the county. This is inconsistent with Mignouna *et al.* (2010), and a number of previous studies (Battese, 1992) which found education to be significant. This implies that residents of Migori County do not appreciate education as a major determinant of their farming practices. Little attention should be paid to aforementioned variables.

4.6 Hypothesis Testing

It was established that economic factors such as tobacco production negatively influenced maize production and using the t- test, the first hypothesis was rejected. Social factors for example age which is a proxy for experience indeed influence maize production. Similarly, using the t- test, the second hypothesis was rejected. However, geographical location of farmers does not significantly affect maize production and using the t- test the researcher failed to reject the third hypothesis.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.1 Summary

This study examined the socio economic factors that affect smallholder maize production in tobacco growing regions of Migori County. Descriptive results indicate that tobacco production in Migori County has continued to grow rapidly at the expense of the traditional food crops while simultaneously degrading the environment. Incidentally, about 83% of the farmers in the study area grew tobacco on their farms implying that tobacco and maize have to share the available land yet 73% of respondents consider tobacco farming to be unprofitable.

When asked about the type of house they stayed in, a majority of respondents (68%) resided in semi permanent houses while 19% of respondents stayed in grass thatched houses. It was established that over 61% of the farmers have realized no change in their social welfare. This reveals that returns from tobacco farming are not commensurate with

the farmer's effort in its production. Most farmers, particularly in tobacco production areas, continue to rely on retained seeds because they cannot afford to buy certified seeds. Similarly, an increasing number of maize farmers use either the local maize varieties or the retained hybrid maize despite the increase in the number of hybrid maize varieties released by the seed companies.

Nevertheless, preliminary investigations revealed that tobacco farming is highly labour-intensive-involving almost an entire family, leaving no room for growing of food crops. The effect is perpetual famine in the tobacco growing zones leading to malnutrition especially amongst the children. Earnings from tobacco were not commensurate with the cost of input incurred by farmers. Tobacco farmers were not in a position to feed, educate or clothe their children adequately. Child labour and school drop-out are common features in the tobacco growing zones. During drying of tobacco leaves (curing) a lot of biomass from indigenous flora is used. This leads to deforestation and even soil erosion. Moreover curing plants (barns) are designed in such a way that farmers are exposed to tobacco smoke - potentially making them candidates for tobacco-related diseases.

The youngest farmer in the study area was 20 years while the oldest was 88 years with an average farmer's age being 41 years and about 89 percent of respondents did not go beyond primary school implying that they are either semi illiterate or totally illiterate. The average household size was 5. However, some households reported as high as 18

members which were attributed to polygamous tendencies among some families with an average farm size of 5 acres and some households owning as low as 0.3 acres and as high as 38 acres. This definitely demonstrates how land is a scarce resource in the county and continues to experience more pressure from the surging population

A Cobb Douglas production model was fitted from the survey data where the value of adjusted R^2 was recorded as 0.549. Results showed that tobacco production negatively influenced maize production. Although it is a cash crop, the amount of income from the tobacco farming was not enough to sustain the livelihoods of the smallholder farmers.
This poses a major challenge to the achievement of goals on food security and poverty reduction.

5.2 Conclusions

The study sort to establish socio economic factors that influence smallholder maize production. It is concluded that smallholder maize production is affected by farmer's age which is a proxy for experience that provides benefits of hindsight in decision making. This calls for acknowledging farmers experience when formulating strategies for improving maize production.

Resource base as captured by size of cattle herd and total cropped area are critical drivers of maize production in Migori County. It is therefore important to empower farmers' resource wise to improve their chances of increasing maize production. This could be done by creating both off-farm and on-farm income generating opportunities that would

improve their purchasing power to facilitate access to production inputs. In addition, maize production faces stiff competition from tobacco farming which is also detrimental to the environment, the health of farmers and seems to keep majority of the farmers in a perpetual cycle of poverty. Measures should therefore be taken to improve the beneficial effect of tobacco on farmers while managing its deleterious effect on the environment and the farmers

5.3 Policy Implications

It is recommended that the extension services provided to farmers in Migori County should embrace simple approaches. Such services should be provided through the local language (s) or be properly translated to avoid misinterpretations by the farmers since they are illiterate and education does not inform their farming practices. On the same note, it is important to sensitize farmers and encourage them to opt out from tobacco farming to another crop such as maize. This is because tobacco farming is labour intensive and degrades the environment while maize is a crop for both commercial and subsistence farming.

