DETERMINANTS OF MAIZE YIELDS AMONG SMALL SCALE FARMERS IN TRANS NZOIA WEST SUB COUNTY, TRANS-NZOIA, KENYA.

BY

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DECLARATION

This research project is my original work and has not been presented for award of degree in this or any other university.

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LA50/76726/2014

This research project has been submitted with my approval as the university supervisor.

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DEDICATION

This research project is dedicated to my wife Lilyan, my son Mike and daughters Victoria and Joy Susan for their sacrifice, love, support and encouragement throughout this course.

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ABBREVIATIONS AND ACRONYMS

AGRA: Alliance of Green Revolution in Africa

DFID: Department for International Development

FAOSTAT: Food and Agriculture Organization Statistics

GOK: Government of Kenya

IPCC: Intergovernmental Panel on Climate Change

KARI: Kenya Agriculture Research Institute

MENR: Ministry of Environment and Natural Resources

NAAIAP: National Accelerated Agricultural Input Access Program

OPVs: Open Pollinated Varieties

OXFAM: Oxford Committee for Famine Relief

SPSS: Statistical Packages for Social Sciences

WHO: World Health Organization

ABSTRACT

Maize is a global crop. In terms of nutrient formation, maize contains approximately 72% starch, 10% protein, 4% fat supplying 365kcal/100g.It is a staple food in many African countries including Kenya with the largest production from small scale farmers. Investigating to understand the determinants of maize yields among small scale farmers is therefore an important area of study. The purpose of the study was to investigate the determinants of maize yields among small scale farmers in Trans Nzoia West Sub County of Trans Nzoia County in Kenya.. The following objective guided the study; to investigate how access to farm inputs determine maize yields in Trans Nzoia West Sub County; to assess how adoption of modern farming techniques by small scale maize farmers determine maize yields in Trans Nzoia West Sub County; to investigate how incentives to small scale maize farmers determine maize yields Trans Nzoia West Sub County; to assess how weather conditions determine maize yields in Trans Nzoia West Sub County. The study adopted descriptive survey design. The target population was 38,183 representing the total number of households that practice small scale crop farming in Trans Nzoia West Sub County. A Sample size of 396 respondents from small scale maize farmers in Trans Nzoia West was used for the study. Cluster sampling of villages in the wards was done then random sampling done on the clusters to get respondents. Questionnaires and interview schedule was used to collect data. A pilot study was done in the neighboring Chebon location. To ascertain the reliability of the instruments, test-retest method was used. The collected data was then analyzed using frequency tables and percentages and explanations given in each case to guide interpretation. Results of the analysis were interpreted and recommendations made at the end of the study. It was found that 40% and 58% of farmers do not use certified seeds and organic fertilizers respectively largely due to cost, distance and unavailability of the inputs close to their farms. In addition, a large percentage of small scale maize farmers do not test acidity levels or manage nutrient levels of their farms. The inputs subsidy program, difficulties to access credit and unavailability of inputs in farmers' locations was experienced by a large percentage of small scale maize farmers.46% and 31% respectively of small scale maize farmers' maize yields had been affected by

unreliable rainfall and high temperatures. Recommendations made included; County Government of Trans Nzoia Should, establish inputs distribution centers in sub locations. Streamline inputs subsidy programs and Extension officers to educate farmers on soil acidity and nutrient management. The study suggested further study on how maize yields is affected by small scale maize farmers' attitude towards modern farming techniques and the influence low market prices for maize and importation of maize which retail at cheap prices.

CHAPTER ONE

INTRODUCTION

1.1Background of the Study

Maize also called corn is believed to have originated from Mexico 7000 years ago from a wild grass. The wild grass was then transformed into a source of food by Native Americans. In terms of nutrient formation, maize contains approximately 72% starch, 10% protein, 4% fat supplying 365kcal/100g.It is currently grown throughout the world. The biggest producers being United States of America, China and Brazil respectively. Republic of South Africa is the twelfth maize producer globally but the leading in Africa. According to Food and Agriculture Organization Statistics (FAOStat), it was estimated that in 2012, the total world production of maize was 875,226,630 tons. Maize, wheat and rice account for 94% of cereal consumption. In Africa where maize is staple food, consumption ranges from 52 to 328 grams per person per day according to World Health Organization (WHO) survey and FAOSTAT food balance sheet obtained in 2009. Maize provides humankind with more nourishment than any other food class with nearly half the calorific requirement. The consumption of maize varies by region; maize is the most preferred in Southern and Eastern Africa, Central America and Mexico. Maize meal and flour are the most popular processed products. Demand for maize has continued to grow as a result of increased food demand. Consequently, such increase in demand must be met by increasing the productivity of maize per unit of land (Paudyal et al., 2001; Pingali, 2001). However, over the decades, the agricultural production including maize has either remained stagnant or increased at a very slow rate (Kaini, 2004).

Maize varieties grown in the world are of various types differentiated by color, grain size and sugar level. Maize kernels can be of different colors ranging from yellow, white and red black. Yellow maize is popular in the United States of America. Maize grown in Africa, Central America and Southern United states are predominantly white. Yellow maize is widely associated with aid or relief and this is one of the reasons it has not been embraced in many parts of the world. Classification by size places maize into dent, flint, waxy, flour, sweet, pop, Indian, and pod corn. Another difference or classification criterion is the sweetness or amount of sugar. The amount of residual sugar depends on the variety of maize and when it is harvested from the field. Sweet maize stores poorly and must be eaten fresh, canned, or frozen before the kernels age, becoming small, tough, and starchy. Sweet varieties cannot be fortified.

In the United States of America, maize that is popularly produced is known as corn. The United States of America is the largest producer of maize. The total production in the year 2013/2014 was 13.02 billion bushels. Corn is mainly used in the manufacture of ethanol and its co-products .There are 80 Million acres or 32million hactares of land set aside for corn cultivation .95% of United States of America's corn farmlands are owned by families with 90 families of farmers accounting for 55% of corn exports. Corn cultivation is majorly done under un- irrigated condition with only 11% carried out on irrigation.

In Brazil there has been continued increase in corn produced attributed to abundant rainfall and increase in acreage under production. The country has two planting seasons annually in September and January. Brazil is the 3rd largest producer of maize in the world according to the 2012/13 global statistics. The production in year 2012/13 is estimated at 76 Million tons surpassing the previous year's 73 million metric tons. In 2012/13, the country

produced on average 4.65 tons per hectare. Other factors that have led to increased production include increased fertilizer use, use of improved maize varieties including genetically modified ones. Usually the first crop produces better yields than the second one though at times the second crop performs better. The first crop is utilized for food as the second crop is taken to markets and exports.

In China, maize is ranked second among its cereal crops. It is the world's second largest maize producer after the United States of America. In 2012, China's production was 208 metric tons. This grew to 348.2 metric tons in 2013 and was projected to grow to 349.3 metric tons in 2014-2015. Maize produced is mainly used as animal feed which accounts for over 67.45% as per the 2006 statistics. China is a net importer of corn and has been working on modalities to become corn sufficient. There are concerted efforts to increase corn productivity mainly due to the growing demand for food and animal protein. Substantial acreage in China is planted with the three main grain crops; corn, rice and wheat. However in the recent past, the acreage for corn has substantially increased mainly due to incentives. Rice has serious quality issues resulting from wet harvesting and lack of drying equipment which puts corn at an advantage since it doesn't suffer this shortcoming. Secondly, many livestock producers are not used to feed wheat to their animals; therefore they are purchasing corn rather expensively.

In Nigeria maize production is practiced predominantly by small scale farmers (Oladeebo, 2004). Nigeria is one of the biggest maize producers in Africa. In 2013, 5.56 million hectares were cultivated with maize accounting for 16% of Africa's production combined. Accelerated growth begun in the 1980s when improved hybrid varieties were introduced. There was however productivity challenges despite increase in area of cultivation.

Whereas the area grew by 3.8%, yields only grew by 0.5%.This was attributed to drought, insect pests such as maize stalk borer, and diseases such as maize steak virus, Gray leaf spot, and maize leaf blight. Parasitic weed striga hermonthica also had a contribution in the slowed growth. Other factors included institutional and policy aspects such as research and capacity, level of input utilization. All of the 36 states and the FCT (Federal Capital Territory) grow maize. Those states with the highest maize area are Niger, Kaduna, Ogun, Kogi, Taraba, Katsina, Oyo, Plateau, Ondo, and Kano. Together, these account for nearly 57% of the total area. As well Kaduna, Niger, Plateau, Borno, Kano, Ondo, Ogun, Taraba, Kogi, and Bauchi together account for close to 60% of maize production in the country

In Kenya, Agriculture provides over 70% of rural employment and approximately 18% formal employment. (Olwande et al., 2009)points out that in Kenya, age, education, credit, presence of a cash crop, distance to fertilizer market and agro ecological potential significantly influenced maize production by smallholder farmers. (Wanyama et al., 2009) notes that in Kenya, change agents (extension) visit to farmers, proportion of land under maize production, sex of household head, and agricultural training significantly affected likelihood of farmers adopting new technologies in maize production. Maize is the main staple in the diet of over 85 per cent of the population in Kenya. The per capita consumption ranges between 98 to 100 kilograms which translates to at least 2700 thousand metric tonnes, per year (Nyoro et al., 2004). Small scale production accounts for about 70 per cent of the overall production. The remaining 30 per cent of the output is from large scale commercial producers (Export Processing Zone Authority, 2005). Small scale producers mainly grow the crop for subsistence, retaining up to about 58 per cent of their total output for household consumption (Mbithi, 2000). Poor weather is blamed for the low output of maize in some

years. However, yields have also remained at an average of 2 tonnes per hectare below the possible 6 tonnes per hectare a situation attributed to inadequate absorption of modern production technologies such as high yielding maize varieties and fertilizers because of high input costs, lack of access to credit and inadequate extension services to small scale producers (Kang'ethe, 2004).

1.2 Statement of the Problem

Maize is the main staple in the diet of over 85 per cent of the population in Kenya. The per capita consumption ranges between 98 to 100 kilograms which translates to at least 2700 thousand metric tons, per year (Nyoro et al., 2004). Small scale production accounts for about 70 per cent of the overall production. The remaining 30 per cent of the output is from large scale commercial producers (Export Processing Zone Authority, 2005). Small scale producers mainly grow the crop for subsistence, retaining up to about 58 per cent of their total output for household consumption (Mbithi, 2000). However, yields have also remained at an average of 2 tons per hectare below the possible 6 tons per hectare a situation attributed to inadequate absorption of modern production technologies such as high yielding maize varieties and fertilizers because of high input costs, lack of access to credit and inadequate extension services to small scale producers (Kang'ethe, 2004).

The economy of Saboti Sub County largely depends on Agriculture. In Trans Nzoia West Sub County, the sustained economic growth of the majority of communities relies on small scale Agriculture. According to Kwesiga (2004), sustainable economic growth is growth that is durable, environmentally friendly and widely supported and shared .The livelihood of the people in Trans Nzoia West Sub County depends mostly on small scale Agriculture. Agriculture provides 70% of rural employment (Olwande et al, 2009).For decades; Trans

Nzoia West Sub County has relied on maize farming to meet its food requirements and income to cater for other social and financial needs. Maize consumption ranges from between 52 to 328 grams per person per day. Farmers also sell part the maize produce to meet needs such as medical, education and reinvestment in the farm for subsequent crop production. Maize production is therefore a key economic activity for people in the sub county hence the need to ensure high productivity of maize crop. However maize production in the sub county has been falling. KARI (2005) attributes the declining maize production to continuous cropping of maize, removal of field crop residue for feeding livestock, overgrazing, burning of Stover in situ to ease ploughing resulting to the deterioration of both the physical and chemical soil properties. In Trans Nzoia West Sub County, the shortage has been evident a situation that has led to marketers bringing in supplies to sell to local inhabitants at high prices. The study thus seeks to establish factors behind the status of maize yields in Trans Nzoia West Sub County.

