DETERMINING FACTORS THAT AFFECT MAIZE PRODUCTION IN TURBO CONSTITUENCY, KENYA

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DECLARATION

This research project report is my original work and has not been presented to any other university for any award.

SIGNATURE……..... **……**

CHUMO MICHAEL KIMELI **DATE**

L50/75767/2012

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

SIGNATURE……..... **……...**

MR. PETER K. HARRY **DATE**

ELDORET EXTRA MURAL CENTRE

DEDICATION

This project is dedicated to my late Dad Mr. Eliud Kiprotich Chumo, your hard work and determination to have us get a good education was never lost to me. My mother Mrs. Peris Jebet Chumo, my brothers Daniel Kipruto Chumo, David Kiptoo Chumo, my fiancée Zetheleza Chelagat Bunei and my local community at large for giving me a chance to be a role model and for inspiring me towards further studies.

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LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA	: Analysis of Variance
CAN	: Calcium Ammonium Nitrogen
DAP	: Di Ammonium Phosphate
FAO	: Food and Agriculture Organization
FAOSTAT	: Food and Agriculture Organization Statistics Databases
IAASTD	:International Assessment of Agriculture Knowledge, Science and Technology Development
IAC	: Inter Academic Council
IFPRI	: International Food Policy Research Institute
IMWIC	: International Maize and Wheat Improvement Centre
IPCC	: Intergovernmental Panel on Climate Change
KARI	: Kenya Agricultural Research Institute
KEPHIS	:Kenya Plant Health Inspectorate Service
M.T	:Metric Tons
NALEP	**:** National Agriculture and Livestock Extension Program
NCPB	: National Cereals and Produce Board
OECD	:Organization for Economic Co-operation and Development
USDA	: United States Department of Agriculture
SSA	: Sub-Saharan Africa
SPSS	: Statistical Package for Social Sciences
WFP	:World Food Programme

ABSTRACT

Maize is the most important cereal crop in Kenya. It forms an important part of the food and feed system, and contributes significantly to income generation for rural households. It is the main staple food for the people of Kenya, providing more than a third of the caloric intake. In terms of land usage, maize accounts for about 56% of cultivated land in Kenya. About 98% of the 3.5 million small-scale farmers in Kenya are engaged in maize production. The study covered the determining factors that affect maize production in Turbo Constituency, Kenya. The objectives of the study included: To investigate the effect of climatic change on maize production in Turbo Constituency, to determine the effect of market demand for maize production in Turbo Constituency, to determine the effect of inputs available in maize production in Turbo Constituency, to determine the effect of quantity of maize produced in Turbo Constituency and to establish other activities carried out in Turbo Constituency. The research shall be of great benefit to; farmers, maize traders, future researchers and the donor community in the region. The total maize farmers' population according to the Ministry of Agriculture Turbo Constituency branch was 5210, the target population for the farmers was 140 and a sample size of 103 was used. Sample size was scientifically computed through Krejcie and Morgan's (1970) formulae. Simple random sampling design was used to select the farmers. Explanatory survey design that involves visit and acquire direct responses which helped as a basic tool to measure variables and examine relationships among variables and captured attitude of the respondents. The study adopted Cob-Douglass Production Theory which is a function used widely to represent relationship of an output to input. Questionnaires and interview schedules were used as research instrument for data collection. Validation of the research was through expert opinion through the supervisor guide, recommend on adjustments and assessing the research instruments used. A pilot study was done together with the pre-test to ascertain the reliability of the research instruments. In analysis descriptive and inferential method was used in data analysis on Statistical Package Social Software which was in line with qualitative and quantitative analysis to ensure achievement of the main objective. The results show that the determining factors that affect maize production were: age, gender, educational level, labour, land, market, farm inputs, transport and infrastructure, and other economic activities within the constituency. ANOVA analysis was used to analyse climatic conditions which it was difficult for respondents to give exact information on weather measurements. The government should address the lack of incentives for farming communities by improving access to credit, farm inputs delivery and distribution on time, better on infrastructure, strengthening agricultural institutions and developing policies to reduce market risks. The agricultural sector should develop new technologies in line with; quality hybrid seeds, mechanisms on combating reduction of soil erosion and conserving water and soils fertility. This study can provide a basis on which agricultural policy makers can plan for irrigation methods in particular dry regions and provide a strategy for combating drought.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Maize was domesticated in Central America some 6,000 to 10,000 years ago. It spread to the rest of the world in the 16th through 18th centuries. World-wide more than 400 million people, primarily in sub-Saharan Africa and Central America, white maize plays a major role in the diet (Morris, 2004).

In the global perspective maize production is connected to technology. According Huang and Rozelle (1996) on Technological change they stipulates that increase in the production of maize and other cereal crops in China during the last several decades has been recognized as one of the most remarkable success stories in science and technology and agricultural policy reform. Development of technology, including hybrid technology; increased water availability through government-funded infrastructural projects; and the supply and use of inorganic fertilizer and other farm chemicals are important factors contributing to maize production growth.

According to the Press Statement by Shenggen Fan, Director General, International Food Policy Research Institute (IFPRI) August 06, 2012 Economic Research Service of the United States Department of Agriculture (USDA) (2012), 62 percent of US farms are located in areas experiencing drought. About 40 percent of maize is produced in areas experiencing severe drought. As a result, national crop yield and harvest estimates for maize have been lowered considerably. Experts suggest that crop losses for maize are coming close to 20 percent and could reach 30 percent or more if extreme drought conditions persist. Prices of maize already started to rise rapidly and could increase further depending on the degree of severity and extent of the drought.

In Australia maize production is recognized as a high yield crop provided optimum crop management used. Yield potential of maize is essentially dependent on amount of intercepted solar radiation, water and nitrogen supply moderated by factors that limit physiological processes. The industry is subject to continuing challenges from use of economic and market forces and expectations of the broader community, especially in resource use efficiency and environmental management and needs to maintain a dynamic research and development program to undergo production practices in the long term (Martin et al, 1991).

A study on Maize in India by Joshi *et al*, (2005) on Production Systems, Constraints, and Research Priorities- found that major biotic production constraints were Echinocloa, Cynodon dactylon, rats, and termites, which reduced maize production levels by more than 50%. Other important abiotic and biotic stresses listed in descending order of importance were: caterpillars, water stress, stem borers, weevils, zinc deficiency, rust, seed/seedling blight, cutworm, and leaf blight. Non-availability of improved seeds, inadequate input markets, ineffective technology dissemination, and lack of collective action were the principal socio-economic constraints.

In Africa perspective Maize cultivation in Nigeria had suffered various problems, rural-urban migration, low yield, pest and diseases, climate change, poor shortage facilities, shortage of key inputs and shortage of irrigation water. Nigeria has experience shortages in maize production in the past. Prices of maize and other product derived from maize boosts up during low production seasons and falls drastically when there is a surplus production, however, due to inadequate marketing facilities in the control, farmers loses some of the product. Since farmers do not know future of maize production and prices while deciding to cultivate this and other crops. There is need to forecast cultivation area, yield and production of maize in Nigeria. (Akande, 1994)

According to Doyer *et al.* (2007) the deregulation of the South African agricultural sector commenced in the 1980s and gradually changed the structure and responsibilities of the actors in the sector. This process of deregulation and liberalization exposed farmers and agribusiness alike to international forces. In Zimbabwe generally, communal and smallholder farmers occupy areas of lower natural potential for agriculture in terms of rainfall, soils and water for irrigation. In addition, these areas are of lower economic potential because of the distances from markets and poor communication and social infrastructure. Until recently, the other group comprised roughly 4,000 large-scale farmers with very sophisticated production systems and occupies about 11 million hectares of land, primarily located in the areas of high agricultural and economic potential. Government of Zimbabwe imports of agricultural products are limited mainly to wheat and maize in drought years.

According to 2004/2005 crop and food supply assessment of the FAO/ WFP in Swaziland, showed that the production of the country's staple food, maize was on

a long term decline, dropping by 70% over a period of five years in most areas. This was due to non-cultivation of the arable lands due to delayed rainfall and the high risk of making loss from agriculture as well as shortage of seeds for alternative crops among others. Swaziland has suffered below average and declining cereal production as a result of erratic rainfall patterns, which are exacerbating the impact of rising unemployment and increased poverty.

Regionally Eastern African countries have taken maize production as a crucial aspect of development. According to Kaliba (1998) in the study on adoption of maize production technologies in Central Tanzania where several issues require closer attention from research, extension, and policy makers. Research and extension efforts need to be linked and strengthened to increase the flow of information to farmers. In developing improved maize varieties, researchers must consider yield as well as other important traits: drought resistance/tolerance, resistance to storage pests, shelling quality, and taste. For this to occur, farmers must participate in the research process. The formal credit system needs to be altered to address the credit problems faced by small-scale farmers. A more efficient marketing system for inputs and outputs would benefit farmers by providing higher maize prices and reducing fertilizer costs. Such a system would require supporting policies from the government.

In a study conducted in Ethiopia on Enhancing the Contribution of Maize to Food Security in Ethiopia, the increment of production in the 1990s indicates a green revolution for food self-sufficiency in Ethiopia. However, the availability of quality seed with necessary inputs at the right time and place with a reasonable price is crucial. Unavailability of improved infrastructure and maize grain marketing represents major limiting factors for maize production. Wise utilization and conservation of natural resources will also have a significant impact on maize grain production. (Nigussie, 2002)

In the case of Uganda a study conducted by Food and Agriculture Organization of the United Nations on Fertiliser Use by Crop, it ascertained that use of improved agricultural technologies remains low even when most farmers may be aware of the potential of these inputs to increase yield. But yield per se may not be enough to guarantee increased adoption - especially for poor farmers when the cost of these inputs compared to the farmers' basic needs may be relatively high. The economic returns from use of these inputs are of essence than yield (FAO, 2006).