This study recommends that the government should pay attention to the farmer's age in order to increase maize productivity in Migori County. They should provide basic production inputs to the elderly because they are more experienced and at the same time reduce school dropout. This will add value to the knowledge of the future farmers who will be required to embrace technology.

Attempts to persuade farmers to opt out of tobacco farming should be made successful by the government agencies, clergy and non-governmental organisations. They should be careful with tobacco firms who are aware of the scheme of the anti-tobacco crusaders and can use their massive financial prowess to thwart those attempts accordingly in order to succeed in making farmers addicted to growing tobacco because while some farmers understand the dangers inherent in tobacco farming, majority do not understand and are not ready to opt out. In the study area, an important tobacco growing zone, farmers should envisage any alternative income generating activities such as maize farming that doubles as food and cash crop. This will reduce competition from tobacco as well as environmental degradation.

In future, a research should be done to investigate the impact of fertilizers in tobacco farming on maize production. Similarly, there is need to investigate the socio economic impact of massive transition from tobacco farming to maize production.

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APPENDIX I: QUESTIONNAIRE FOR THE FARMERS

Name of the interviewer _____

Respondent's Code No. _____

Date of interview _____

County:_____

District:_____

Division:_____

Characteristics of Respondent

1.	Name of respondent	_____(Optional)
2.	Age (Years)	_____
3.	Marital status	[Married=l , Single=2, Widower/Widow=3]
4.	Father's occupation	[Same as respondent=l, Other=2(specify)]
5.	Highest level of education	[Pre-primary=1, Primary=2, Secondary=3, Post Secondary=4]
6.	Religion	[Christian=1,Muslim=2,Other=3(Specify)_____]
7.	Gender of head of household head	[Male=0, Female=1]
8.	Head of household’s occupation	[Farmer=1, Businessman=2, Formal employment=3 other=4 (specify)_____]
9.	Ethnic group	[Luo=1, Kuria=2, Kisii=3, Luhya=4,Other=6(specify)____]

Respondent's Family

Particular	<5 Years			5-18 Years			>18 Years			Grand Total		
	M	F	T	M	F	T	M	F	T	M	F	T
10. No. of family members												
11. No. at school												
12. No. working on the farm a) Fulltime												
b) Part-time												

13. Estimated Family Income (Per year)

Income from crops	Kshs._____
Income from livestock	Kshs._____
Income from labor (from outside farm)	Kshs._____
Remittances	Kshs._____
Any other	Kshs._____
Total family income	Kshs._____

14. Family's expenditure pattern

Item's expenditure	Expenditure/Month (Kshs.)	Expenditure/ Year (Kshs.)
a) Food Items		
b) Education		
c) Medical/ Health		
d) Cloths (including woolens/shoes		

etc)		
e) Social Functions		
f) Any other (Specify)_____		

15. Type of house

a) Grass thatched
b) Semi-permanent
c) Permanent
d) Other(specify)_____

Land use pattern

Description	**Area (acres)**
16. Own farm size	_____
17. Total cropped area in acres	_____
18. Leased area in acres	_____
19. Total farm size	_____
20. Area under trees	_____
21. Area under non-agric. Use	_____

22. Did you grow tobacco on your farm last season? Yes/No

23. If so, where did you sell your tobacco?

a) Alliance Company
b) Broker
c) Mastermind Company
d) Other(specify)____

24. Are you planning to plant tobacco this season Yes/No

25. When do you plant tobacco in this area? Month_____

26. How often do you grow tobacco on your farm?

a) Every year
b) Every 2 years
c) Every 3 years
d) Every 4 years

27. How long have you grown tobacco on your farm?

a) Less than 4 Years
b) 4-8 years
c) 8-12 years
d) More than 12 years

28. Immediately after harvesting tobacco which crop do you grow on your farm?

a) Maize
b) Beans

c) Groundnuts d) Cassava

e) Other(specify)_____

29. What determines your choice of a particular crop enterprise and how much land you allocate to it?

a) Commercial Value of the crop b) Experience

c) Tradition d) Other(specify)_____

30. Cropping **pattern, production and marketing (last season)**

Crop	**Area (Acres)**	**Yield(--/Acre)**	**Prodn(Bags/Kgs)**	**Home consum. (Bags/Kgs)**	**Marketed surplus (Bags/Kgs)**	**Market price (Kshs.)**	**Prodn value (Kshs.)**	**Marketed value (Kshs.)**
Tobacco								
Maize								
Cassava								
Sugarcane								
Sorghum								
Fodder								
Vegetable								
Sweet potato								
Beans								

31. Please list the quantity of labor used in the following crop activities and associated unit cost for last season

	Labor requirements and unit cost															
Activity\Crop	Tobacco		Maize		Cotton		Sugarcane		Sorghum		Fodder		Vegetable		Fruits	
	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost
Land clearin																

g																
Ploughing																
Harrowing																
Planting																
Weeding																
Harvesting																
Total																

32. Out of the total labor requirements mentioned in 69 above, specify their sources and their relative importance for each crop.