1.3. Purpose of the Study

The purpose of this study was to investigate the determinants of maize yields among small scale farmers in Trans Nzoia West Sub County, Trans Nzoia in Kenya.

1.4. Objectives of the Study

i. To investigate how access to farm inputs determine maize yields in Trans Nzoia West Sub County.
ii. To assess how adoption of modern farming techniques by small scale maize farmers determine maize yields in Trans Nzoia West Sub County.
iii. To investigate how incentives to small scale maize farmers determine maize yields Trans Nzoia West Sub County.
iv. To assess how weather conditions determine maize yields in Trans Nzoia West Sub County.

1.5. Research Questions

i. How does access to farm inputs determine maize yields among small scale farmers in Trans Nzoia West Sub County?
ii. How does adoption of modern maize farming techniques determine maize yields in Trans Nzoia West Sub County?
iii. How do incentives determine maize yields among small scale farmers in Trans Nzoia West Sub County?
iv. How do weather conditions determine maize yields among small scale maize farmers in Trans Nzoia West Sub County?

1.6. Significance of the Study

The research findings were purposed to provide information to the county Government of Trans Nzoia on the determinant of maize yields and suggest areas of improvement. Secondly, the findings were to be a resource to stakeholders including Agriculture extension officers, financial institutions and farmers on sustainable maize production. In addition the findings were intended to form a basis for further research by scholars to establish other factors that determined maize yields. Lastly, the research findings were to be used as reference material in the University of Nairobi Library for other scholars carrying out studies in similar or related fields and the general public.

1.7. Delimitations of the Study

The study was carried out in Trans Nzoia West Sub County. The sub county covers an area is 745.5square kilometers. (Trans Nzoia County Development Profile, 2013). The scope of the study will be limited to small scale maize farmers in Trans Nzoia West Sub County and Agriculture extension officers. Given that the other sub counties in Trans Nzoia as well as other counties in the country practice maize farming, findings of this research will be generalized to the other maize growing zones.

1.8. Limitations of the Study

This study was inhibited by a number of factors as discussed below. Firstly, accessing a majority of interior areas was challenging due to bad roads. The researcher hired motor cycles in order to access interior areas. The research assistants hired were locals who understood the terrain. Secondly, some respondents were illiterate and therefore were unable to read and write. This was overcome by employing the services of the research assistants who read and interpreted the questions to the respondents and noted down the responses. Prolonged dry spells brought extreme sunny conditions which were mitigated by supplying umbrellas to research assistants.

1.9. Assumptions of the Study

1. The researcher assumed the responses from the filled questionnaires represented the views and position of all small scale maize farmers in Trans Nzoia West Sub County.

2. Respondent's answers were assumed to be true in regard to the questions in the questionnaire document.

1.10. Definition of Terms

Determinants of maize yields: Factors that affect yields

Modern farming techniques: Improved or superior farming methods capable of delivering high yields

Access to farm inputs; the ease to acquire maize seeds and fertilizer

Incentives; Motivators, subsidies, ready markets etc to maize farmers

Weather conditions; climatic aspects such as rainfall, temperature etc**.**

Staple food; food consumed most by majority of the population

1.11. Organization of the Study

The study was organized in five chapters. Chapter one focused on the introduction, background to the study, statement of the problem, purpose and objectives of the study, research questions, significance of the study, delimitations to the study, limitations to the study, assumptions of the study and definition of terms. Chapter two handled literature review. The chapter was organized according to the objectives of the study. It also dealt with the theoretical framework, conceptual framework, research gap and finally a summary of literature review. Chapter three was on research methodology. This encompassed research design, target population, sampling procedure and sample size, research instruments, data collection procedure and analysis and operationalization of variables. Chapter four presented data analysis, interpretation, presentation and discussions of the findings. Chapter five focused on the summary, conclusions, recommendations and suggestions for further research in the area of study.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This chapter focused on the review of earlier research and findings about the subject areas or themes of this study. It reviewed earlier research and findings on access to farm inputs by small scale maize farmers, adoption of modern farming techniques, farmer incentives and the influence of weather conditions on maize yields. The main aim of this review was to understand the research milestones already covered and relate the earlier findings to experience the ground in Trans Nzoia West Sub County.

2.2. Access to farm inputs and maize yields

To achieve high maize productivity, the quality of inputs is paramount. According to Nyoro, 2002, high quality farm inputs are a prerequisite for high maize yields. Among agricultural inputs, seed is recognized to have the greatest ability of increasing on-farm productivity since seed determines the upper limit of crop yields and the productivity of all other agricultural inputs (MoA 2004). There has been considerable adoption of hybrid maize seed in the high maize potential. According to M. Ayieko (2005) and Tegemeo Household Survey 2004, cerified maize seed usage in Kenya's high maize potential areas is 61% whereas 39% use retained or indigenous maize seed. There are cases of farmers using part of harvested grain, retained maize seed from previous seasons and open pollinated varieties (OPVs). Farmers who recycle grain are faced by risk of declined yields of between 5 percent for open pollinated varieties (OPV) and 30 percent for hybrids (Pixley & Banziger 2001). According to Langyintuo et al. 2008, a study done to compare improved maize seeds sales volume showed a decline between 1997 and 2007 in Eastern and Southern Africa Countries with Angola reducing by 7% Zimbabwe by 2% and Kenya by 1%Kenya. Farmers have also been discouraged from adopting certified maize seed due to past disappointments.Unscrouplous business people have infiltrated the maize seed market with substandard maize seed packaged in branded bags of know companies duping farmers to buy the products, as a result, germination has been poor and consequently poor yields. Consequently, small scale farmers have continued to lose faith in hybrid maize seed brands and resorted to uncertified seeds. As noted by Nyoro, (2002), farmers who adopt this poor quality although certified seeds have been disappointed as a result of poor germination and low yields of the certified maize seeds.

Soils in the once fertile high potential zones have continued to lose fertility as a result of a number of factors including mono cropping, burning of crop residue, inadequate fertilizer use and erosion. The remedy to this challenge has been to push farmers into full adoption of fertilizer use which has seen an increase in usage especially in high potential zones Sheahan,(2011).To achieve optimal usage the Government and other stakeholders have initiated programs aimed at enhancing access and accelerating fertilizer usage. In Kenya, National Accelerated Agricultural Inputs Access Program (NAAIAP) is one such program. The aim of the program besides improving productivity is to increase soil fertility. Organic fertilizer usage has however been low among small scale maize producers. According to Kherallah et al. (2002), majority of small scale farmers cannot afford the cost of fertilizer. He also notes that inadequate supply and high transportation cost due to far off distances from farms to supply outlets also affect adoption and usage of organic fertilizer. Larson and Frisvold (1996) also notes that low usage of organic fertilizer is partly due to inadequate supply and lack of affordable packaged fertilizer for farmers dealing with small pieces of land.

2.3. Adoption of modern farming techniques and maize yields

Maize production from land preparation to the final stage when the produce is taken to the market involves a number of operations that impact on the profitability. The farming techniques touch on how land is prepared, the time planting is done, seed and fertilizer selection and usage, weeds and diseases control techniques, harvesting and storage etc. A migration from the tradition methods across the entire cycle to modern technology guarantees better sustainable yields. According to Jain et al., 2009, Agricultural technologies include all kinds of improved techniques and practices which affect the growth of agricultural output. As Challa, (2013) notes, there is a relationship between inputs used and yields and those farmers who empress improved

agricultural technologies realize improved production which results in overall socio-economic development. Adoption of improved agricultural technologies has been associated with: higher earnings and lower poverty; improved nutritional status; lower staple food prices; increased employment opportunities as well as earnings for landless laborers (Kasirye, 2010). Embracing of improved technologies is believed to be a major factor in the success of the green revolution experienced by Asian countries (Ravallion and Chen, 2004; Kasirye, 2010).The same input/output relationship plays out for those who are stuck to tradition subsistence production techniques. As Jain et al., (2009) notes, such farmers can hardly maintain their marginal livelihood with socio-economic stagnation leading to deprivation. This happens to be the reality with majority small scale maize farmers as they rely on traditional methods of production as a result drastically lowering productivity Muzari et al., (2012).Small scale farmers in developing countries have to adopt modern technology as they are exposed to factors that affect productivity such as erratic rainfall, soil infertility, pests, diseases and weeds and uncertain markets which call for modern storage techniques to await better market prices.

Use of traditional maize harvesting, drying, packaging and storage lead to losses before and after harvesting the maize crop. According to Compton, 1992; Azu, 2002; Republic of Kenya, 2004, Maize grain losses contribute to food insecurity and low farm incomes not only in Kenya but also in other sub-Saharan African countries. Maize losses are witnessed at different stages including during staking, de-husking, transportation, drying, shelling, and storage. Timely harvesting also prevents attacks by weevils, rotting and theft. In addition, farmers need to embrace modern practices to manage soil acidity which is one of the leading hindrances to maize yields in high potential areas.

Failures to manage soil acidity levels and plant nutrients have great impact on crop productivity. Due to low soil pH and poor availability of plant nutrients, such as phosphorus (P), calcium (Ca), magnesium (Mg) and potassium (K).soil biological activity hinders organic matter mineralization and therefore, nitrogen availability (Baligar and Fageria, 1997; Kamprath, 1984). In Kenya, acid and low-fertility soils particularly low available P and N are the major causes of low and declining maize yields (Kanyanjua et al., 2002; Ayaga, 2003). Acid soils which cover 13% of the Kenyan land area (Kanyanjua et al., 2002) are found in areas of high rainfall and are potentially suitable for maize production (Muhammad and Underwood, 2004). Maize crop needs different nutrients at different stages in its growth cycle. Soon after germination, sufficient nitrogen and phosphorous is needed to initiate the growth of stems, leaves and ear structures. Insufficient Nitrogen and phosphorous at two to six weeks after germination of maize can result into reduced yields (Jones, 1985). Significant amounts of N are transferred from leaf tissue to grain during the grain-fill process. Phosphorus uptake is more constant throughout the season as the dry weight increases. An efficient fertilization process needs adequate Nitrogen and potassium. Large quantities of Nitrogen are needed at tasseling and silking stage. Topdressing with Nitrogen fertilizer ensures losses resulting from leaching and minimized as high water uptake and transpiration by the corn plant during this period of rapid growth

2.4. Incentives and maize yields

Agricultural production is an economic activity and just like any other business the players want to make profits whether financial or in terms of good harvest to meet both food demands and household income. The sector has however had setbacks in terms of high production and marketing costs resulting into losses or extremely low profit margins. **Costs** involved include land preparation costs, inputs costs, labor, harvesting, transportation and

storage. Where output is low, these costs are far much higher than the cost of investment. According to Jayne (1999), in most countries in eastern and southern Africa, maize marketing costs account for about 40% to 60% of the total retail price of maize meal paid by consumers. She therefore notes that a reduction of these costs will make production more profitable to farmers as well as ensure food security. Profits resulting from improved yields and low production costs will have multiple benefits to farmers; they will be able to sell part of the produce in order to meet other food requirements besides funding the subsequent Agricultural production. The state of being economically empowered and food secure is a big incentive to farmers.