In Kenya though maize is grown in almost all Agro-ecological zones, the highest productivity is in the high potential and central highland zones while the lowest potential for increasing is in the lowland regions. An inter-zonal variation has been attributed to better soils, rainfall, access to agricultural extension services as well as adoption of technologies such as hybrid maize and fertilizers (Karanja, *et al*., 1998).

Kenya has lost its competitiveness in maize production to the neighbouring regions due to the high cost of maize production (Nyoro, 2004). One of the most important avenues for reducing production cost is to increase yield per unit area by increasing technical efficiency. This Study has concluded that increased input use (i.e. seed and fertilizer) and a household's characteristics impact yield across and within regions.

Credit is necessary to encourage technical innovations, such as use of yield-enhancing inputs, which cost slightly more, but shifts production, transforming the entire input-output relationship. Small farm producers in developing countries appear to be unresponsive to apparently economical justified technical innovations because probably due to risk attitudes and liquidity constraints. At the subsistence level where sheer survival is at stake, risk-averse producers are likely to prefer the traditional technologies that may promise a higher average yield with lower variance to new technologies that may require a higher average yield but also present the risk of greater variance (Todaro, 1997). The farmers are also risk averse because of uncertainty in repayment and high interest rates. Producing higher maize yields on existing cultivated land is therefore the surest way of generating the extra maize grain required to feed the nation. To achieve this goal, a number of remedial activities must be put in place (Jones, 2007).

1.2 Statement of the Problem

Declining trends on quantities of maize produced has been evident at the global and regional level with a majority of the world producers of maize recording significant declines in the quantities of maize exported (Pingali, 2001). Importation of maize leads to lack of market to maize farmers regionally and locally which discourages farmers to continue farming this product (Mutunga et al., 2003).

Farmers in the Turbo constituency region have adopted the use of the modern technologies through government agencies and have received some training

on maize production through programs such as the NALEP program but declines in maize production have persisted.

Following the market liberalization reforms undertaken by the Government of Kenya in the late 1980s and early 1990s, agricultural markets are characterized by the following constraints among others: long chains of transactions between the farm-gate and consumers; poor access to appropriate and timely information; small volumes of products of highly varied quality offered by individual smallholders farmers; and poor structured and poor markets (Mude, *et al,* 2006).

Over the past 50 years, human activity has altered ecosystems more rapidly and extensively than in any comparable period in the history of mankind, largely to meet the demand for food, fresh water, fuel and other industrial raw materials. Its impact is climatic change includes increased intensity and frequency of storms, altered rainfall amounts and patterns, altered hydrological cycles, rising temperatures, persistent droughts and flooding (FAOSTAT, 2006).

Constraints to credit access have been identified as some of the barriers to adoption and use of sufficient and improved agricultural inputs in developing countries Feder et al., (1985). The demand for improved seeds was also relatively low, due mainly to poor promotion and marketing efforts, high prices, and the inability of farmers to purchase complementary inputs, especially fertilizer.

Other factors that affect maize production in Turbo Constituency; Soil acidity is one of the factors limiting maize production in some parts of Kenya notably in Uasin Gishu County. Regular annual dressings of sulphate of ammonia fertiliser brought about a substantial decrease in topsoil pH within a very short time (Robinson, 1956). Farmers lack storage facilities thus maize gets destroyed due to humid, theft and exposure to unworthy conditions. Maize production also affected due to the decrease in land since population increase is on the rise thus land for cultivation is being encroached (Farm Management Handbook,2007).

Infrastructure especially in Turbo Constituency is very poor and as a result farmers either cannot receive farm inputs in time or transport their maize to the market in good time, slow reimbursement of seed credit sales. There has been a general lack of research on the causes of decline in the maize production. Other economic activities involved in the area replacing on productivity of maize production due to the long duration and processes before benefiting from the output. Quantity of maize produced and how it affects the people of the region. The study

therefore seeks to investigate on selected determining factors that affect maize production in Turbo constituency, Kenya.

1.3 Purpose of the Study

The study sought to establish determining factors that affect maize production of Turbo Constituency, Kenya.

1.4 Research Objectives

The study addressed the following objectives;

1. To investigate the effect of climatic change on maize production in Turbo Constituency.
2. To determine the effect of market demand for maize production in Turbo Constituency.
3. To determine the effect of inputs available in maize production in Turbo Constituency.
4. To determine the effect of quantity of maize produced in Turbo Constituency.
5. To establish other activities carried out in Turbo Constituency.

1.5 Research Questions

The study sought to answer the following research questions;

1. What are the effects of climatic change in maize production in Turbo constituency?
2. What are the effects of farm inputs available for maize production in Turbo constituency?
3. What are the effects of market on maize production in Turbo Constituency?
4. What are the effects of quantity of maize produced in Turbo constituency?
5. What are other activities carried out in Turbo Constituency?

1.6 Scope of the study

The scope of the study was to establish the determining factors that affect maize production in Turbo constituency. Turbo constituency is within Uasin Gishu County known for large scale production of maize. The study took place between the month of March and targeted farmers in Turbo Constituency. Objectives were formulated to capture the essence of maize production from the farmers in Turbo

constituency hence questionnaires and interviews were used as valid research instruments.

1.7 Significance of the Study

The study was of great benefit to a number of stakeholders which include: farmers, maize collection and manufacturing plants, donor communities, researchers and Kenya as a country. Farmers knew reasons why they are not able to maximize maize production; they were in a position to know the causes and determining that affect maize production; they learnt best farming practices to enhance sufficient collection of maize quantities. Maize collection and manufacturing plants had insights on determining factors that affect maize production, they advised on ways to maximize quantities of maize quantities and this would result to higher production in their region of operation. Donor communities would educate to enlighten on the challenges, provide monetary support, and collaborate with farmers on solutions to maize producing farmers on the existing problems. Researchers would add exiting pool of knowledge on the concept of maize, document information on effective ways on maximizing productivity thus vital for the Kenyan economy, would enable future researches built on documented knowledge.

1.8 Limitations of the Study

The researcher anticipated the language barrier limitation as some of the respondents who are farmers in the local regions were not in a position to communicate in the same dialect fluently and the researcher solved this by the use of translators who came in handy. The study was also limited geographically owing to the terrain of the region. The researcher had to navigate through the rough terrain of the region in order to be able to collect the data. The researcher employed the services of a local who knows the region well. The study was limited in terms of the willingness of the respondents to participate in the study. They viewed the intentions of the research with a lot of suspicion. The researcher therefore aimed to assure the respondents that the data being collected is for confidential and academic purposes only.

1.9 Delimitations of the study

The study delimited itself to the factors affecting maize production within the boundaries of Turbo Constituency in order to avoid interference from factors affecting maize production in other regions. These factors include market, labour and capital. This factors have been identified as the factors to be investigated in the study because of the significant role they play in determining the quantity of maize that a given area or farmer can produce. This are considered the factors of production that the farmer should actively manage to harness quantities of production.

The study also delimited itself to Turbo Constituency because of the ability of the region to produce maize in large quantities owing to the availability of the factors production in the region and good climate that favours the maize crop.

1.10 Assumptions of the study

The study assumed that the farmers in the study area were well aware of the factors affecting maize production in Turbo constituency. The study also assumed that the respondents were willing to cooperate and give out valid information needed for the study and were also sincere in answering questions. The study assumed that the respondents would fill and return the questionnaires under a stipulated period.

1.11 Operational definition of terms

Capital: A factor of production that is not wanted for itself but for its ability to help in producing other goods (Martinez, 2000). In this study the term capital will be used to refer to the monetary requirement in the maize production process.

Income: These are the returns that a farmer gets from the sale of produce in a certain defined period of time having employed the factors of production.

Market: This are the targeted group of buyers that are ready and willing to buy the farmers produce at an agreed price determined by the buyer and the seller.

Production: it is the quantity (value) of agricultural output per unit quantity (value) of input(s) used in production (OECD, 2001).

Input: Insertion of all the necessities production cycle to bring forth agricultural output in terms of seeds, fertilizers, pesticides, implements, capital, human labour, weeding, harvesting, threshing, all management operations and method of cultivation.

Climatic Change: is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decadesw to millions of years. It may be a change in average weather conditions, or in the distribution of weather around the average conditions

1.12 Organization of the Study

The study was organized in to five chapters as discussed below:

In chapter one, it consists of the background of the study, statement of the problem, purpose of the study, objective of the study, research questions, assumptions, significance of the study, limitations of the study, delimitation of the study, definition of key operational terms and the organization of the study. Chapter two, it reviews the previous studies on the related field, acknowledges the contribution made by the scholars' publications and seminar papers, conference proceedings, business journals text books and periodicals, identifies the gaps and provides the way forward. A critical review is done to identify gaps, thereafter a summary is made to show how unique the study is. The literature review has been categorized under various sub headings. Chapter three contains the research design to be used, target population of the study, the sampling design and sample size, data collection instrument, validity and reliability of the study, data procedure and data analysis. Chapter four will discuss the analysis of the data collected and present it in forms of graphs and tables. The information presented is interpreted and discussed. Relationships are established from the information presented and try to deduce the clear meanings of the data collected in the study. Chapter five is the final chapter and consists of the following: Summary of findings, conclusion and recommendations

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of the past studies that have been conducted in this area relating to maize production with specific focus into the factors that affect maize farming including; market, climatic change, input availability. This chapter gives a theoretical framework and a conceptual framework to govern the study.