	Labor requirements and unit cost															
Activity\Crop	Tobacco		Maize		Cotton		Sugarcane		Sorghum		Fodder		Vegetable		Fruits	
	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost	Qty (md)	Unit cost
Family labor																
Hired labor																
Total																

33. Which months of the year do you require plentiful supply of labor?

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept.	Oct.	Nov	Dec
Yes												
No												

34. Do you consider tobacco growing to be profitable? Yes/No

35. If so, how much profit did you make last season? Kshs/acre_____

36. How has your economic status changed because of tobacco farming?

a) Become better
b) No change
c) Worsened
d) Other(specify)_____

37. Does tobacco growing compete with food crops for your piece of land Yes/No

38. If so, how has it affected your ability to provide your family with food from your farm?

a) Reduced
b) Increased
c) No change
e) Other(specify)
d)

39. Livestock ownership

Livestock	**Number**
Bullocks	
Cows a. Ayshires b. Friesians c. Zebus d. Crossbreeds e. Jerseys	
Sheep a. Local Breed b. Exotic c. Crossbreed	
Goats a. Local breed b. Exotic c. Crossbreed	
Poultry a. Layers b. Broilers c. Indigenous	

Soil fertility management

40. Have you ever tested your soil for nutrients composition? Yes/No

41. If not, what makes you not to test your soil for fertility?

a) It is too expensive
b) I don't know where to test
c) There are no testing facilities around
d) I don't see any need to go for test-

here ing

42. If so, what are the benefits of testing your soils?

a) It helps you to know how much fertilizer to apply
b) It prevents wastefulness in fertilizer use
c) It enables you pick the right fertilizer for your farm
d) It enables you understand your soil

43. Do you use fertility enhancing products on your farm? Yes/No.

44. If not, which of the following reasons explain your inability to use fertility enhancing inputs on your farm?

a) Expensive
b) Ignorance
c) Lack of information on proper use of inputs
d) It is uneconomical

	Soil amendment type				Soil amendment type				Soil amendment type			
Period of usage	<3 Years				3-6 Years				>6 Years			
Crop	FYM (kg)	P (kg)	N (kg)	Lime (kg)	FYM (kg)	P (kg)	N (kg)	Lime (kg)	FYM (kg)	P (kg)	N (kg)	Lime (kg)
Tobacco												
Maize												
Sugarcane												
Sorghum												
Fodder												
Vegetable												

45. If so, list below the period, types and quantities of the following soil fertility amendments used on your farm?

46. Have you been told before that inappropriate use of fertilizer can damage your soils? Yes/No

47. If so, what was the source of this information?

a) Extension agents
b) Neighbors
c) NGOs
d) Universities
e) Research Institutions
f) Local administrators' baraza's

48. What do you consider to be bad use of fertilizer?
    a) Excessive use of fertilizer
    b) Application of fertilizers without testing soils
    c) Use of wrong types of fertilizers
    d) Use of fertilizer on non-valuable crops
    e) Other specify)_____

49. Has your farm suffered from effects of bad use of fertilizer? Yes/No

50. If not, how have you managed to escape damaging effects of bad use of fertilizer?
    a) I don't use inorganic fertilizer
    b) I test my soil before applying fertilizer
    c) I use FYM
    d) Other(Specify)_____

51. Which of the following soil fertility improvement measures do you practice on your farm?
    a) Chemical fertilizers
    b) Compost manure
    c) Farm yard manure
    d) Other(Specify)_____

52. For each of the following crops indicate application rater (kgs/acre), frequency (per year) and price(Kshs.) of the following fertility improvement practices.