The Kenya Government came up with distribution of subsidized fertilizer through the National Cereals and Produce Board to ensure small scale farmers access fertilizer to boost maize production. Studies carried out in Malawi indicate that there is an average increase in maize yields by accessing subsidized fertilizer. Chibwana et al. (2011) found that in the Kasungu and Machinga districts of Malawi, the average increase in maize yield from accessing subsidized maize seed and subsidized fertilizer is 447kg/ha for hybrid maize and 249kg/ha for local maize. Ricker-Gilbert and Jayne (2011) in their study findings point out that in Kasungu and Machinga Districts in Malawi, by accessing subsidized fertilizer, the average increase of yields per hectare is 447Kilograms for hybrid maize and 249 Kilograms for local maize. According to Dorward 2009, a major concern with input subsides relates to the extent of leakages and diversion of subsidized inputs away from their intended use. World Bank Report also point at diversion and inefficiency such that actual benefits to farmers were often very limited (World Bank, 1981).

Closely related to high inputs cost is lack of sufficient and timely supply of farm inputs. Many small scale farmers have had to resort to using uncertified inputs due to lack of quality

inputs in the market during planting season. This resonates with the findings of World Bank which indicate that the low usage of fertilizer in African countries is as a result of high and unsustainable fiscal and administrative costs, governments' weak capacity to implement programs, and governments' inability to take account of the diversity of production systems and farmers' needs (Denning et al, 2009).Similar bottle necks in fertilizer management has also been singled out by Dorward et al, 2008.In his findings regarding the Malawi situation, he notes that a number of operational challenges work against efforts of increasing fertilizer usage among small scale farmers, he identifies delays in program design and implementation leading to delayed delivery of inputs in some areas, cumbersome coupon processing and redemption systems, the need to improve program information sharing with the intended beneficiaries and general public, shortages of fertilizers and mismatch of coupons and fertilizer types in some areas. Studies done in Asia also point to same challenges which affect productivity. According to Djurfeldt, (2005), poor infrastructure and related high transport costs for farm inputs, inadequate institutional support (credit and extension), political instability, diverse agro-ecological complexities, low fertilizer use, and the limited availability of suitable high-yielding varieties have all contributed to low agricultural productivity growth and therefore food insecurity. In regard to poor infrastructure, farmers find it difficult to transport inputs to remote areas as well as transport produce to the market. Where such services are procured, the cost is very high. While comparing Sub Saharan Africa and Thailand, Banful (2010) notes that around 50 percent of market fertilizer prices can be attributed to transaction costs compared 20 percent in Thailand, due to poorly developed infrastructure, the costs of transporting inputs to remote areas, particularly in landlocked countries, are very high. Comparing Sub Saharan Africa to Thailand, Banful (2010), notes that around 50 percent of market fertilizer prices can be attributed to transaction costs

compared 20 percent in Thailand. Once the bottom line is affected, the buying power of farmers goes down which has an effect on suppliers who down scale production. Introduction of input subsidies has the potential of boosting demand and encourage input suppliers to expand their presence to remote areas.

Access to affordable credit is a big challenge for small scale maize farmers. Financial institutions find it difficult to offer credit for reasons ranging from collateral, fear of default and the marketing challenges. The cost of credit is as well too high .According to Dorward (April 2009), points out, borrowing costs, especially for borrowers of small amounts, may be two or three times as much as nominal interest payments.Besidesinterest rates, the other costs the small scale farmer meets include transport, motivation of bank officials some of whom ask for bribes before processing credit, processing fees, legal fees etc. These costs include waiting in line, transportation costs, bribes, legal and title fees, paperwork expenses, and time lost from work to deal with these demands. According to Bali, 2001, only 5% of the farmers in Africa and approximately 15% in Latin America and Asia have had access to credit facilities from formal institutions. On average, across developing countries 5% of borrowers received the biggest share at 80% of the credit.

2.5. Weather conditions and maize yields

Drought occurrences associated with climate change have become more pronounced in Kenya in the recent years with great impact on Agricultural productivity (UNEP, 2007).Kenya has experienced a series of severe weather related phenomena particularly droughts, floods and landslides (Murungaru, 2003).Droughts in Kenya are a common phenomenon where there has not been time to fully recover from one drought shock before another occurs (Oxfam 2006). Different parts of Kenya experience varied climatic conditions. The coast has a narrow belt

which is relatively hot and wet. Not far from the coastal strip lies arid and semi arid areas followed by the temperate highlands (DFID, 2008).The variability in climate is contributed by aspects such as topography, proximity to large water bodies such as lakes and oceans such as Indian ocean and Lake Victoria, and the equator (Ojwang et al., 2010).Kenya has two rainy seasons namely: the long rainy season that runs from March to May and the short rainy season that runs from October to December (McSweeney et al., 2008). The highest amount of rainfall in Kenya is received in the highlands and a narrow coastal belt along the Indian Ocean while the least amount is received in the North eastern parts of the country and around the Lake Turkana. There are also parts of Kenya that receive medium amount of rainfall. These are the high to medium potential areas of the country comprising of humid, sub humid and semi humid zones. They make up to 20% of the Kenyan land area. A larger proportion of Kenyan population about 80% resides in these medium potential areas and most of the crop agriculture is done in these areas.The remaining proportion of Kenya's area is the arid and semi arid areas that are predominantly occupied by pastoralists. The Kenyan climatic conditions have been undergoing some changes McSweeney et al. (2008), the average temperatures in Kenya have increased and annual rainfall declined as the rains between October and December increase (MENR, 2009)..

Agriculture production in developing countries is rain reliant. Production cycles are therefore pegged on rain season. Maize production in many parts of Kenya is done in March and April at the onset of long rains. However in the last decade, the rainfall pattern has been inconsistent where the season sets in earlier than March or delay to later in April. The inconsistency across the crop cycle has resulted in drying up or poor grain formation particularly when rain in not sufficient at tussling stage. This reliant on rain-fed Agriculture is viewed by observers as makes Agriculture the most vulnerable economic sector in regard to climate

variability. According to Katz and Brown, (1992), climate variability is likely to increase under global warming both in absolute and relative terms. According to reports of The Intergovernmental Panel on Climate Change (IPCC) Africa is vulnerable to weather variability due to a number of factors one being ecosystem degradation. Mt Elgon forest has undergone depletion due to logging effects of which is erratic rainfall patterns in most parts of Trans Nzoia and Bungoma Counties. In both counties, majority of the rural population is engaged in small scale Agriculture dominated by a single crop, mainly maize, consequently, any instability on rainfall received drastically affects their livelihoods as a decline in maize productivity would lead to famine given the single crop culture and the fact that maize is staple food to majority of the households. In addition, farmers' purchasing power is pegged on maize productivity; consequently even if there were supplies of food from other areas, they would not afford to buy. According to Mariara and Karanja, (2006), the two extreme climate events that may adversely impact on the agricultural sector are drought (crop water stress leading to declining yields) and flooding (resulting in water logging) in both the ASALs and high potential areas.

Extreme temperatures as a result of drought and flooding have potential to affect the normal growth of crops resulting into lower yields. Many crops already grow close to their tolerance limits (Conway, 2009) and a few days of extreme temperature can seriously affect yields (Challinor et al, 2006, Wheeler et al, 2008). In Ukraine prolonged hot summer in 1972 with temperature rising by over 2 to 40% increase from normal temperatures resulted into a decline in yields of wheat by 13 %(Battisti and Naylor, 2009.Kenya as well has had such extreme temperature conditions in a number of years including 1971-73,1983-84,1991-2 and 2004-6.A estimated 2.5 million Kenyans were affected by the prolonged drought. In 2008-10,10million people were affected (Rarieya and Fortun, 2009).The other extreme aspect of

weather is floods. A majority of most of these floods is the El nino effects. Kenya experienced ElNino effects in 1997-98 and 2002(Rarieya and Fortun, 2009).The result of El Nino is flooding which causes massive destruction of infrastructure and crops. The aftermath of El Nino is high temperatures whose effects have significant impact on crop yields and increases uncertainty. Studies by (Amissah-Arthur et al, 2002),though inconclusive notes impact on maize yields in Kenya following El Niño linked rainfall during the short rains season (October-December).A report by IPCC,2007 asserts that at local farm level, moderate warming may improve crop yields in temper

2.6. Summary of Literature Review

The chapter on literature review focused on findings by studies done in the past in the same area of determinants of maize yields. The researcher reviewed published materials on determinants of maize yields including access to inputs, adoption of modern farming techniques, farmer incentives and weather conditions and the impact these factors have on maize yields based on earlier studies. From earlier research findings access to inputs, adoption of modern farming techniques, initiatives and weather conditions have influence on maize yields. According to Nyoro, (2002), farmers who adopt this poor quality although certified seeds have been disappointed as a result of poor germination and low yields of the certified maize seeds. High transaction costs and poor infrastructure contribute to the high cost of farm inputs and reduction of these costs is an incentive to farmers. According to McSweeney et al. (2008), the Kenyan climatic conditions have been undergoing some changes. According to the report by the Ministry of Environment and Natural Resources (MENR, 2009), the average temperatures in Kenya have increased and annual rainfall declined as the rains between October and December increase.

2.7. Theoretical framework

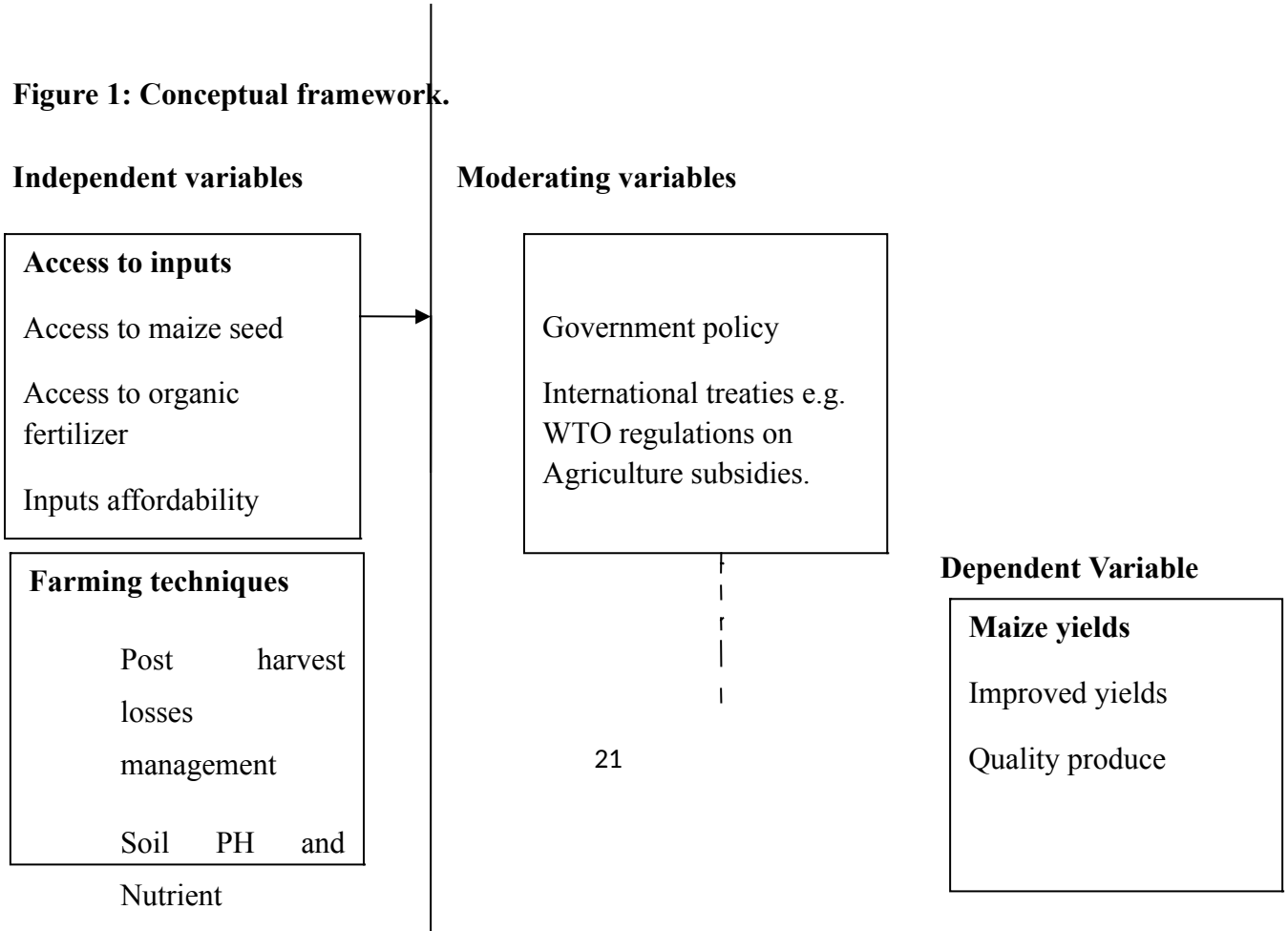
The study is grounded in the Theory of Change by Mackenzie, M. and A. Blamey (2005). This theory of change looks at an emerging understanding of how improvements in access to finance, technical assistance, markets for products and country-level infrastructure can unlock a virtuous cycle of productivity, improved resilience and reduced risk that in turn leads to positive impact on rural families, communities and ecosystems. With many actors in the smallholder support community working at different levels of the agricultural value chain, this theory of change helps to create a shared vision for how these efforts combine to promote smallholders' prosperity and environmental stewardship, and recognizes that trust and shared value among value chain actors is paramount to ecosystem development. According to the theory of change proponents, people are not passive but active participants and therefore have to actively play their role for the success of programs. In addition, understanding the context is very important in determining the causes. This research looks at the determinants of maize yields among small scale farmers. The study examines factors that determine maize yields in Trans Nzoia West Sub County in Trans Nzoia, Kenya. The study looked at how access to farm inputs, adoption of modern techniques, incentives and weather conditions determine maize yields. A shift by farmers to a combination of use of certified maize seeds and organic fertilizer, modern farming techniques such as soil PH management and improved post harvest management, incentives to farmers and favorable weather conditions have capacity to unlock small scale maize productivity.