2.2 Maize Production Globally

Maize production in the global arena can be categorized into white maize production and yellow maize production (Meyer *et al*., 2006). White maize is biologically and genetically very similar to yellow maize, although there is a difference in appearance due to the absence of carotin oil pigments in the kernel which otherwise cause the yellow color of the grain. Production conditions and cultivation methods are largely identical (Martinez, 2000).

World production of white maize is currently estimated at around 65-70 million tons, representing 12-13 percent of the annual world output of all maize. Over 90 percent of the white maize is produced in the developing countries, where it accounts for around one quarter of total maize output and just under two-fifths of the total maize area. In the developing world, a larger area is planted to white than to yellow maize in the tropical highland and sub-tropical/mid-altitude environments, and it occupies about 40 percent of the lowland tropical maize area (Lopez, 1998).

Maize is widely cultivated throughout the world, and a greater weight of maize is produced each year than any other grain. The United States produces 40% of the world's harvest; other top producing countries include China, Brazil, Mexico, Indonesia, India, France and Argentina. FAO. (2010) FAOSTAT shows that in 2008, North America recorded the largest production of maize with about 38.8% of the global output. This is followed by Asia (28.5%); South America (11.2%); Europe (11.1%); Africa (6.9%); Central America (3.4%); and Oceania (0.07%).

Argentina, Brazil and China account for over 60 percent of total maize output in the developing world, China alone for 45 percent. When these countries are excluded from consideration, white maize constitutes over 60 percent of the maize area in developing countries, and just under 60 percent of total maize output in those countries. By contrast, white maize is a product of much lower importance

for the developed world. In the United States, for example, by far the world's largest producer of maize, white maize cultivation accounts for less than one percent of the total domestic maize output, produced to a large extent under contract farming due to the relatively limited market (Martinez, 2000).

Two other significant areas of white maize production are, firstly, Central America excluding the Caribbean sub-region, where it represents about 90 percent of total maize output of the region, and, secondly, the northern part of South America Colombia and Venezuela. Among the main producers in Asia China, Indonesia and the Philippines. Yellow maize is considerably more important in their total cereal production than white maize. White maize tends, however, to be a main staple food in certain areas of these countries (Morris, 2004).

2.3 Maize Production in the Africa

Introduced into Africa by the Portuguese in the 16th to 18th century, maize has become Africa's most staple food and feed system. In 2005, the top exporters of maize in sub-Saharan Africa were South Africa, Tanzania, Uganda, Zambia and Swaziland, with the top importers of maize Zimbabwe (a maize exporter until the late 1990s), Angola, Ghana, Kenya and Mozambique. Facing a growing population, several studies (Pingali, 2001) (World Bank, 2007) note that it is critical for Kenya and other African countries to increase maize production in order to feed their people. According to FAO/WFP 2004/2005 crop and food supply assessment, the production of the country's staple food, maize was on a long term decline, dropping by 70% over a period of five years in most areas. This was due to non-cultivation of the arable lands due to delayed rainfall and the high risk of making loss from agriculture as well as shortage of seeds for alternative crops among others. The African rain-fed agriculture is viewed by many observers to be the most vulnerable sector to climate variability and the potential impacts of climate change on agriculture are highly uncertain. The report by World Meteorological Organization (WMO)

According to reports of IPCC (2007), factors such as endemic poverty, bureaucracy, lack of physical and financial capital, frequent social unrest and ecosystem degradation contribute to Africa's vulnerability to climate variability. Despite progress made in national and international policies since the first world conference on women in 1975, the International Assessment of Agriculture

Knowledge, Science and Technology Development (IAASTD, 2009) reported urgent action is still necessary to implement gender and social equity in policies and practices in order to better address gender issues as integral to the development process especially for maize production.

Most of the maize produced and consumed in Africa comes from smallholder rural farms. Production takes place under difficult conditions characterized *inter alia*, by poor soils; low-yielding varieties; inadequate access to yield-enhancing inputs such as fertilizers and improved seeds; inadequate access to finance by producers, suppliers and buyers; and variable climatic and environmental conditions. There are also heavy post-harvest losses due to poor storage and processing facilities and technologies. The entire maize value chain, from input supply through production to marketing and consumption, suffers from constraints that could be removed if known technologies and policy and marketing innovations could be harnessed effectively and efficiently (FAOSTAT, 2007). Traditionally clay-lined maize grain silos are used for storage in Africa. In each instance, subsistence farmers and agribusiness alike must take into account the difficulties of storing maize at optimal conditions and balance humidity, the moisture content of the kernels, and the potential for pest infestations. International Maize and Wheat Improvement Centre, (IMWIC), (2008). Domestic trade in maize has been completely liberalized and the Government's farm support price system has been abolished. Only the import and export monopoly has been retained by the National Grain Marketing Board (FAO, 1994).

2.4 Maize Production in Kenya

The major counties that are suitable for maize production are; Trans Nzoia, UasinGishu, Kakamega, Nakuru, Embu, Nyeri, Kirinyaga, TaitaTaveta and Kwale. The area under maize cultivation is estimated at 1.5 million hectares, producing about 26 million bags of maize annually. This falls short of the annual domestic maize consumption estimated at 34 million bags (Kamau, 2003). Due to diminishing availability of arable land implies that future growth in maize production would have to depend mainly on yield gains made possible by wide-spread use of productivity enhancing technologies such as use of improved farming methods (Gitu, 2008). Kenya cereals and produce board provide market for maize producers. It is government granaries that buy surplus maize during pamper harvest. It also

regulates maize prices in the market. Other maize buyers are major millers within the neighbouring towns; these are Dola millers, Unga millers'. However the millers do not buy maize at good price.

Each year, the average Kenyan consumes 98 kilograms of maize, the staple of the Kenyan diet. At the same time, maize prices in Kenya are among the highest in sub-Saharan Africa, and the poorest quarter of the population spends 28 percent of its income on the crop (Farm Management Handbook, 2007). Increased productivity and efficient markets, in conjunction with rational government policies, can dramatically alter the economic contribution of the subsector. With proper reforms in place, the maize industry will become a key element in accelerating growth and reducing poverty. However, poor rains, a reduction in planting after the 2008 post-election violence, and a decrease in fertilizer application due to higher prices have resulted in lower harvest yields for smallholder farmers in 2009. Kenya normally has a deficit in maize, which is filled by informal cross-border trade from Uganda and Tanzania; however, the present deficit is so large (estimated at 400,000 to 700,000 MT) that imports from the international market have been required.

A major problem for smallholder farmers is the lack of access to timely and accurate market information. The lack of access to storage facilities, roads contributes to high food costs and low selling prices as well as high post-harvest storage losses caused by weevils and the larger grain borer. The trend, as witnessed in Kenya with trade liberalization and privatization, has led to a dismantling of many market services that were once available to rural farmers. (Inter Academy Council, 2004).

In Kenya these strategies proved to be only moderately successful (De Groote et. al., 2005). Due to a number of reasons, including: the quasi-monopoly power in Kenya's seed sector and fertiliser, a poor transportation infrastructure and a lack of a formal distribution network. Government spending on research and extension was substantially reduced along with formal credit for farmers.

Table: 2.1 Maize production trends in Kenya, 2003 - 2008

Year	2003	2004	2005	2006	2007	2008
Area(Ha)	1,670,914	1,819,817	1,760,618	1,888,185	1,615,304	1,706,814
Prod(90kg bag)	30,120,530	27,249,721	32,423,963	36,086,406	32,542,143	26,230,000
Consumption est.'s 90 kg bags	30,150,000	31,135,000	32,120,000	33,105,000	34,098,000	35,121,000

Source: Economic Review of Agriculture 2008

2.5 Maize Production in Turbo Constituency, Kenya.

This is largely attributed to the climatic condition of the area that is providing by the climate of Uasin Gishu County, it has a rainfall of 12500mm a year and temperature ranging from 16 to 30 degrees. The annual temperature average is around 25^{o}C. This is a perfect climate for maize crop so no irrigation will be needed. The type of seeds that is appropriate for the area is H614, H629, H6213, this variety are bred and recommended for medium to high altitudes (1500-2100m) which is specifically where they lies, where day temperatures seldom exceed 28 C during growing season and where the night temperatures drop to as low as 8 C. Rainfall requirements ranges from 800-1500mm.Where similar conditions prevail Turbo and therefore this variety is recommended. This variety is known to be among the best seeds which perform best in highlands of Kenya.

In Turbo, with all conditions necessary conditions provided, the yield per hector will range from 4800kg^{-1} to 5150 kg^{-1}. Given necessary condition, required management, and maize very do well in Turbo area. The necessary conditions as per the soil of Turbo area are; 185kg^{-1} of DAP fertilizers, 185 kg^{-1} of CAN top dresser and certified seeds from Kenya seed. Cost of labour has been increasing for example weeding in 2010 the price per acre was Kshs. 700 in 2013 its Kshs. 1500. In addition to that communal farming has been decreasing with time. Soil acidity is one of the factors limiting maize production in some parts of Kenya notably in Uasin Gishu County. Fertilisation especially with some nitrogenous fertilisers containing strong acid forming anions such as sulphate may increase acidity of soils with weak buffering capacity. Regular annual dressings of sulphate of ammonia fertiliser brought about a substantial decrease in topsoil pH within a very short time

(Robinson, 1956). Fertilizer prizes have always fluctuated with more tendency of rising with time. For instance, in the year 2009 100kg bag of went for Kshs. 12000, in 2010 the price came down to Kshs. 5800 and in the year 2011 the same bag went for Kshs. 7200. The current market price is around Kshs. 10,000 for the same bag while the 100kg bag of top dresser is relatively stable at Kshs. 7500. Seeds on the other side has seen slow but stable rise in price hitting Kshs.150 per kg in 2012.