Crop	P-fertilizer			N-fertilizer			Composed manure			FYM			Other(specify)		
Tobacco	Rate	Freq.	Pric	Rate	Freq.	Price	Rate	Freq.	Price	Rate	Freq.	Price	Rate	Freq.	Price
Maize															
Sugarcane															
Sorghum															

Fodder															
Vegetable															

53. What is the distance to your nearest tobacco selling point? _____

54. How do you dispose off your tobacco to the market

a) I deliver myself to the factory
b) Contracting company picks from my farm
c) I sell through broker
d) Other (specify)_____

55. Do you experience any problems when trying to sell your commodities? Yes/No

56. What are the major constraints to marketing of tobacco?

a) Bad prices
b) Delayed payment
c) Distant markets
d) Poor infrastructure

57. Do you experience any soil erosion problems on your farm? Yes/No

58. If so, what are the main causes of soil erosion?

a) Intense rain b) steep slopes c) soil characteristics d) Lack of soil conservation structures

59. Are you aware of any soil and water conservation measures? Yes/No

60. If so, what was the source of this information?

a) Extension agents
b) Neighbors
c) NGOs
d) Universities
e) Research Institutions
f) Local administrators baraza's

61. If not, what is the reason?

a) Am not interested
b) My farm is not susceptible
c) Have never been trained
d) Other (specify)_____

62. If so, have you instituted any soil and water conservation measures on your farm? Yes/No

63. If yes, what types of soil and water conservation measures do you practice on your farm?

a) Fanya juu/chini
b) zero/conservation tillage
c) Bench Terraces
d) Planting trees
e) Cut off drains
f) River bank protection
g) Trash lines
h) vegetation strips
i) Mulching
j) Stone lines

64. Are you a member of any group that engages in /tobacco or maize farming? Yes/No

65. If so, describe the type of activities that you do together as a group.

_____

_____

_____

66. Have such group interactions been of value to you? Yes /No

APPENDIX II: WORK PLAN

Phase/activity	**Time(month)**	**Dates**
Development of proposal	1	October 2011
Piloting	1	November 2011
Data collection	1	February 2012
Data organization, analysis and interpretation	3	May 2012
Report writing editing/submission	3	August 2012

APPENDIX III: BUDGET

N o.	**Item**	**Description**	**Estimated Amount (Ksh)**
1.	Personnel	1 field assistant @ 500/day for 21 days	10,500
2.	Printing materials	Binding cost, Papers, , writing materials, drinks for focused group discussions etc.	7,000
3.	Transport	Fare	10,000
4.	Services	Photocopy, secretarial	5,000
5.	Miscellaneous	Leisure and others	2,000
Total			**34,500**

APPENDIX IV

CORRELATION MATRIX

VARIABLES	Highest Level of Education	Gender of HH	Occupation of HH	Ln Age	Ln Farm Size	Ln Labour	Ln Capital	Ln Fertilizer	Ln House Hold Size	Ln Area for Tobacco
Highest Level of Education	**1**	**.018**	**.295****	**-.117**	**.010**	**-.016**	**.006**	**-.051**	**-.104**	**-.042**
Gender of HH	**.018**	**1**	**-.151**	**-.037**	**.198***	**-.068**	**-.047**	**.134**	**-.002**	**.148**
Occupation HH	**.295****	**-.151**	**1**	**-.086**	**.121**	**-.046**	**.201****	**-.063**	**-.053**	**.117**
Ln Age	**-.117**	**-.037**	**-.086**	**1**	**.462****	**-.016**	**.088**	**-.118**	**.142**	**.230****
Ln Farm Size	**.010**	**.198***	**.121**	**.462****	**1**	**.051**	**.041**	**-.040**	**-.036**	**.432****
Ln Labour	**-.016**	**-.068**	**-.046**	**-.016**	**.051**	**1**	**-.145**	**.062**	**.070**	**-.024**
Ln Capital	**.006**	**-.047**	**.201****	**.088**	**.041**	**-.145**	**1**	**.187***	**-.015**	**.033**
Ln Fertilizer	**-.051**	**.134**	**-.063**	**-.118**	**-.040**	**.062**	**.187***	**1**	**-.011**	**-.004**
Ln Household Size	**-.104**	**-.002**	**-.053**	**.142**	**-.036**	**.070**	**-.015**	**-.011**	**1**	**-.055**
Ln Area For Tobacco	**-.042**	**.148**	**.117**	**.230****	**.432****	**-.024**	**.033**	**-.004**	**-.055**	**1**

** & * Correlations significant at 1% and 5% respectively.

Source: Author's Survey Data, 2013