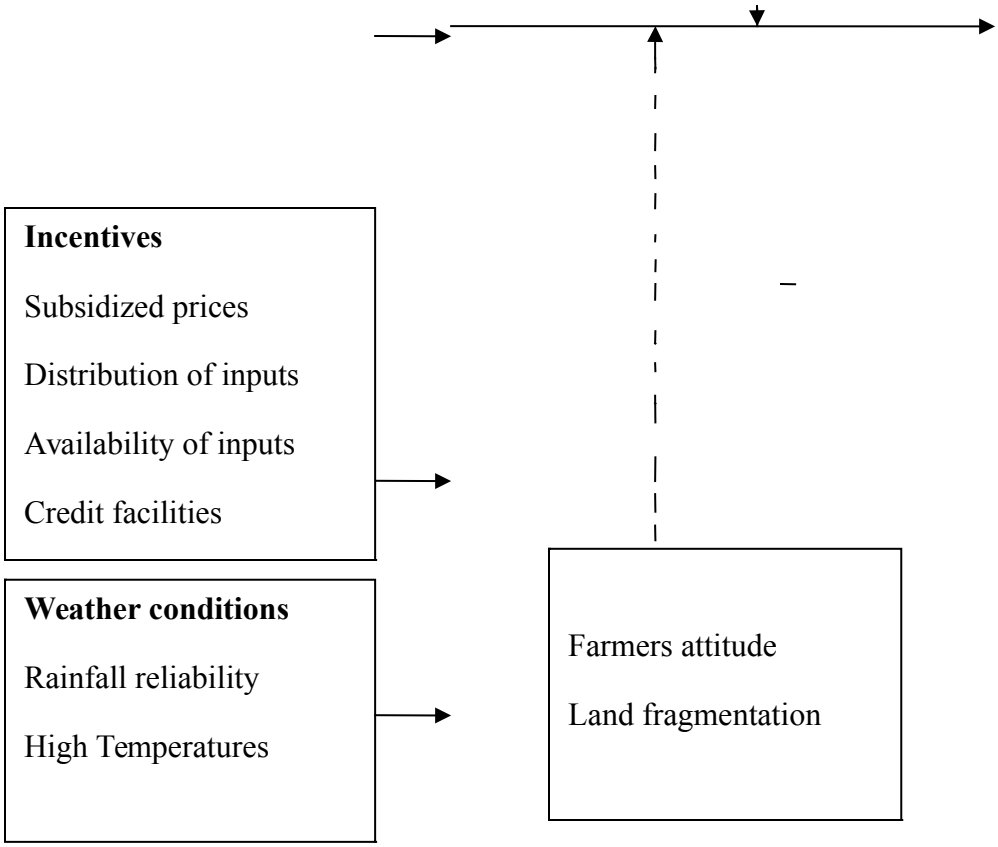
2.8 Conceptual framework

The conceptual framework of this study has been guided by research objectives. The research objectives are all aimed at establishing how maize yields in Trans Nzoia West Sub

County is determined by access to farm inputs by small scale farmers, adoption of modern farming techniques, farm incentives and weather conditions.

Figure 1: Conceptual framework.





Intervening Variables

CHAPTER THREE

RESEACH METHODOLOGY

3.1. Introduction

This chapter focuses on research design, target population, sample size and sampling procedure and research instruments. It also included validity and reliability of research instruments, data collection procedures, data analysis techniques, ethical considerations and operational definition of variables. According to Cohen, Manion and Morrison (2000), research methodology is the procedure by which the research describes, explains and predicts phenomena.

3.2. Research Design

A research design constitutes a blueprint for the collection, measurement and analysis of data. Brink and Wood (1998) states that the purpose of research design is to provide a plan for answering the research questions and is a blueprint for action. For purposes of this study a descriptive survey design was adopted. Descriptive survey design is convenient in collecting substantial amount of views from respondents over a large area (Koul, 1997).This design allows collection of a wide range of social indicators and economic information. According to Mugenda and Mugenda (1999), descriptive survey attempts to collect data from members of a given population so as to determine the current status of that particular population in respect to one or more variables. The design would therefore assist to answer the questions regarding the study.

3.3. Target Population

The target population for the study was 38,183.This comprised 38,183 households engaged in small scale farming. Five ward agriculture officers were interviewed to provide backup information. According to the 2009 population and housing census,Trans Nzoia West Sub County had 38,183 households engaged in small scale farming spread across five wards namely Kinyoro (7763), Matisi (8656), Tuwan (11335), Machewa (3713) and Saboti (6716).Target population is the entire aggregate of respondents that meet the designated set of criteria (Burns&Grove 1997).According to Mugenda&Mugenda (2003), target population is defined as an entire group of individuals; events or objects having common observable characteristics.

3.4. Sampling procedure and sample Size

A sample is a part of the entire population that carries attitudes, opinions, habits, or characteristics that you wish to investigate or study (Intell, 2012).This is determined by the purpose of conducting the study.

3.4.1. Sampling procedure

The sample frame for the study comprised small scale farmers sampled from five wards that make up Trans Nzoia West Sub County of Trans Nzoia. The researcher obtained expert supporting information on maize production from Ward Agriculture Officers through interviews. Households engaged in small scale maize production were sampled based on number of households in the ward using Yamane formula (Yamane, 1967).The confidence level or margin of error was -+5 or 95 percent level of confidence.

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

Where; n= sample size

N= Target Population size

e= Precision level

Therefore $n = \frac{38183}{1+38183(0.05)^2}$

=395.84 respondents. This was rounded up to 396 respondents

The 396 respondents were distributed to the five wards based on the number of households as below;

Saboti (6716/38183*396) =70

Kinyoro (7763/38183*396) =81

Tuwan (11335/38183*396) =118

Machewa (3713/38183*396) =39

Matisi (8656/38183*396) =88

The researcher used cluster sampling to obtain a number of clusters in the wards. This was made possible by obtaining the list of villages and headmen from the sub chiefs. Trans Nzoia West has 24 sub locations (Trans Nzoia County Development Profile, 2013). The researcher applied random sampling on the villages in each sub location to come up with equal number of villages in each sub location. Random sampling was employed again to establish the required number of respondents on the selected villages according to the sample size of the ward.

3.4.2. Sample Size

The proportion of the target population that met the inclusion criteria was 396 small scale maize farmers. This was arrived at using Yamane formula (Yamane, 1967) at 95% level of confidence or +-5 margin error.

3.5. Research Instruments

The researcher used questionnaires to collect views and observations from respondents regarding determinants of maize yields in Trans Nzoia West Sub County. Choice of this instrument was based on the nature of data, time available and the objectives of the study. The researcher was assisted by research assistants to distribute the questionnaires to the respondents for purposes of data collection. Distribution, answering and collection of answered questionnaires took 21 days.

3.5.1. Piloting of the Research Instruments

Piloting of research instruments was conducted on forty small scale maize farmers before actual study was conducted. This was 10% of the sample size of 396.The pilot sample population was not part of the main study sample. According to Mugenda & Mugenda (2003), a sample size of 10% of the sample size is considered adequate for descriptive study. This was to assist to ascertain validity and reliability (Mugenda&Mugenda, 2003).Piloting was done on maize farmers in Chebon location. Chebon neighbours Machewa ward. This helped to identify any hiccups that could have come up in the actual data collection exercise.

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3.5.2. Validity of the Instruments

To achieve validity, the researcher sought guidance from his supervisor who went through the questionnaires to offer expert advice as to whether the instruments could measure what they were going to measure. Validity refers to the degree to which the research instrument measures what it purports to measure (Mugenda and Mugenda2003).It focuses on the sufficiency of questions so that responses can help to draw conclusions. Those charged with drawing conclusions should be given the instruments in advance before the actual data collection exercise (Frenekel (1993).This will help to improve content validity.

3.5.3. Reliability of the Instruments

According to Borg and Gall (1986) reliability is the level of internal consistency or stability of the measuring device overtime. The researcher conducted a pilot study that was done in the neighboring Chebon location to test reliability of the instruments before the actual research commenced. The researcher used test-retest method to assess the reliability of the research instruments. The researcher administered forty questionnaires to small scale farmers. After two weeks the researcher administered again a similar number of questionnaires to forty farmers in Chebon location. Instrument reliability was ascertained by correlating the scores on the two questionnaires. The scores were computed in Spearman rank correlation coefficient giving a correlation of 0.901.Data collection instruments are considered reliable if the correlation coefficient falls above 0.6 (Mbwesa, 2006).

3.6. Data collection procedures

Once the research proposal had been approved, the researcher obtained an introductory letter from the university and a permit from the ministry of science and technology to present to government officials in Trans Nzoia West Sub County to authorize the study. The introduction

letter enabled the researcher to conduct the researcher without suspicion from locals. Security of the researcher and assistants was also guaranteed. The researcher then collected data from the field using stated data collection instruments coded and analyzed the data then compiled a report to present before University of Nairobi panel for consideration of award of Master of Arts degree in Project Planning and Management.

3.7. Data analysis techniques

According to Bryman Cramer (1999), analysis helps in fulfilling research objectives and provides answers to research questions .The data collected was coded and analyzed using statistical packages for social sciences (SPSS) computer program. Inferential technique was used to analyze open ended questionnaires. Descriptive statistics was used to analyze quantitative data from closed ended questions in order to obtain distribution of measurement of phenomena being studied. This entailed use of measures of distribution i.e. frequencies, percentages and tables.