2.5.1 Farm inputs

For the best outcome to be realized from a farm in Turbo, proper timing should be done coupled with the following availing the following inputs:

Table 2.2: Farm Inputs

Input	**Quantity/ha**	**Price Kshs.**	**Total for 10ha (Kshs.)**
NPK fertilizer	100KG	74 kg^{-1}	74000
CAN	100KG	58 kg^{-1}	58000
Foundation Seeds	25kg	150kg^{-1}	12500
Ploughing	1	6250	62500
Harrowing	1	5000	50000
Planting	1	1600	16000
Labour			
Pesticides application	1	1600	16000
First weeding	1	1600	16000
Second weeding	1	1600	16000
Data selling	1	1600	16000
Staking	1	1600	16000
Harvesting	1	1600	16000
Shelling	-	1600	16000
Post harvest *Insecticides (Actelic)*	4kg	500	20000
Direct supervision	-	5000	20000
Empty bags (50kg)	80	2400	24000
Contingencies			63000
Total cost			**682000**

Source: Ministry of Agriculture Turbo Constituency 2012

Upon application of the above mentioned items following the correct procedure, at least 2700kg to 3600kg of maize is expected per ha.

This means that the totals harvest expected therefore is:

Table2.3: Expected Harvest

Area in ha	1 hectare	10 hectares
Maximum	3600kgs	36000kgs
Minimum	2700kgs	27000kgs

Source: Ministry of Agriculture Turbo Constituency 2012

If the maize is to be sold to the Kenya cereals and produce board, their buying price is Kshs. $45kg^{-1}$

The product can fetch:

= 36000kg x Kshs. 45 kg^{-1}

=Kshs. 1,620,000 (maximum expected output from the farm)

= 27000kg x Kshs. 45 kg^{-1}

=Kshs. 1,215,000 (minimum expected output from the farm)

Profits

Profit expectation from the farm will be arrived at by subtracting the input from the output: **Maximum Expected Profits Profit**

Profits = output – inputs

=1620000 – 682000

=Kshs. 938000

Minimum Expected Profits Will Be;

=1215000 – 682000

=Kshs. 533000

The average profits expected will be:

=(938000+533000)/2

=Kshs. 735500

Table 2.4 Maize Production Trends in Turbo Constituency

Year	Target Ha	Achieved ha	target annual production (bags)	achieved annual production(bags)
2006	11000	10450	627000	620032
2007	11000	10800	788240	604800
2008	13746	10476	769776	586656
2009	12300	11200	651900	593600
2010	12300	11500	593600	368000
2011	12510	12300	639735	378810
2012	12300	12000	660000	744000

Source: Ministry of agriculture 2012

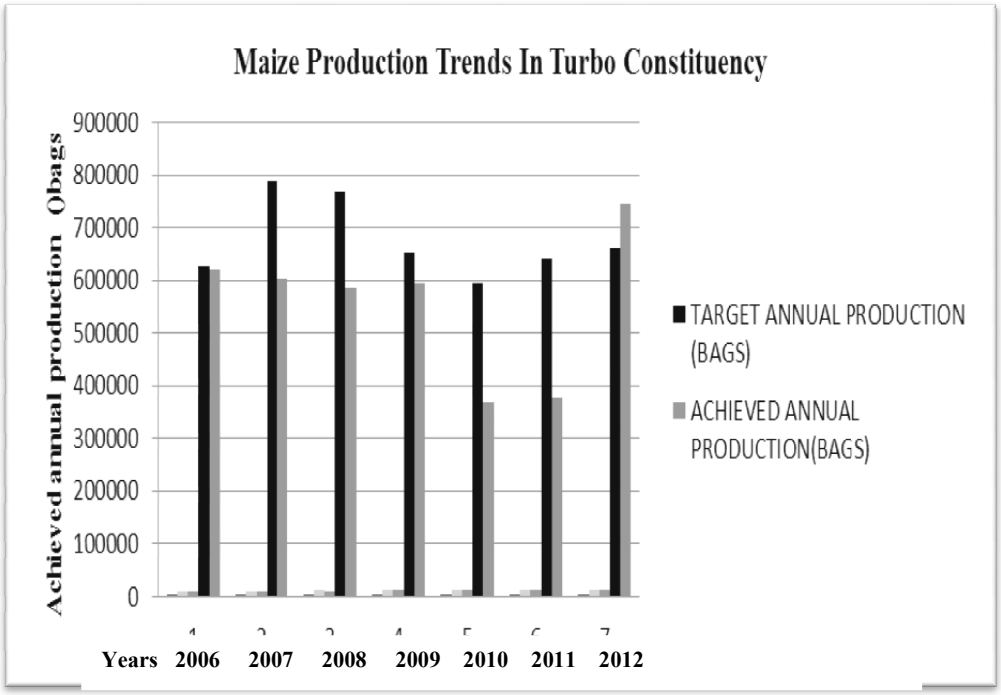

Figure 2.1 Maize production trends in Turbo Constituency

2.6 Influencing Maize Production

Among the major factors affecting yields are the production environment, production systems, seed varieties and other production inputs and financial outlays on research. All other things equal, yield potential appears to be higher in temperate environments than in tropical environments. As an example of differences in production systems, the average white maize yield in Zimbabwe on large-scale

commercial farms averages over 4 tons per hectare, compared with around 1 ton per hectare in the small-scale commercial and subsistence sectors. Much of that difference is the result of differences in moisture regime and soil quality, but part would remain even if these latter factors were controlled (Pardey, 1991).

In the majority of countries, open-pollinated varieties are still the most common type of seed used. They can easily be multiplied so that their seeds are cheap and readily available, and the farmer usually retains a certain portion of his harvest for future planting. In fact, 60 percent of the total maize area in the developing world, outside of Argentina, Brazil and China, is estimated to be still planted to unimproved, local varieties. Although national and international breeding programs have considerably increased the yields of open-pollinated varieties over the past, they remain below those of hybrids. Yields of hybrids, in fact, can exceed those of landraces open-pollinated varieties by 30-100 percent, with an average of perhaps 40-50 percent. When hybrids have replaced improved open-pollinated varieties, the yield advantage of hybrids has usually been no more than 15-25 percent. Whereas almost all of the white maize produced in developed countries is from hybrid seeds, there appears to be still considerable scope in the developing countries to expand their usage (Weber, 1992).

In some Latin American and African countries, yields of white maize are generally higher than those of yellow varieties as national plant genetic research and breeding programs for white maize have received preference when research resources were allocated. By contrast, in many developed countries, where most of the research efforts have gone into the production of yellow maize, preferred as animal feed, yields of the white varieties remain generally below those of yellow maize. In the United States, for example, yields of white varieties are reportedly still some 10-15 percent below yields of yellow maize, compared with 15-20 percent a decade ago (Jones, 2007). In some parts of the United States e.g. east-central Illinois, white maize hybrids may be approaching yield parity with yellow hybrids. Alternatively, there are some reports that in a traditional white maize economy, such as Zimbabwe, commercial farmers are obtaining higher yields with yellow maize than with white (Byerlee, 1994).

White maize is grown almost exclusively under rain fed conditions. Full irrigation is practically unknown with the major exception of Egypt. However, supplementary irrigation is applied in some cases to support the early growth of the

crop. As many of the important white maize producing areas are located in regions susceptible to drought, dependence on rainfall has resulted in marked annual fluctuations of output. For example, production in Zimbabwe and in the Republic of South Africa fell sharply from 1.5 million and 3.8 million tons, respectively, in 1991 to 0.3 million and 1.3 million tons in 1992, it recovered, reaching 1.7 million tons and 4.4 million tons in 1993 and advancing further to 2.2 million and 6.1 million tons in 1994. For all maize, at any given yield level, country yields are more variable for African than for Latin American or Asian countries (Heisey, 1999).

Fertilizer use on maize also varies widely among countries. In maize producing developing countries excluding Argentina, Brazil and China, on average two-thirds to three-quarters of total maize area receives some fertilizer in Central and South America and in Asia. In sub-Saharan Africa, only a little over one-third of all maize area is fertilized. In Egypt, all maize is fertilized at high application rates (Morris, 2001).

2.6.1 Effects of Inputs Factor on Maize Production

Factors that influence productivity of a particular producer may be classified into three, as: the quantity and quality of inputs used including land, labour and capital, fertiliser, seeds farm and farmer characteristics and external factors such as government policy (Wiebe, 2001). Capital inputs among others include seed, fertiliser, and farm equipment. Farm and farmer characteristics on the other hand include factors such as size and topography of area cultivated, location of the farm with respect to input and output markets, age, gender, education level, household size, access to extension services, and access credit (Michele, 2001).

Access to finance is essential for the further development of maize farming enterprises: for example, successful marketing depends upon the purchase of containers for processing and packaging of products. Credit is necessary for maize farming associations running collection centres, buying products from producers and selling on in bulk. However, significant financial assets are not essential for maize farming at subsistence level A good maize farming project will work to ensure that all available capital assets are taken into consideration, without dependence on any that are not. For example, too many projects have depended on the importation of the beeswax foundation used in frame hives: this is impossible for beekeepers without financial assets (Bourdieu, 1984).

In poor societies, lack of credit is a major constraint to everyone concerned with selling and buying maize. Beekeepers with maize to sell expect to receive cash from maize-collection centre's or private-sector traders; otherwise they prefer to sell their maize in small quantities in markets to obtain an instant but low cash return. People buying maize need access to credit during the maize season. Lack of credit leads to insignificant volumes of maize available for sale, no interest from traders and a stagnant industry (Nahapiet, 1998).

According to Bourdieu (1984), the social capital is the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance or recognition. Because very often entrepreneurs do not have access to extensive information sources, they are backed up by actors in their environment who influence their decision-making process. Social capital contributes to the availability of information, and it has a positive impact on the innovative performance of small and medium-sized enterprises. Social capital fosters trust and decreases barriers to the exchange and combination of new knowledge, (Nahapiet, 1998). The amount of land that can be sown and harvested is, clearly, tied to available and affordable labour supply. Planting and harvesting are both activities that require far more labour than the rest of the agricultural cycle. In communities where these activities are shared, productivity on individual plots may be greater than if families had to provide all the labour that they could not afford to hire. Communal farming, although no longer common, provides some of the same advantages (Morris, 2004).

Where greater integration into the market economy disrupts traditional labour exchange, production may fall, as shown in Gudeman's classic study of a Panamanian village (Gudeman, 1982). The reduction of patronage ties, such as in South Asian villages that have adopted GR technologies, may also produce labour bottlenecks that affect harvests. In many parts of SSA, modern cropping programs fail where men control most of the land, technology, and proceeds but women are supposed to do much of the work, especially weeding. In Kenya, the increase in crop yield resulting from weeding was 56 per cent in female-headed households, but only 15 per cent in male-headed households; this led researchers to hypothesize that women do a less thorough job of weeding where they do not expect to control the benefits (Gittinger, 2008).

High labour costs may discourage extra hand cultivation and marginally lower outputs. But low agricultural wages discourage participation in the agricultural economy, where industrial or other opportunities exist (Heisey, 1995). Scarcity of labour more than land is also a major constraint on production in much of Africa, where larger land areas since colonial times have experienced labour bottlenecks, as men were drawn off to work in the mines or to do other waged work and left women to clear, plant, and weed, with peak agricultural labour demands during the hungry season (Richards 2009). In such contexts, the problem of hunger is linked to underproduction in a vicious cycle.

2.6.2 Effect of Climatic Change factor on Maize production

Agro-climatic conditions mainly imply soil conditions and weather factors including rainfall, temperature and humidity (Michele, 2001). In the fifty years human activity has altered ecosystems more rapidly and extensively than in any comparable period in the history of mankind, largely to meet the demand for food, fresh water, fuel and other industrial raw materials (FAOSTAT, 2006).

Climate change impacts include the increased atmospheric pollution, increased intensity and frequency of storms, rise in sea level, altered rainfall amounts and distribution, altered hydrological cycles, rising temperatures, desertification, decline of mountain glaciers and snow cover, Arctic warming, persistent droughts and flooding (FAOSTAT, 2006). Generally, the impacts of global climatic change on agricultural crop productions include alteration of crop type and variety, reduction of soil moisture, increased evaporation and evapotranspiration, alteration of plant growth stages, reduced periods of grain filling, yield reductions, effects on partitioning and quality of plant biomass, and finally spatial shifts of agricultural potential (Mearns, 1995).

Kenya is already experiencing what scientists explain as the extensive impacts of climate change; persistent food problems as a result of decreased yields, increased water problems leading to conflicts, declines in soil fertility, habitat change in some areas leading to species range shifts, and changes in plant diversity which includes indigenous foods and plant-based medicines. Kenya's maize production peaked during mid- to late 1980s, and it has since stagnated due to declining yields (De Groote *et al*., 2005). The major climatical factors affecting maize production in Kenya include rainfall, temperature, day length, solar radiation, and humidity.

2.6.3 Effect of market demand factor on maize production

The maize market in general is characterized by a variety of marketing arrangements. Since the liberalization of the marketing system, several private sector entrepreneurs have joined the various parts of the maize supply chain. These entrepreneurs include companies that are active in regional maize grain trading, informal cross border traders, produce agents, small and medium millers, transporters, wholesalers and retail stores. Virtually all the domestic transactions made by these players are spot market and cash based. They sell the maize grain in l00kg bags without any grading and premiums prices for quality produce. However, for milled maize, there are three major grades. The flour is sold in kilograms and prices differ by grade (Jones, 2007).

A typical maize supply chain was noted to have the following shortcomings: This supply chain has too many participants with many speculative traders and agents who make the movement of maize time consuming. There is normally over supply of maize during the harvest season as farmers and traders have no stores. Participants' competition reduces as one goes up the chain. No clear flow of market information. Transactions are 'on spot' market and cash based. The markets are thin and volatile in terms of prices, trading volumes and liquidity. The marketing arrangement is not well developed leading to inadequate market outlets, high transaction costs and minimal value addition (Anderson, 2002). According to Minten, (2010), maize farming in Africa has faced serious challenges that have led to the overall declines of the quantities of maize produced. Denk, (2011) however explains that Africa is a suitable region for maize farming given the suitability of the climatic conditions of the area but the lack of knowledge on the right practices of maize farming has led to the practice decline trends especially in the quantities of maize produced.

Rural livelihoods in many areas depend on the viability of maize production as a commercial crop. On the other hand, the food security of the growing urban population and many rural households who are buyers of maize depends on keeping maize prices at tolerable levels. For many years, policy makers have attempted to strike a balance between these two competing objectives how to ensure adequate returns for domestic maize production while keeping costs as low as possible for consumers. Maize marketing and trade policy has been at the centre stage of debates over this food price dilemma, including discussions over the appropriateness of

trade barriers and the role of government in ensuring adequate returns to maize production, (Ministry of Trade and Industry, 2010).

2.6.3.1 Market prices and market price control by the Government of Kenya

The government has pursued its maize pricing and income transfer policies through:
(a) The activities of the National Cereals and Produce Board (NCPB), which procures and sells at administratively, determined prices.
(b) Restrictions on external maize trade through a variable maize import tariff Ministry of Trade and Industry (2010).

Potentially rationing how much maize they will buy or sell at their administratively determined prices (i.e. by choosing the amount of net purchases to make during any particular period). comparison of local and import parity prices in Nairobi over the 2000-2009 period indicates that imported maize has been more expensive than domestically produced maize up to February/March 2009, the only time when there would have been an incentive to import maize. Indeed, the waiver granted in January 2009 has restrained the increase in grain prices, with the gap between local and parity prices reducing. Tegemeo's assessment in early September 2009 indicates that the proportion of imports in the stocks held by traders has increased in most markets, being about 80% in Nakuru. Maize grain and flour prices have shown similar trends between 2000 and 2009.

Table 2.5: Showing current prices of maize in Kenya

Produce	Location	Weight	Unit	Low	High
Dry Maize	KITALE	90	kg Bag	3200	3600
Dry Maize	ELDORET	90	kg Bag	3400	3500
Dry Maize	KISUMU	90	kg Bag	3700	3800
Dry Maize	MOMBASA	90	kg Bag	3200	3550
Dry Maize	NAIROBI	90	kg Bag	4100	4250

Source: Farm Management Handbook 2007

2.6.3.2 Maize Market Populations

The most stable food in Kenya is maize. Kenyans consume 2,155 kilocalories of food per day on average. Of this, 1,183 kilocalories (55%) are in the form of the main staples: maize, wheat, beans, potatoes, plantains, and rice. Over

the last 40 years. Maize accounts for nearly 20% of total food expenditures among the poorest 20% of urban households, declining to 1% of total food expenditures among the wealthiest 20% (Muyanga, 2005). Because national maize production is not keeping pace with the growth in national demand, imported wheat and rice are increasingly filling the residual food needs gap. For this reason, the share of wheat and rice in staple food expenditures are rising, leading to more diversified basket of staples over time. Kenyan population is roughly estimated at 40 million, most of the population depends on maize particularly that produced from the country, and however, only three among eight provinces are major maize producers. These are Rift Valley, Central and Western.

Table 2.6: Table showing provincial population in Kenya

Province	Population
Nairobi	3,100,000
Central	4,00,000
Coast	3,300,000
Eastern	5,700,000
North Eastern	2,300,000
Nyanza	5,400,000
Rift Valley	10,000,000
Western	4,300,000

Source: Kenya maize handbook, 2009

2.6.3.3 Maize Market Challenges

New private investment in storage facilities could be vulnerable to huge losses if the NCPB continued to be a major player in the market, offered prices to farmers and millers that did not rise through the marketing season (pan-seasonal prices), or set a narrow margin between its buying and selling prices that could be underwritten by the treasury all of which happened during much of the 2000s (Kaplinsky, 2010). For these and other reasons to be explored below, private investment in grain marketing facilities did not proceed as rapidly as anticipated. The prices change and fluctuation of maize supply produced from the key producing counties are also a challenge. These are giant maize producers; their maize hit the market in the month of November, December and January. During the months of June, July and August,

prices are very high in the country. This is due to high demand triggered by low supply. It would therefore be very important to sell maize in Nairobi during the high demand season, the months of June, July and August would be appropriate.