3.8. Ethical Considerations

The researcher obtained a letter of transmittal from the University and a license from the Ministry of Education for introduction. The researcher treated with confidentiality all the information provided from respondents and only used it for this academic study.

3.9. Operationalization of Variables

According to Mugenda and Mugenda (2006) this refers to description of operations that are used in measuring the study variables. This included research objectives, type of variables, indicators, scale of measure, and statistical test. These were put in a diagram to show how they interact with each other. This was shown in table1.

Table1: Operationalization of Variables

Objective	Type of variable	Indicators	Scale of Measurement	Statistical Test
To investigate how access to farm inputs determine maize yields in Trans Nzoia West Sub County.	**Independent variable** Access to farm inputs **Dependent variable** Increased maize yields	Increased use of high certified maize seeds and organic fertilizer.	Nominal Ordinal	Qualitative Analysis Frequency Tables
To assess how adoption of modern farming techniques by small scale maize farmers determine maize yields in Trans Nzoia West Sub County.	**Independent Variable** Adoption of modern farming techniques **Dependent variable** Increased maize yields	Weed control, Soil acidity and nutrient management and storage and preservation facilities	Nominal Ordinal	Qualitative Analysis Frequency Tables
To investigate how incentives to small scale maize farmers determine	**Independent variable** Farmer incentives **Dependent variable**	Reduced inputs costs, reduced transaction costs,	Nominal	Qualitative Analysis Frequency

maize yields Trans Nzoia West Sub County.	Increased maize yields	availability of inputs, affordable credit to farmers	Ordinal	Tables
To assess how weather conditions determine maize yields in Trans Nzoia West Sub County.	**Independent variable** Weather conditions **Dependent variable** Increased maize yields	Rainfall reliability and High temperatures	Nominal Ordinal	Qualitative Analysis Frequency Tables

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1. Introduction

This chapter focuses on data analysis, presentation and interpretation. It looks at questionnaires administered, completed and returned. In addition, the chapter analyses demographic information in terms of gender, age and level of education. The researcher also analyses responses from respondents to various questions on thematic areas and presents the findings in frequencies tables and percentages.

4.2. Questionnaire Return Rate

The researcher distributed 396 questionaires to small scale maize farmers in Trans zoia West Sub County , Trans Nzoia for the purpose of investigating the determinants of maize yields among small scale farmers.After two weeks,the questionaires were collected and the return rate is shown in table 4.1.

Table 4.1. Questionaire return rate

Questionaire	Sample Size	Return rate

Questionaires returned	371	93.68
Questionaires not returned	25	6.32
Total	**396**	**100**

Table 4.1 show that out of 396 questionaires that were distributed to respondents,371 were correctly answered and returned and 25 were not returned.This depicts a return rate of 93.68%. Bobbie (1990) suggested that a response rate of 60% is good; 70% is very good. A return rate of 93.68 % was therefore considered adequate for the study.

4.3. Demographic Information of Respondents

In this section information about respondents gender,age and level of education was analysed by use of frequencies and percentages.

4.3.1. Gender of Respondents

The sampled population comprised male and female respondents.The respondents were asked to indicate their gender as either male or female.Information about the gender of respondents was important in determining the gender distribution pattern of smale scale maize farmers which was important to this study. The results are shown in table 4.2.

Table 4.2 Distribution of respondents by gender

Gender	No of respondents	Percentage
Male	289	78
Female	82	22
Total	**371**	**100**

Table 4.2 illustrates that 289(78%) of small scale maize farmers were male while 82(22%) were female. This shows that majority of small scale maize farmers in Trans Nzoia

West Sub county were male.This is was attributed to the fact that men are considered heads of the family and the owners of land.

4.3.2. Age of Respondents

The researcher sought to establish the age brackets of the small scale maize farmers in Trans Nzoia West Sub County.Data on the age of farmers was important in establishing the distribution of farmers across different age brackets which was important to this study.Knowledge on how people at different age brackets were involved in farming was important as it would inform policy makers on the appropriate interventions to improve the sector. The results are in table 4.3

Table 4.3 Distribution of respondents by age.

Age range (years)	No of Respondents	Percentage
18-30	29	8
31-40	99	27
41-50	214	57
Above 51	29	8
Total	**371**	**100**

Table 4.3 shows that 214(57%) of respondents were aged between 41 to 50 years.99(27%) of respondents were aged between 31 to 40 years.29(8%) of respondents were aged between 18 to 30 and 51 and above years respectively.This results show that the largest number of small scale farmers are aged between 41 to 50 followed by 31 to 40 years.This shows that small scale maize production is practised mostly by people aged between 31 to 50 years.This is because they are young and energetic and can therefore provide the needed labour during land preparation,planting,weeding,top dressing,harvesting and storage.

4.3.3. Level of Education of Respondents

The research investigated the levels of education of small scale maize farmers.This was an important important to this study as findings would show the distribution of small scale maize farmers by their level of education.The researcher therefore asked respondents to indicate the level of formal education attained.The respondents were asked to select from different levels of education which included Certificate,diploma, bachelors degree,Master degree and PhD.The reseacher assumed that even those who did not attend formal education must have undergone some form of workshop which would pool them together with certificate holders.The results are shown in table 4.4.

Table 4.4 Distribution of respondents by level of education

Level of Education	No of respondents	Percentage
Certificate	231	62
Diploma `	96	26
Bachelors Degree	39	11
Masters Degree	5	1
Total	**371**	**100**

Table 4.4 shows that 231(62%) of small scale maize farmers have attained certificate level of education.96(26%) have attained diploma level of education,39(11%) have attained bachelors degree level,5(1%) have attained masters degree level while there were none who had attained Phd.The results show that a majority of small scale maize farmers have attained certificate level of education.This shows that maize farming attracted more people who had not attained levels of education beyond certificate level.

4.4. Investigating how accesses to farm inputs determine maize yields in Trans Nzoia West Sub County.

The researcher attempted to establish how access to farm inputs such as certified maize seed and organic fertilizer for planting and top dressing determined the yields in Trans Nzoia West Sub County.

4.4.1 Use of Certified seeds and Adequate Organic Fertilizer and Maize yields

The researcher investigated use of certified maize seed as a thematic area of this study. The researcher sought to establish the usage of certified maize seed by small scale farmers. The results are shown in table 4.5

Table 4.5. Use of certified maize seeds

Response	No of respondents	Percentage
Yes	148	40
No	223	60
Total	**371**	**100**

Table 4.5 shows that 223(60%) of small scale farmers used certified maize seed for maize production whereas 148(40%) did not use cerified seeds.This shows that majority of small scale maize farmers used certified maize seeds for maize production.Research findings by M. Ayieko 2005& Tegemeo Household Survey 2004 points out that in high potential areas 61% of farmers use certified maize seed whereas 39% use retained or indigenous seeds. According to Pixley & Banziger 2001, Farmers who recycle grain are faced by risk of declined yields of between 5 percent for open pollinated varieties (OPV) and 30 percent for hybrids. Langyintuo et al. 2008, referring to a study done to compare improved maize seeds sales volume showed a decline between 1997 and 2007 in Eastern and Southern Africa Countries with Angola reducing by 7% Zimbabwe by 2% and Kenya by 1%Kenya

4.4.2. Farmers Used Certified maize seeds on the Farm

The researcher established the position of the respondent in regard to usage of certified maize seed as input for planting. The position was measured on the scale of agreement of usage of certified maize. The results are in table 4.6.

Table 4.6. The Farmer used certified Maize

Response	No of respondents	Percentage
Strongly Agree	100	27
Agree	122	33
Undecided	29	8
Disagree	93	25
Strongly Disagree	27	7
Total	**371**	**100**

Table 4.6 shows 122(33%) agree to use certified maize seed.100(27%) of respondents strongly agreed that they plant certified maize seed.122(33%).93(25%) disagreed that they use certified maize seeds.29(8%) of the respondents were undecided while 27(7%) of respondents strongly disagreed to have use certified maize seeds.This findings show that a majority of small scale maize farmers agree to have used certified maize seed.This concurs with research findings by M. Ayieko 2005& Tegemeo Household Survey 2004 which indicate that in high potential areas 61% of farmers use certified maize seed whereas 39% use retained or indigenous seeds. Use of uncertified seeds has potential to reduce maize yields by up to 50% with maize (Ochieng and Tanga, 1995; Guillen-Portal et al., 2002; Lapinski and Stojalowski, 1999)

4.4.3. Use of Adequate Organic Fertilizer by Small Scale Maize Farmers

The researcher sought to establish usage of adequate organic fertilizer by small scale maize farmers at planting and top dressing stages.This was important since soils in the once considered fertile soils have lost fertility due to a number of reasons including monocropping and inadequate fertilizer use and therefore this information was important to this study.The results are shown in table 4.7.

Table 4.7: Use of adequate Organic Fertilizer to Plant and Topdressing Stages

Response	No of respondents	Percentage
Yes	156	42
No	215	58
Total	**371**	**100**

Table 4.6 shows that 215(58%) of respondents did not use adequate organic fertilizer during planting and top dressing stages while 156(42%) of respondents used organic fertilizer.This results show that a majority of small scale maize farmers in Trans Nzoia West Sub County do not use organic fertilizer. According to Kherallah et al. (2002) Majority of small scale farmers cannot afford the cost of fertilizer. The maize plant requires Nitrogen and Phosphorous soon after germination to start the growth of stems, leaves and ear structures. Inadequate Nitrogen availability during the first 14 to 42 days after planting can result in reduced yield potentials (Jones, 1985).

4.4.4 The Farmer uses adequate Organic Fertilizer to plant maize

The researcher established the respondents feeling and take on the usage of adequate organic fertilizer to plant and top dress maize crop.The results are in table 4.8.

Table 4.8 Farmers Use Organic Fertilizer at Planting

Response	No of respondents	Percentage
Strongly Agee	29	7.8
Agree	119	32
Undecided	0	0
Disagree	193	52
Strongly Disagree	30	8.2
Total	**371**	**100**

Table 4.8 shows that193(52%) of respondents disagree that they use organic fertilizer to plant and topdress their maize crop maize. 119(32%) of respondennts agree that they use organic fertilizer to plant and top dress. 30(8.2%) of respondents strongly disagree whereas 29(7.8%) of respondents strongly agree that they use organic fertilizer to plant and topdress their maize crop.The results show that a majority of small scale maize farmers disagree that they use organic fertilizer for maize production.Research has shown that failure to use adequate fertilizer on maize crop can lead to reduction in yields.

4.4.5. Affordability of Farm inputs

The researcher established from respondents how affordable the farm inputs are.Information and data on affordability was important to this study since in influenced adoption and usage of improved farm inputs. The results are shown in table 4.9.

Table 4.9: Affordability of Farm Inputs

Response	No of respondents	Percentage
Yes	54	15
No	317	85
Total	**371**	**100**

The table shows that 317(85%)of respondents can not afford to pay the cost of farm inputs while 54(15%) can afford. This shows that a majority farmers in can not afford to buy farm inputs.This supports earlier research on fertilizer by Kherallah et al. 2002; Morris et al. (2007) which indicated that majority of small scale farmers cannot afford the cost of farm inputs.