2.6.3.4 Market competition

The maize market in general is characterized by a variety of marketing arrangements. Since the liberalization of the marketing system, several private sector entrepreneurs have joined the various parts of the maize supply chain. These entrepreneurs include companies that are active in regional maize grain trading, informal cross border traders, produce agents, small and medium millers, transporters, wholesalers and retail stores. Virtually all the domestic transactions made by these players are spot market and cash based. They sell the maize grain in l00kg bags without any grading and premiums prices for quality produce. However, for milled maize, there are three major grades. The flour is sold in kgs. and prices differ by grade (Jones, 2007).

The maize marketing arrangements are categorized into the typical and the emerging new maize chains. While in all districts, a bigger proportion of the maize produce passes through the typical maize supply chain, there are also institutions and associations that have been set up in the same districts that market the maize. These associations differ by district and category of farmers but involve fewer participants in the chain as will be shown in the subsequent sections (Rubey, 1995).

A typical maize supply chain was noted to have the following shortcomings: This supply chain has too many participants with many speculative traders and agents who make the movement of maize time consuming. There is normally over supply of maize during the harvest season as farmers and traders have no stores. Participants' competition reduces as one goes up the chain. No clear flow of market information. Transactions are 'on spot' market and cash based. The markets are thin and volatile in terms of prices, trading volumes and liquidity. The marketing arrangement is not well developed leading to inadequate market outlets, high transaction costs and minimal value addition (Anderson, 2002).

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on the right practices of maize farming has led to the practice decline trends especially in the quantities of maize produced. Rural livelihoods in many areas depend on the viability of maize production as a commercial crop. On the other hand, the food security of the growing urban population and many rural households who are buyers of maize depends on keeping maize prices at tolerable levels. For many years, policy makers have attempted to strike a balance between these two competing objectives; how to ensure adequate returns for domestic maize production while keeping costs as low as possible for consumers. Maize marketing and trade policy has been at the centre stage of debates over this food price dilemma, including discussions over the appropriateness of trade barriers and the role of government in ensuring adequate returns to maize production (Ministry of Trade and Industry, 2010).

2.7 Effect of quantity of maize produced in Turbo constituency

Poverty reduction-maize production in Turbo Constituency has been a source of nutrition to many households providing carbohydrates which is a vital ingredient to human health. Food in primary schools for lunch so that student can actually save on time wasting and concentrate on their studies. Maize production involves so many activities and this has been source of employment among the women and youth within the society. Farmers earn income through reaping of the output and this uplifts their living standards especially to the rural areas. Maize production is also essential as a source of food to the livestock like dairy cattle, pigs, and poultry among others.

Another very important aspect with effect of maize production is it supports efforts of the government to make Kenya food secure country and alleviate hunger to its citizens. Improving the productivity of maize-based farming could significantly reduce hunger, enhance food security and alleviate poverty through increasing the purchasing power of the farmers. Increases in agricultural productivity lead also to agricultural growth and can help to alleviate poverty in poor and developing countries, where agriculture often employs the greatest portion of the population. As farms become more productive, the wages earned by those who work in agriculture increases. At the same time, food prices decrease and food supplies become more stable. Labourers therefore have more money to spend on food as well as other products. This also leads to agricultural growth. People see that

there is a greater opportunity earn their living by farming and are attracted to agriculture either as owners of farms themselves or as labourers.

However, it is not only the people employed in agriculture who benefit from increases in agricultural productivity. Those employed in other sectors also enjoy lower food prices and a more stable food supply. Their wages may also increase. Agricultural productivity is becoming increasingly important as the world population continues to grow. India, one of the world's most populous countries, has taken steps in the past decades to increase its land productivity. For many farmers (especially in non-industrial countries) agricultural productivity may mean much more (Jones, 2006).

A productive farm is one that provides most of the resources necessary for the farmer's family to live, such as food, fuel, fibre, healing plants, etc. It is a farm which ensures food security as well as a way to sustain the well-being of a community. This implies that a productive farm is also one which is able to ensure proper management of natural resources, such as biodiversity, soil, water, etc. For most farmers, a productive farm would also produce more goods than required for the community in order to allow trade.

2.8 Other activities in Turbo constituency

The people of Turbo constituency are involved in many other economic activities which include: Agriculture-this involves fish farming which is a recent project initiated by the Government of Kenya through Ministry of Fisheries and livestock, Sugar plantations, horticulture (passion fruits, banana, and vegetables among others), bee keeping, and dairy farming. Jua-kali sector which involves Construction firms, garages, machinery and metal equipment, electrical goods, and furniture.

Trade is also an economic activity in Turbo constituency where there is wholesale, retail, motor trade (i.e. transport), hotels and restaurants and open air markets where people by good and services to satisfy their basic needs. There are some of the activities which end up affecting maize production positively and negatively in the region for example sugar farming where the land used in maize production is being replaced thus the decline in maize production. Positive example is Jua-kali sector where machinery used in farming activities can be made or repaired and as a result it becomes an aspect which benefits maize production.

2.9 Theoretical Framework

The study will adopt the Production theory according Cobb-Douglas production model. The model (in Cobb-Douglas form) represents total output (Y) as a function of total-factor productivity (A), capital input (K), labour input (L), and the two inputs' respective shares of output (α is the capital input share of contribution). An increase in either A, K and L will lead to an increase in output. While capital and labour input are tangible, total-factor productivity appears to be more intangible as it can ranch from technology to knowledge of worker (human capital). The reason why Cobb-Douglas equation is used in this function is because it exhibits constant return to scale.

That is, if we double input, we get a double output.

$$Y = A \times K^{\alpha} \times L^{1-\alpha}$$

Where:

Y = total production (the monetary value of all goods produced in a year)

L= labour input

K = capital input

A = total factor productivity

α and β are the output elasticity's of labour and capital, respectively. These values are constants determined by available technology. Returns to scale refers to a technical property of production that examines changes in output subsequent to a proportional change in all inputs (where all inputs increase by a constant factor). If output increases by that same proportional change then there are constant returns to scale, sometimes referred to simply as returns to scale. If output increases by less than that proportional change, there are decreasing returns to scale. If output increases by more than that proportion, there are increasing returns to scale (Cobb, 1970). The theory is relevant to our study in that the factors that affect maize production that would influence the quantities of maize and thus the current study will be aiming to create a balance between the inputs from the factors of production to enhance the quantities of maize collected. It is against these that the study will aim to determine the factors affecting the maize production in Turbo Constituency as factors of production which can be controlled in an effort to maximize on the quantity of maize collected. Aspect of climatic condition is basically taken to be in good condition so as to bring in the component of capital in line with fertiliser, seeds, pesticides, land, machinery and other factors of production.

2.10 Conceptual framework

The study will be based on the following model of study that identifies the independent and the dependent variable of the study. The framework conceptualizes factors affecting maize production as independent variable while quantity of maize produced as dependent variable.

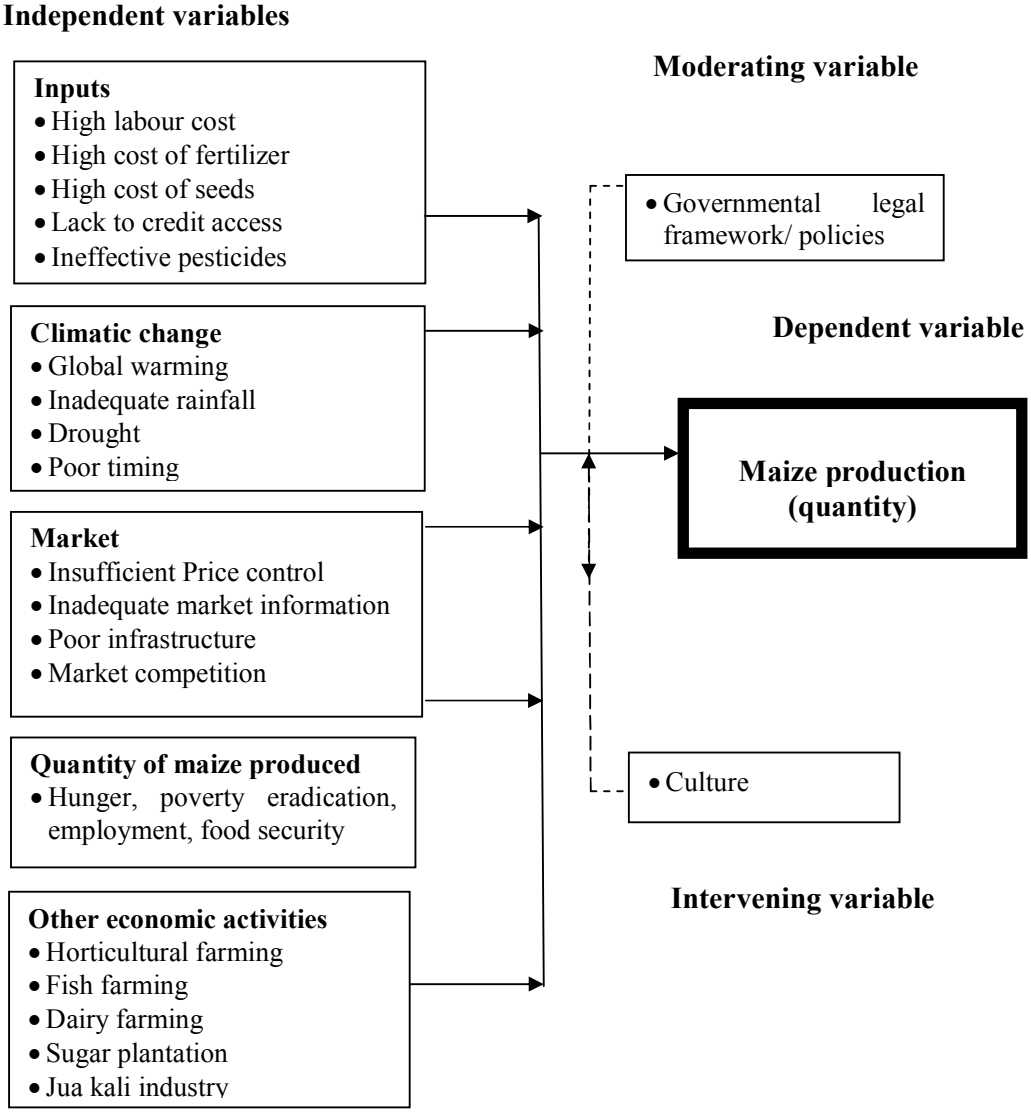


Figure 2.2: Conceptual Framework

According to the conceptual framework farm input is a factor that affects the production of maize in turbo constituency. High labour cost affect the maize production in the essence that the farmers with a low income scale could not afford labour due to its nature of high cost hence affect the production of maize. Cost of fertilizer on the other hand affect the production of maize as crops with no fertilizer