4.4.6 Farm Inputs are Affordable to the Small Scale Farmer

The researcher investigated the farmers' views regarding the cost of farm inputs and if according to their observation and experience farm inputs are affordable to them. Establish the farmers views regarding inputs affordability was important to this study as it brought out the varied experiences by small scale farmers regarding cost and affordability of farm inputs. This information would be useful to policy makers and implementers in the Agriculture sector. Results are in table 4.1

Table 4.10 Affordability of Farm Inputs to Small Scale Maize Farmers

Response	No of respondents	Percentage
A gree	56	15
Undecided	4	1
Disagree	125	24
Strongly Disagree	186	50
Total	**371**	**100**

Table 4.10 shows 186(50%) strongly disagree that the cost of farm inputs is affordable to them**.** 125(24%) of respondents disagree that the cost of farm inputs is affordable, 56 (15%) of respondents agree that the cost of farm inputs is affordable to them.4 (1%) of respondents are undecided whereas The results show that a majority of small scale maize farmers cannot afford to purchase maize farm inputs. Research by Kherallah et al. (2002) showed that majority of small scale farmers cannot afford the cost of fertilizer.

4.5. To assess how adoption of modern farming techniques by small scale maize farmers determine maize yields in Trans Nzoia West Sub County.

The researcher asked respondents how modern farming techniques determine maize yields among small scale farmers in Trans Nzoia West Sub County in Trans Nzoia County.

4.5.1 Soil PH and Plant Nutrient Management

The researcher investigated how farmers managed soil acidity and plant nutrient levels. This was important to the study as soil acidity and plant nutrient levels affected yields and corrective measures including liming and use of appropriate fertilizer was necessary. The responses are captured in table 4.11.

Table 4.11.Soil acidity and nutrients testing and management

Response	No of respondents	Percentage
Yes	41	11
No	330	89
Total	**371**	**100**

The table shows that 41(11%) of respondents conducted soil acidity ,nutrients testing and management. 330(89%) of respondents did not test soil acidity and nutrients.The result shows that a majority of small scale maize farmers do not test the acid levels of the soil and nutrient levels of the soil. A majority of those who did not conduct the soil acidity and nutrient testing indicated they did not have information about the exercise.They had not been educated on the importance of managing the soil acid levels.Those who conducted the tests indicated that the exercise had assisted them to manage fertilizer choice depending on what the soil lacked.They however said the soil testing services were not easily accessible and they have to travel long distances to Kitale town to procure the services. According to One Acre Fund report 2014 and Ministry of Agriculture, Soil acidity is important for several reasons: At low soil pH (more acidic), nutrients abundant in the soil become unavailable for plants to utilize. This frequently results in plant nutrient deficiencies and poor yields. Some elements in the soil (aluminum) can become toxic. Soil acidity must be addressed for farmers to receive the greatest benefits from their investments in seed and fertilizer. In Kenya, acid and low-fertility soils particularly low available P and N are the major causes of low and declining maize yields (Kanyanjua et al., 2002; Ayaga, 2003).

4.5.2 The Farmer Regularly Tested Soil Acidity and Plant Nutrients Levels

The researcher tested the level of adoption of soil acidity and nutrient management by small scale maize farmers in Trans Nzoia West Sub County. The results were important to this study as this would influence the recommendations of the study. The results are shown in table 4.12.

Table 4.12 Farmers Regularly Tested soil acidity and Plant nutrients

Response	No of respondents	Percentage
Agree	41	11
Disagree	256	69
Strongly Disagree	74	20
Total	**371**	**100**

Table 4.12 above shows that 256(69) of respondents disagree that they conduct soil tests to establish acidity and nutrients levels.74(20%) strongly disagree that the condict tests to establish soil acidity and nutrient levels.41(11%) agree to conduct tests on the soil to check acidity and nutrient levels. The results show that a majority of small scale maize farmers do not manage acid levels and soil nutrient levels on their farms. Acid soils which cover 13% of the Kenyan land area (Kanyanjua et al., 2002) are found in areas of high rainfall and are potentially suitable for maize production (Muhammad and Underwood, 2004).

4.5.3.Pre and Post Harvest Losses

The researcher investigated losses incurred by maize farmers before and after harvesting the crop.This was important to this study as the losses affect yields.Data on the losses incurred by farmers would also guide formulation of recommendations by this study to improve maize yields among small scale farmers. Timely and well supervised pre harvest and post harvest

processes ensures minimal losses of maize produce.Pre and post harvest losses include rotting resulting from untimely harvesting, weevils attack,produce loss while during transportation and drying, theft etc.The respondents were asked to indicate whether they have experienced maize pre and post harvest losses.The results are in table 4.13

Table 4.13 Pre and post harvest losses

Response	No of respondents	Percentage
Yes	341	92
No	30	8
Total	**371**	**100**

Table 4.13 shows that 341(91%) of responses experienced pre and post harvest maize losses while 30(8%) did not experience maize pre and post harvest losses. The resuts show that a majority of small scale maize farmers have experienced pre and post harvest maize losses.Pre harvest losses were mainly as a result of theft and rotting resulting from wet conditions. According to Compton, 1992; Azu, 2002; Republic of Kenya, 2004, maize (Zea mays) grain losses contribute to food insecurity and low farm incomes not only in Kenya but also in other sub-Saharan African countries.

4.5.4. The Farmer has experienced by Pre and Post Harvest Losses

The researcher investigated the levels of farmers pre and post harvest losses. Establishing the levels of loss was important to the study since it provided a clear picture of the intensity of the losses which would form a basis for coming up with interventions. The findings are in table 4.14.

Table 4.14. The Farmer experienced Pre and Post harvest maize losses

Response	No of respondents	Percentage
Strongly Agree	86	23
Agree	257	69
Disagree	28	8
Total	**371**	**100**

Table 4.14 shows that 86(23%) of respondents strongly agree that they have experienced pre and post harvest maize losses.257(69%) of respondents agree to have experienced pre and post harvest maize losses.28(8%) of respondents disagree to have experienced maize losses during pre and post harvest stages. The results show that a majority of respondents agree to have experienced crop losses.

4.6 . To investigate how incentives to small scale maize farmers determine maize yields Trans Nzoia West Sub County

The researcher assessed farmer incentives to small scale maize farmers in Trans Nzoia West Sub County. The incentives included access to subsidized inputs by farmers, availability of inputs at close proximity and at the right time in the maize crop cycle and access to credit to fund maize production costs. Obtaining this data was important to the researcher as it informed the relationship between incentives and yields. It would also form an important basis for formulating specific initiatives to manage and address the shortcomings in the distribution of the subsidized farm inputs to small scale maize farmers. Initiatives would also be put in place to seal all loopholes through which this inputs get diverted to retailers and able large scale farmers instead of the intended beneficiaries.

4.6.1.Maize Farmers Benefitting for Inputs Subsidizing Program

The researcher investigated if farmers had been benefitting from farm inputs subsidizing programs and initiatives. The Government of Kenya has been running the inputs subsidizing program for purposes of boosting productivity but the full benefits are yet to be realized by the intended beneficiaries. The managers of the program at the National Cereals and Produce Board(NCPB) who run the program have ended up selling the inputs to rich farmers and traders who re package and sell the inputs. Information obtained therefore would be important to this study since access to farm inputs in one of the determinants of maize yields. This would also inform study recommendations to stakeholders who manage the inputs subsidizing program. The results are in table 4.15.

Table 4.15. Benefitting from Inputs Subsidising Program

Response	No of respondents	Percentage
Yes	41	11
No	330	89
Total	**371**	**100**

Table 4.15 shows that 330(89%) of small scale farmers in Trans Nzoia West Sub County do not benefit from Kenya Government input subsidizing program.41(8%) of small scale farmers in Trans Nzoia West Sub County agreed to have benefitted from inputs subsidizing program.This result demonstrate that a majority of small scale maize farmers in Trans Nzoia West Sub County do not access Government subsdized inputs.A majority of respondents said they have heard of the program but have not benefitted from it due to bureaucratic procedures which they believed were meant to keep them off.They indicated that the inputs for the subsdizing program ended up being sold to rich commercial farmers.In addition, these inputs were corruptly sold to traders who re packaged them then sold to farmers.Some of those who had benefitted said they had to

bribe the local administrators and managers at the NCPB in order to access the subsidized inputs. According to Dorward 2009,inputs under the subsidizing program get diverted to large scale farmers or are sold to other countries at a discount.

4.6.2 The Farmer Benefited from Inputs Subsdizing Program

The researcher sought to establish if maize farmers benefitted from inputs subsidizing program.The information was important to the study as it would inform study recommendations for stakeholders. The results are in table 4.16.

Table 4.16 The farmer Benefitted from Inputs Subsidizing Program

Response	No of respondents	Percentage
Agree	57	15
Undecided	19	5
Disagree	152	40
Strongly Disagree	143	39
Total	**371**	**100**

Table 4.16 shows that 152(40%) disagree to have benefitted from inputs subsiding program,143(39%) strongly disagree, 57(15%) agree and 19(5) were undecided.The results depict that a majority of maize farmers did not benefit from inputs subsiding program by the Government.This results concurs with World Bank report which showed that there is diversion of inputs and inefficiencies such that there was limited support to the intended beneficiaries (World Bank, 1981).

4.6.3. Availability of Farm Inputs at the Right Time at Close Promity to Farmers

The researcher assessed availability of farm inputs at the onset of planting season and at close proximity to small scale farmers.This was significant to this study as it determines the timeliness of planting and expenses associated with transporting farm inputs.Delays in the availing of inputs results to desperateness among farmers for fear of missing on the long March to April rains.They therefore end up using substandard inputs.Long distances to inputs distribution centres also force those farmers who do not have financial means to resort to using substandard inputs.The responses are captured in table 4.17

Table 4.17. Availability of Farm Inputs at the Right Time at Close Proximity to Farmers.

Response	No of respondents	Percentage
Yes	45	12
No	326	88
Total	**371**	**100**

Table 4.17 shows that326(88%) of respondents indicated that farm inputs are not always available during planting seasons in their locations while 45(12%) said inputs are available in their localities during planting season.This results demonstrate that farm inputs are not available in time and close proximity to majority of maize farmers. As a result, farmers indicated that they end up planting wrong variety of maize seeds because the preferred variety runs out of stock.They also cited long distances from their farms to stockists in Kitale and Kiminini where quality maize seeds and organic fertilizer can be obtained.They associated inputs found at local retail shops with adulteration. In addition, delays in availing inputs late in the season leads to

late planting and low yields. Dorward et al, 2008 in his findings regarding the Malawi situation, he notes that a number of operational challenges work against efforts of increasing fertilizer usage among small scale farmers, he identifies delays in program design and implementation leading to delayed delivery of inputs in some areas, cumbersome coupon processing and redemption systems, the need to improve program information sharing with the intended beneficiaries and general public, shortages of fertilizers and mismatch of coupons and fertilizer types in some areas.

4.6.4 Farm Inputs are Available in Famers Location

The researcher assessed the availability of farm inputs during planting season and proximity to farmer's locations. Availability of inputs at the right time ensured timely planting. Close proximity of suppliers on the other hand would reduce transactional costs associated with transportation. This would also ensure farmers do not buy adulterated inputs. Research on this was therefore important to the study as it could help establish to what extend maize production has been affected by unavailability of inputs and distance. The results are in table 4.18

Table 4.18.Farm inputs are available in farmer's locations during planting season

Response	No of respondents	Percentage
Agree	48	13

Undecided	11	3
Disagree	283	76
Strongly Disagree	29	8
Total	**371**	**100**

Table 4.18 above shows 76 %(283) disagree that inputs are available at the right time and at close proximity to maize farmers. 48(13%) agree that inputs are available at the right time and at close proximity to small scale maize farmers during planting season.29(8%) strongly disagree that inputs are available at the right time and at close proximity to small scale farmers during planting season.11(3%) are undecided. The findings show that to majority of small scale maize farmers, inputs are not available in good time and near their farms for easy access. These findings are supported by Dorward et al, 2008 on the Malawi Situation who points at operational and logistical challenges which lead to delays in delivery of farm inputs to points where farmers can access them easily.