will tend to have a low produce that those fertilized and considering the low income of the farmers, they could not afford the purchase of fertilizer hence the low production. Climatic conditions on the other hand affect the production of maize. Global warming has resulted to undetermined rainfall pattern thus affecting the production of maize. Drought on the other hand affects the production of maize as it does not allow for growth of maize plantation.

Market trend has also been a factor that has affected the production of maize as insufficient price control creates imbalance in terms of cost of inputs and the sale of maze produced hence affecting the production. Inadequate market information also detains the maize produced hence affecting the next production of maize

2.11 knowledge Gap

The research therefore acknowledges that there is very little comprehensive research focusing on how specifically the individual factors affecting maize farming affect the quantities of maize collected. No single factor has been identified as the factor affecting the quantity of maize collected more than the other. The research also notes that the farmers lack the technical information about all the factors affecting the maize farming practice and as such they have failed to be able to explain why their maize quantities are declining despite the efforts to adopt latest equipment's to boost the production of maize.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter explains the methods that were used during the collection of the information. It highlights the following elements: research design, sampling methods, sampling procedure, data collection tools, data collection procedures, data analysis, presentation and the conclusion.

3.2 Research Design

The study used an explanatory survey design. These enabled the researcher visit the region and seek responses from the Constituency. Explanatory research helps determine the best research design, data collection method and selection of subjects (Russell, 2005).

The survey research design sought to identify the respondents by selecting the stakeholders in the maize farming activities. The basic idea behind research design is to measure variables by asking the respondents questions and then to examine relationships among the variables. The research design helped attempt to capture attitude or patterns of the questions being sought.

3.3 Target population

Target population study is a study of a group of individuals taken from the general population who share a common characteristic, such as age, sex, or health condition (Kombo and Tromp, 2006). The population of respondents that constitute the bulk of the population in the region was picked in order to evaluate how factors affecting maize production in the region and their effects on the production quantities that target population included the maize farmers, in the Constituency. The study employed simple random sampling technique to select farmers from each ward in Turbo constituency.

According to the Turbo Constituency Ministry of Agriculture office (2012) the total numbers of maize farmers in the Constituency was 5210 and from this the study targeted 140 farmers from the seven wards. This number constituted of at least 20 farmers from each ward which was the average number of farmers per ward engaging in maize production on a commercial basis. The farmers are selected because they are the group of farmers who are keen on the factors of production as the farming is mainly done for commercial purposes.

Table 3.1 Target population

Constituency	Total	Farmers	Target population
Kamagut	750		20
Ngenyilel	700		20
Tapsagoi	700		20
Kaptebee	880		20
Sugoi	720		20
Sosiani	700		20
Kapyemit	760		20
Total	**5210**		**140**

Source: Author, (2013)

3.4 Sample Size and Sampling Procedures

The sample size is considered the major part of all statistical analyses. The computation of the appropriate sample size is generally considered the most important and the most difficult step in statistical study. The sample size plays a crucial role in those cases of statistical studies where the statistical studies like sample survey, experiments, observational studies, etc. are involved. The sample size to be employed for the identified target population was scientifically computed through the Krejcie and Morgan's (1970) formulae. Kaptebee word was added 5 more people because the word had bigger number of maize farmers than others wards.

$$SIZE = \frac{X^2 NP\,(1-P)}{d^2\,(N-1) + X^2 P\,(1-P)}$$

X^2 = table value of Chi-Square @ d.f. = 1 for desired confidence level
.10 = 2.71 .05 = 3.84 .01 = 6.64 .001 = 10.83
N = population size
P = population proportion (assumed to be .50)
d = degree of accuracy (expressed as a proportion)

Source: Krejcie and Morgan 1970

Table 3.2: Sample population

Constituency	Target population	Sample size
Kamagut	20	14

Ngenyilel	20	14
Tapsagoi	20	14
Kaptebee	20	19
Sugoi	20	14
Sosiani	20	14
Kapyemit	20	14
Total	**140**	**103**

Source: Ministry of Agriculture Turbo Constituency

3.5 Data collection procedure

The researcher acquired a permit from the district offices to conduct the research. The permit was used to get permission from the Frontline Extension Agricultural Officers within Turbo Constituency to administer the questionnaires to the farmers.

Primary data included data collected during the actual field study. This method was used so as to obtain specific and current data needed in the study which was not available in previous studies, obtained from the field by use of questionnaires and interviews. Data was collected by the researcher assisted by assistants who administered the questionnaire to the respondents.

Secondary data was collected in order to provide the necessary support to the primary data accumulated. Secondary data also gives information that cannot be obtained from primary data. It is mainly gathered from existing literature reports, seminar papers, books, research journals, magazines, publication among others, the internet and past research information.

3.6 Research Instruments

The researcher used the following instruments: questionnaire and interview schedules.

3.6.1 Questionnaire

Kothari (2008) defines a questionnaire as that consisting of a number of questions printed or typed in a definite order on a form or set of forms. The researcher constructed close-ended and open-ended questions, which was administered to the farmers of within Turbo Constituency.

The researcher used questionnaire because of its low cost. Even if the universe is large and widely spread geographically, respondents have adequate time to give well thought out answers and large samples can be made use of and thus the results can be made more dependable and reliable (Kothari, 2008).

Questionnaire is commonly used to obtain data about population, since each item is developed to address a specific objective, research questions or hypo research project of the study (Mugenda and Mugenda, 2003). Such information is collected rapidly through questionnaire. Their structure was such that they elicited responses relevant to the study. The questionnaires were structured and generally included two types of questions:

Close-ended and open ended questionnaires were employed .The closed sections of the questions dominant so as to make it easier to analyze the findings. These questions pre-specify all the possible answers calling for the respondent to make a choice among them. Multiple choice questions offering three or more options, and balanced rated scales which measures satisfaction from highly to not satisfy. Open-ended questions were used where the respondent was allowed to respond in his or her own words.

3.6.2 Interviews Schedules

An interview is a conversation between two or more people where questions are asked by the interviewer to elicit facts and statements from the interviewee. This method is flexible, more explanatory in nature; first hand information is collected to ensure the research achieves its objectivity (Weiss, 1994).

3 .7 Validity of the instruments

This means that the research method produces information which is relevant to the topic i.e. does measure what it is supposed to be measuring (Kombo, 2006). Validity is the extent to which differences found with a measuring instrument reflect true differences among those being tested (Kothari, 1990). The validity of the research instruments was tested through expert opinion. This involved the researcher presenting the research questions to the supervisor for the supervisor to check for the objectivity of the questionnaires that was used in the study.

3.8 Reliability of the instruments

A reliable criterion is stable or reproducible. Reliability is a measure of how consistent the results from a test are (Kombo and Tromp, 2006). Reliability is quantified if you administer a test to a subject twice and get the same score on the second administration as on the first (Kombo and Tromp 2006). For the reliability of the instrument a pilot study was done together with pre-test. The examiner's manual or technical manual for most tests had information on the validity of the test (Kombo and Tromp 2006).

The researcher used the Cronbach's alpha method of computing reliability of the research instruments by computing correlations between values. Cronbach's alpha splits all the questions on your instrument every possible way and computes correlation values for them all. In the end, your computer output generates one number for Cronbach's alpha and just like a correlation coefficient; the closer it is to one, the higher the reliability estimate of your instrument. A value of 0.7 or greater will indicate that the questionnaires are reliable and therefore can be used for data collection. Pilot study was conducted to Kiplombe ward using the same sample size of each ward which is a ward outside Turbo Constituency to ascertain reliability of the instrument.

3.9 Data analysis

The study adopted both the qualitative and quantitative analysis in order to achieve the objective of the study. According to Cooper (2003) qualitative research includes an array of interpretive techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency of certain more or less naturally occurring phenomena in the social world. He refers it as interpretive research because it seeks to develop understanding through a detailed description. For quantitative techniques, inferential statistics was applied which dealt with drawing conclusions and, in some cases, making predictions about the properties of a population based on information obtained from a sample.