4.6.5 Access to Credit Facilities from Financial Institutions

The researcher sought to find out farmers' access to credit facilities from financial institutions to fund maize production costs. This was important to the study since maize productions has funding costs which include land preparation,inputs,transportation and marketing and which affect yields and returns.Farmers need a financier who can finace production then get paid when the produce is harvested, marketed and sold.However, small scale maize farmers face challnges ranging collateral, high interest rates, bribery and un tailor made Agricusiness credit products.The results are in table 4.19.

Table 4.19 Access to Credit Facilities

Response	No of respondents	Percentage
Yes	48	13
No	323	87
Total	**371**	**100**

Table 4.12 shows that 323(87%) of respondents did not access credit facilities to fund maize production while 48(13%) indicated to have accessed credit for maize production.The resulsts depicts that a majority of small scale maize farmers did not access credit from financial institutions to fund maize production costs. Majority of respondents cited the complicated application process,high interest rates lack of information on credit and lack of collateral as the factors as the hindrance to accessing credit from financial institutions.Finacial institutions lacked credit products tailored to meet the unique needs of farmers as loans demanded mionthly payments which a maize farmer can not afford as maize is a seasonal crop.This resulted to high rates of default which further affected the credit worthness of farmers.In addition, most maize farmers indicated they do not have collataral or personal guarantees to secure the loans. Dorward (April 2009), who points out that, borrowing costs, especially for borrowers of small amounts, may be two or three times as much as nominal interest payments. Besides interest rates, the other costs the small scale farmer meets include transport, motivation of bank officials some of whom ask for bribes before processing credit, processing fees, legal fees etc.According to Bali, 2001, only 5% of the farmers in Africa and approximately 15% in Latin America and Asia have had access to credit facilities from formal institutions. On average, across developing

countries 5% of borrowers received the biggest share at 80% of the credit. CBN, 2008 estimated that only 2.5 percent of the total commercial Bank loans and advances is directed to agriculture.

4.6.6 The farmer accessed credit facilities from financial institutions

The researcher assessed the level of access to credit facilities by small scale maize farmers. The findings were important to this study as they would indicate the distribution pattern of access to credit and which could then be compared to the impact. The results are in table 4.20

Table 4.20.Access to Credit by Small Scale Farmers from Financial Institutions

Response	No of respondents	Percentage
Agree	52	14
Undecided	4	1
Disagree	229	62
Strongly Disagree	86	23
Total	**371**	**100**

Table 4.20 depicts that 62 %(229) disagree that they had accessed credit facilities from financial institutions for maize production.86 (23%) strongly disagreed have accessed credit facilities from financial institutions for maize production. However, 52(14%) agree that they had accessed credit facilities from financial institutions for maize production.4 (1%) were undecided. These findings show that a majority of small scale maize farmers have not been able to access credit from financial institutions for maize production. They therefore have had to resort to their limited resources thereby using cheap and substandard inputs.

4.7. To assess how weather conditions determine maize yields in Trans Nzoia West Sub County.

The researcher investigated the impact of weather conditions to maize yields. He paid special attention to rainfall reliability and extreme temperatures. This was important to this study because Trans Nzoia like many other parts of the country rely on rain fed Agriculture production. Data on effects of temperature was important as it affected maize productivity. Maize production in Kenya and in other African countries is largely rain fed. The weather pattern especially rainfall availability in quantities and season have a greater impact on the growth of crops including maize and the subsequent yields.Temparatures which are closely related to rainfall pattern also has influence on crops. The researcher asked respondents how weather conditions affect maize yields in Trans Nzoia West Sub County in Trans Nzoia County.

4.7.1 Rainfall Reliability

The researcher assessed Rainfall reliability from small scale maize farmers.This was important to this study as small scale maize production in Kenya is rain fed. A majority of farmers plant during the March-April long rains.The crop does well if the amounts are moderate and well spread allowing short dry spells.However due to climate change,there has been eratic rainfall patterns characterised by extremely heavy down pours causing floods and extremely long dry spells leading to drying of the crop.The researcher asked respondents to indicate whether rainfall has been reliable for maize production.The responses are captured in table 4.21

Table 4.21 Rainfall Reliability

Response	No of respondents	Percentage
Yes	200	54

No	171	46
Total	**371**	**100**

Table 4.13 show that (200)54% of respondents say rainfall has not been reliable whereas 171(46%) say rainfall has been reliable.The results demonstrates that a majority of maize farmers have suffered effects of unreliable rainfall. The short and long rains were unpredictable in some cases setting in early in February or late in April. The October short rains have also been largely unpredictable effects of which have been poor maize grain formation and yields. Reference was also made to extremely heavy rainfall accompanied with strong winds which cause soil erosion and destruction of the maize crop. A study done by Mariara and Karanja, (2006), the two extreme climate events that may adversely impact on the agricultural sector are drought (crop water stress leading to declining yields) and flooding (resulting in water logging) in both the ASALs and high potential areas. Drought occurrences associated with climate change have become more pronounced in Kenya in the recent years with great impact on Agricultural productivity (UNEP, 2007).Kenya has experienced a series of severe weather related phenomena particularly droughts, floods and landslides (Murungaru, 2003).Droughts in Kenya are a common phenomenon where there has not been time to fully recover from one drought shock before another occurs (Oxfam 2006).

4.7.2 Rainfall was Reliable for Maize Production

The researcher assessed rainfall reliability. This was important to this study as maize production in Kenya and Trans Nzoia is largely rained. The results are in table 4.22

Table 4.22 Rainfall was reliable for maize production

Response	No of respondents	Percentage

Agree	164	44
Undecided	11	3
Disagree	196	52
Total	**371**	**100**

Table 4.22 shows that 164(44%) of respondents agree that rainfall has been reliable for maize production, 196(52%) of the respondents disagree that rainfall has been reliable for maize production. 11(3%) are undecided as to whether rainfall has been reliable for maize production. This results depicts that a majority of small scale maize farmers in Trans Nzoia West Sub County hold that rainfall has not been reliable for maize production. This concurs with findings by (Oxfam, 2006) which showed that droughts in Kenya are common phenomenons where there has not been time to fully recover from one drought shock before another occurs (Oxfam 2006). Small Scale farmers in Kenya experienced ElNino effects in 1997-98 and 2002(Rarieya and Fortun, 2009).The result of El Nino is flooding which causes massive destruction of infrastructure and crops.

4.7.3 The Impact of High Temperatures

The researcher investigated how high temperatures have affected small scale maize production in Trans Nzoia West Sub County.This was important to this study since high temperatures effect normal growth of maize which affects yields. Extreme temparatures in Kenya and other African Countries have had significant impact on maize yields.The results are shown in table 4.23.

Table 4.23 The Impact of High Temperatures on Maize crop performance and yields

Response	No of respondents	Percentage
Yes	257	69
No	114	31
Total	**371**	**100**

Table 4.23 shows that 257(69%) of respondents agree that high temperature had affected the performance of their maize crop and therefore negatively affected the yields.114(31%) of respondents disagreed that high temperatures had affected the performance of their maize crop.This findings show that a majority of the farmers had their maize crop and yields affectd by high temperatures. According to Conway, 2009; Wheeler et al, 2008, many crops already grow close to their tolerance limits and a few days of extreme temperature can seriously affect yields. According to a report by Ministry of Environment and Natural Resources (MENR, 2009) the average temperatures in Kenya have increased and annual rainfall declined as the rains between October and December increase.

4.7.4 Maize has been affected by Extreme Temperatures

The researcher sought to establish how the maize crop performance had been affected by high temperatures in Trans Nzoia West Sub County. This was important to this tudy because findings could be used to establish the impact of high temperatures to maize crop across the farmers in the five wards that make up Trans Nzoia West Sub County.The information would be important to stakeholders and decision makers on the specific initiatives to combat the effects of high temperatures. The results are in table 4.24.

Table 4.24 Maize Crop Performance and Yields were affected by High Temperatures

Response	No of respondents	Percentage
Agree	229	62
Undecided	29	8
Disagree	113	30
Total	**371**	**100**

Table 4.24 shows that 229(62%) of small scale maize farmers agree that their maize crop performance and yields had been negatively affected by high temperatures.113(30%) disagreed that their maize crop performance and yields had been affected by high temperatures.29(8%) of the respondents were undecided as to whether their maize crop performance and yields had been affected by high temperatures.The results demosnstrate that a majority of small scale maize farmers yields have been affected by high temperatures.This concurs with research findings by Conway(2009) who notes that Many crops already grow close to their tolerance limits and a few days of extreme temperature can seriously affect yields. In Ukraine prolonged hot summer in 1972 with temperature rising by over 2 to 40% increase from normal temperatures resulted into a decline in yields of wheat by 13 %(Battisti and Naylor, 2009. Kenya as well has had such extreme temperature conditions in a number of years including 1971-73, 1983-84, 1991-2 and 2004-6.A estimated 2.5 million Kenyans were affected by the prolonged drought.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, DISCUSSION, CONCLUSION AND RECOMMENDATIONS.

5.1. Introduction

This chapter deals with summary of the research findings,a discussion of the findings, conclusion and recommendations.

5.2 Summary of Findings

The study sought to investigate the determinants of maize yields among small scale farmers in Trans Nzoia West Sub County in Trans Nzoia County in Kenya.For a small scale farmer to realise optimal yields from their farms the type of seeds and use of organic fertilizer plays a major role.In addition, the farming techniques employed including land preparation,intercropping and crop rotation, harvesting and storage have impact on maize yields. Farmer incentives including subsidized inputs, access to credit and availability of inputs at the right time and near the farms is crucial in boosting yields.Equally important is well distributed rainfall throughout the crop cycle and favourable temperatures.

5.2.1 How access to farm inputs determined maize yields among small scale farmers in Trans Nzoia West Sub County.

From the study 60% of small scale farmers use certified maize seed whereas 40% do not use certified maize seeds 33% of respondents agree to use certified maize seeds.27% of respondents strongly agree to use certified maize seed.25% disagreed to use certified maize seed.8% were undecided whereas 7% strongly disagreed to use certified maize seed.The results show that the number of farmers who use certified maize seed is more than those who use traditional seeds. The results however indicate that there is still a large number of farmers who who do not use certified maize seeds. The reasons for non usage of certified maize seed included high unaffordable cost, long distances to distribution cetres and past experience with certified seeds which did not yield as per their expectation ,delay and in some incitances unavailability of maize seed stocks.

Research finding regarding use of organic fertilizer showed that 58% of small scale farmers did not use organic fertilizer while 42% used organic fertilizer.52% respondents disagreed to use organic fertilizer for maize production,32% Agreed to use organic fertilizer,8.2% strongly disagreed to use organic fertilizer for maize production while 7.8% strongly agreed to use organic fertilizer for maize production.The results show that a large number of small scale maize farmers do not use organic fertilizer for maize production.This they attributed to high cost of fertilizer which they can not afford, Long distances to distrinution centres which increase transportation cost.

5.2.2. How Farming Techniques determined maize yields in Trans Nzoia West Sub County

The findings show that 41(11%) of respondents conducted soil acidity and nutrients testing and management.330(89%) did not conduct soil acid testing and nutrient management.69% disagreed to have tested the soil acidity and nutient management of their

farms. 20% strongly disagreed to have conducted the tests of both acidity and nutrients of their farms. 11% Agreed to test soil acidity and nutrients of their farms.The reasons for not adopting the technique of testing soil acid levels and nutrient levels were lack of information, unavailability of soil testing services in the villages near farms and the cost of the exercise.Consequently, these farmers continued to apply same variety of fertilizer over years which they admitted was not yielding as per their expectation.The proportion .

5.2.3 How Incentives to farmers determined maize yields in Trans Nzoia West Sub County

From study findings, 89% of small scale farmers in Trans Nzoia West Sub County do not benefit from Kenya Government input subsidizing program.39% strongly disagreed saying they had not heard of existence of such program in their locations.40% disgreed saying although they had heard of the program, the entry requirements were stringent and they had not succeeded in benefiting from it.They said the program benefitted the commercial farmers and traders who acquired the inputs for use in their farms or for re- packaging to sell respectively. 8 % of small scale farmers in Trans Nzoia West Sub County agreed to have benefitted from inputs subsidizing program.Majority said they were assisted by program faccilitators or were introduced by known influential persons.5% of respondents were undecided as they did not know what the program was all about.

88% of respondents say farm inputs are not always available during planting seasons in their locations.They said inputs stocks ran out before they got supplies and even when supplies were available, they had to travel long distances to traders in Kitale Town or Kiminini to get seeds and organic fertilizer.They associated village input traders with sub standard inputs. 87% of respondents said they had not accessed credit facilities to fund maize production.They cited credit cost and distance from farms to Kitale where financial institutions are located as impedements.They also cited other related costs such as bribes to bank credit staff as

discouraging factors.13% accessed credit facilities for maize production.They said they were introduced to financial by individuals who were known and willing to offer a guarantee in in case of default.Lack of collateral and previous default history by small scale farmers ware also identified as a reason why financial institutions were reluctant to offer credit to small scale farmers.

5.2.4. How weather conditions determined maize yields in Trans Nzoia West Sub County

Table 4.13 show that 54% of respondents say rainfall has not been reliable.89 respondents (50%) cited delayed onset where rains set in late in April resulting to late planting.In addition the said there are lengthier dry spells between the crop cycle which affect grain formation.53 respondents(30%) of those who agreed that rainfall has not been reliable cited inadequacy and extremely heavy down pours which result to wilting of the crop and crop destruction and soil errosion respectively.35 respondents(20%) of those who agreed said heavy rainfall accompanied by heilstones have caused damages to their maize crop leading to lower yields. 46% of the respondents agreed rainfall has been reliable.98(60%) said rainfall has been evenly distributed throughout the maize cycle. 66(40%) associated reliability with sufficiency of the rainfall.11(3%) of the respondents were undecided as to whether rainfall has been reliable for maize production.They said they have not noticed any change in rainfall patternsMajority of the respondents at 257(69%) agree that high temperatures has affected their maize yields.103(40%) of the respondents said high temperatures caused wilting of their crop at early stages.90(35%) cited high temperatures to have affected seed formation leading to poor quality grains.64(25%) of respondents said high temperatures resulted in moisture loss making it difficult to apply top dressing fertilizer.114(31%) of respondents disagreed that high temperatures had affected their

maize crop.They said even though there were at times long dry spells, their being close proximity to rivers and forested hilly areas moderated the temperatures.

5.3 Conclusion

The study aimed at investigating determinants of maize yields among small scale farmers in Trans Nzoia West Sub County in Trans Nzoia County in Kenya.

In conclusion, access to certified maize seeds and organic fertilizer by small scale farmers has greater impact on maize yields. Farmers who plant certified maize seeds using organic fertilizer realize better yields. 60% of small scale farmers' plant certified maize seeds whereas 40% use traditional seeds.

Farming techniques equally play a big role in determining yields. Adoption and embracing of modern farming techniques by small scale maize farmers results into better yields. For instance farmers who use quality seeds and fertilizer realize better yields. In addition farmers who regularly test soil acidity and nutrient levels are able to manage the quality of the soil thereby ensuring better yields.

Farmer incentives in form of availability of inputs in markets near their farms and in season ensure farmers access the inputs at low costs. The study also shows farmers are unable to access credit from financial institutions to fund production costs. Some of the major inhibiting factors to access to credit are the high cost of credit, transport cost and unstructured loan products.

Weather conditions specifically rainfall reliability and high temperatures have great impact on the maize yields among small scale farmers in Trans Nzoia West Sub County.Trand Nzoia West Sub County experiences erratic rainfall in terms of delays in relation to expected planting season in March and May. There are also cases of excess rainfall which washes away the crops in some cases the storms destroy the crop. High temperatures are largely responsible for withering of the crop and poor grain formation.

5.4 Recommendation of the Study

Based on the findings of the study, the following is recommended;

1. County Government of Trans Nzoia should establish maize inputs distribution centers in all sub locations in the county for farmers to easily access farm inputs for maize production. This is because many respondents said the inputs can only be found in distances far off in Kitale town or Kiminini.

2. The County Government of Trans Nzoia should streamline the inputs subsidizing program and put in place measures to ensure all eligible small scale farmers benefit from the program. Most respondents said they have not benefitted from the program.

3. Agriculture Extension officers should educate farmers on the need to test the acidity and nutrient levels of their farm soils. Majority of the respondents have never tested the acidity levels of their farm soils.

4. The Government should invest in research to come up with maize variety that is resistant to drought.

5.5 Suggestions of the Study

The study was conducted in Trans Nzoia West Sub County in Trans Nzoia County in Kenya. The following observations were made for further research.

1. The study concentrated on access to farm inputs, farming techniques, incentives and weather conditions. Future studies should investigate farmer's attitudes towards modern farming techniques.

2. As a form of incentives, future research should examine how low market prices for maize and maize importation affects maize yields among small scale farmers.

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APPENDIX I

LETTER OF TRANSMITTAL

UNIVERSITY OF NAIROBI
COLLEGE OF EDUCATION AND EXTERNAL STUDIES
SCHOOL OF CONTINUING AND DISTANCE EDUCATION
DEPARTMENT OF EXTRA-MURAL STUDIES
KAKAMEGA & WESTERN KENYA AREA

Your Ref:
Our Ref: Uon/Cees/Kak/1/47/(25)
Kakamega 056-31038

P.O. Box 422
KAKAMEGA
Telephone

26h June, 2016

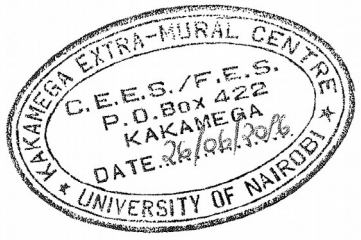
TO WHOM IT MAY CONCERN

REF: JOHN MASINDE WANJALA - REG NO. L50/76726/2014

This is to confirm that the above named person is a student at the University of Nairobi, College of Education and External Studies, School of Continuing and Distance Education, Department Of Extra-Mural Studies, pursing a course leading to the award of Masters of Arts in Project Planning and Management. He has completed the coursework and is now working on research work on the topic. **"Determinants of maize yields among small scale farmers in Trans Nzoia West Sub County in Trans Nzoia County in Kenya"** Kindly accord him the necessary assistance to collect data for the above research. This is purely for academic purpose.

Any assistance accorded to him will be highly appreciated.

Yours faithfully,



Dr. Stephen Okelo,
Resident Lecturer,
Kakamega & Western Kenya Area.

APPENDIX II

QUESTIONAIRE FOR MAIZE FARMERS

Dear Maize Farmer,

I am a student at the University of Nairobi undertaking a Master of Arts degree in Project

planning and management. I have identified you as a respondent to a questionnaire to collect information on the determinants of maize yields among small scale farmers in Trans Nzoia West Sub County,Trans Nzoia County in Kenya. I kindly request you to fill in the questionnaire as honestlyas possible. All your responses will be handled with confidentiality and will only be used foracademic purposes.**Do not write your name on this questionaire**. Thank you for your cooperation**.**

Thank you.

SECTION A: DEMOGRAPHIC INFORMATION

Please tick(√) where appropriate

1. **Gender**

   Male [ ]Female [ ]

2. **Age**

   18-30 [ ] 31-40 [ ] 41-450[ ] 51and above[ ]

3. **Level of Study**

   PhD [ ] Masters [ ]Bachelors degree[ ]Diploma[ ]

   Certificate [ ] None [ ]

SECTION B: OPEN ENDED QUESTIONS

ACCESS AND AFFORDABILITY OF FARM INPUTS AND MAIZE YIELDS

1. **What type of maize seed have you been planting on your farm**

Certified[ ] Uncertified [ ]

Describe the yields you have been realising……..

2. **Do you use organic fertilizer in your maize crop?**

Yes[ ] No[ ]

If your answer above is (NO) explain the reason and the impact on maize yields…….

3. **Is the price of maize seed and fertilizer affordable to you?**

Yes[ ] No[ ]

How has the cost of maize seeds and organic fertilizer influenced your maize production……..

FARMING TECHNIQUES AND MAIZE YIELDS

4. **Do you test soil acidity and nutrients on your farm ?**

Yes[ ] No[ ]

If your answer is (NO) explain the reasons and the impact on maize yields……..

5. **Have you experienced maize pre and post harvest losses ?**

Yes[ ] No[ ]

Describe the losses and how you could have mitigated against the losses……..

6. **Has there been a maize inputs price subsidizing program you have benefited from?**

Yes[ ] No[ ]

Explain why you have/have not benefitted from the inputs subsidizing program……..

7. Are farm inputs (maize seeds and organic fertilizer) available during planting season in your location?

Yes[ ] No[ ]

Describe inputs availability in your location and the impact to maize production……..

8. Do you access loan facilities for maize production from financial institutions?

Yes[ ] No[ ]

Explain what you think is the reasons for your access or lack of access to credit and the impact to maize production…

9. Has rainfall been reliable for maize production in your locality?

Yes[ ] No[ ]

Describe the rainfall situation and the impact on maize crop…….

10. Has your maize crop been affected by high temperatures

Yes[ ] No[ ]

Describe the effects of high temperature on your maize crop and yields……

SECTIONC: LINKERT QUESTIONS

To what extend do you agree with the following statements related to maize yields?Rate as follows SA(Strongly Agree),A(Agree),U(Undecided),D(Disagree)and SD(Stronly Disagree)

		SA(5)	A(4)	U(3)	D(2)	SD(1)
1	The farmer used certified maize seed during planting					
2	The farmer usedn adequate organic fertilizer during and top dressing of maize crop.					
3	The price of maize seed and organic fertilizer is affordable to the farmer.					
4	The farmer tests soil acidity and nutrient levels of soil on their farm					
5	The farmer experienced maize pre and post harvest losses					
6	The farmer benefitted from subsidized maize inputs					
7	Maize seeds and organic fertilizer were available in the maize production cycle					
8	The farmer accessed loan facilities for maize production from financial institutions					
9	Rainfall had been reliable for maize production					
10	High temperatures had negatively affected maize yields					

APPENDIX III

INTERVIEW SCHEDULE FOR WARD AGRICULTURE OFFICERS

Instructions: This interview schedule is aimed at investigating determinants of maize yields in Trans Nzoia West Sub County in Trans Nzoia County. You are requested to answer all questions to the best of your knowledge and with a lot of honesty. The researcher guarantees confidentiality for all the responses to the questions.

1. What are some of the factors that influence the type of maize seed that farmers plant in their farm

2. Comment on the rate of organic fertilizer usage in maize production in your Ward
3. How has the cost of certified maize seed and organic fertilizer impacted on maize yields
4. How do farmers manage soil acidity and nutrient levels on their farms
5. What forms of maize pre and post-harvest loses has been experienced in your ward
6. What forms of incentives are available to maize farmers
7. How has proximity and stocking of farm inputs impacted on maize yields
8. How do farmers finance farm costs?

   Comment on the availability of credit to maize farmers to finance production cost

9. Have farmers suffered any losses due to rainfall unreliability? Explain your answer

10. Have high temperatures had any impact on maize production? Explain your answer