3.10 Ethical Consideration Issues

The researcher agreed to comply with the following principles which aim at protecting the dignity and privacy of every individual who, in the course of the research work carried out under the project, was requested to provide personal or

commercially valuable information about him/her or others hereinafter referred to as a subject of research. Before an individual becomes a subject of research, he/she shall be notified of: the aims, methods, anticipated benefits and potential hazards of the research; his/her right to abstain from participation in the research and his/her right to terminate at any time his/her participation; and the confidential nature of his/her replies. No individual shall become a subject of research unless he/she is given the notice referred to in the preceding paragraph and provides a freely given consent that he/she agrees to participate. No pressure or inducement of any kind shall be applied to encourage an individual to become a subject of research. The identity of individuals from whom information is obtained in the course of the project shall be kept strictly confidential. At the conclusion of the project, any information that reveals the identity of individuals who were subjects of research shall be destroyed unless the individual concerned has consented in writing to its inclusion beforehand. No information revealing the identity of any individual shall be included in the final or in any other communication prepared in the course of the project, unless the individual concerned has consented in writing to its inclusion beforehand.

CHAPTER FOUR: PRESENTATION, DISCUSSION AND INTERPRETATION OF THE FINDINGS

4.1 Introduction

This chapter analyzes the data collected for the study. It interprets the data in relation to the research objectives. After data collection procedure, the researcher dealt specifically with data analysis of the collected procedure. The researcher ensured that all the data collected, information was close to the realized issue. The collected data was analyzed and presented in the form of statistic tables.

4.2 Demographic characteristics of the respondents

The study sought to identify the demographic characteristic of the respondents. The findings are presented in the tables below:

Table 4.1 Gender respondents

Gender	**Frequency**	**Percent**
Male	75	72.8%
Female	28	27.2%
Total	**103**	**100.0%**

Source: Author

4.2.1 Gender of the respondents

The study indicated that 75(72.8 %) of the respondents were male and 28(27.2 %) were female. This implies that most of those who participated were male and are the most likely to be participating in maize farming. This also implies that the community around the wards is culture oriented which brings forth gender inequality in within the region.

4.2.2 Age of the respondents

The researcher sought to establish the ages of the respondents. The findings were as presented on table 4.2 below

Table 4.2 Age of the respondents

Age limits	Frequency	Percent
18-30 years	14	13.6%
31-40 years	27	26.2%
41-50 years	31	30.1%
51 and above years	31	30.1%
Total	**103**	**100.0%**

Source: Author

According to the findings, 14(13.6%) were aged between 18-30 years, 27(26.2%) were aged between 31-40, 31(30.1%) were aged between 41-45 years while 31(30.1%) were aged above 51 years. The reasons why majority of the respondents were aged above 41 years could have been because they are group of people who own farms hence are able to practice maize farming.

4.2.3 Length of time the respondents have practiced farming

The researcher sought to establish the length of time the respondents have practiced farming and presented the findings on table 4.3

Table 4.3 Length of time in farm practice

Length limits	Frequency	Percent
less than 2 years	7	6.8%
between 2-5 years	24	23.3%
between 5-10 years	31	30.1%
over 10 years	41	39.8%
Total	**103**	**100.0%**

Source: Author

The study indicated that 7(6.8%) had practiced farming for less than 2 years, 24(23.3%) had practiced farming for between 2-5 years, 31(30.1%) had practiced farming for between 5-10 years while 41(39.8%) had practiced farming for over 10 years. The study evidently revealed that most of the respondents had practiced farming for over 10 years. This could be because they hold enough experience in farming and because this is an activity they are well familiar with.

4.2.4 Size of land they practice maize farming

The researcher sought to establish the size of land they practiced farming and presented the findings on table 4.4

Table 4.4 size of land

Land sizes	Frequency	Percent
less than 25	51	49.5%
26-50 acres	27	26.2%
51-100 acres	12	11.7%
over 100 acres	13	12.6%
Total	**103**	**100.0%**

Source: Author

The study revealed that 51(49.5%) had less than 25 acres, 27(26.2%) had between 26-50 acres, 12(11.7%) had 51-100 acres while 13(12.6%) had over 100 acres. The reason why majority of the respondents had less than 25 acres could have been because they consist of a group of small scale farmers hence do not own large tract of land. This also implies that small scale farmers are the majority in the constituency.

4.2.5 Educational background

The study sought to establish educational background of the respondents. The findings were as presented on table 4.5

Table 4.5 educational background

Educational levels	Frequency	Percent
No formal education	41	39.8%
Middle school	12	11.7%
O level	16	15.5%
A level	8	7.8%
Training college	10	9.7%
Technical school	5	4.9%
Polytechnic	5	4.9%
University	6	5.8%
Total	**103**	**100.0%**

Source: Author

The study findings indicated that 41(39.8%) of the respondents had no formal education, 16.(15.5%) had O-level education, 10(9.7%) had acquired training in college, 5(4.9%) had acquired polytechnic education, 12(11.7%) had reached middle school, 8(7.8%) had A- level of education, 6(5.8%) had reached university, middle school and polytechnic level of education, 5(4.9%) had reached a technical school.

The finding implies that most farmers in the area (41.80%) had no formal education on maize farming. This could be because farming does not need more of educational knowledge but in the real sense may be they do not know information on right farming techniques thus production decline.

4.3 Specific information

The researcher sought to assess the specific information of the respondents and presented the information as shown below

4.3.1 Sale of produce

The study sought to identify where the farmers sell their produce. The findings are presented in the 4.6

Table 4.6 Sale of produce

Market	Frequency	Percent
NCPB	64	62.1%
Millers	15	14.6%
Wholesalers	10	9.7%
Retailers	14	13.6%
Total	**103**	**100.0%**

Source: Author

The findings indicated that 64(62.1%) of the farmers in the area sell their produce to NCPB, 15(14.6%) sell their produce to millers 10(9.7%) % sell theirs to wholesalers while 14(13.6%) sell their products to retailers. The findings imply that most farmers prefer selling their produce to NCPB this could be due to the benefits in terms of fair price they gain from them.

4.3.2 Transport to the market

The study sought to identify the state of the farmers' transport of their produce to the market. The findings are presented in the table below:

Table 4.7 Transport Logistics

Statements	Mean	% Mean	Skewness		Kurtosis	
	Statistic	Mean / 1 * 100	Statistic	Std. Error	Statistic	Std. Error
I use my own vehicle to transport my own produce to the market	.7320	73.20%	-1.064	.245	-.887	.485
The road to the market is in a very bad state	.7653	76.53%	-1.272	.244	-.392	.483
The markets are located very far from	.7041	70.41%	-.908	.244	-1.200	.483

Source: Author

The findings indicated that 76.53% (mean= 0.7653) noted that the road the market is in a very bad state, 73.20% (mean=0.7320) noted that they use their own vehicles to transport their produce to the market and 70.41% (mean=0.7041) indicated that the markets are located very far from the market. The results were positively skewed and kurtosis under normal distribution.

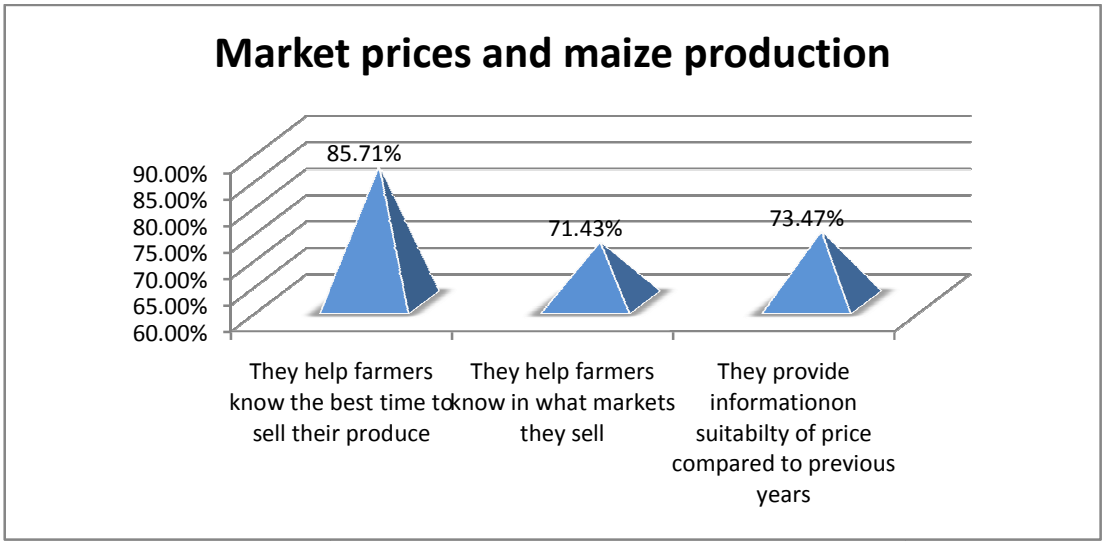
This implies that the state of transport in the area is a factor that becomes a challenge to the farmers. Most farmers undergo difficulties in transporting their produce to the market due to the state of roads in the area and the distance to the market. This challenge may affect farmers from delivering their produce.

The findings are in line with Inter Academy Council (2004), a major problem for smallholder farmers is the lack of access to market information. The lack of access to storage facilities and roads contributes to high food costs and low selling prices as well as high post-harvest storage losses caused by pests. The trend, as witnessed in Kenya with trade liberalization and privatization, has led to a dismantling of many marketing services that were once available to rural farmers.

4.3.3 Relevance of market prices in the maize production process

The study sought to establish the relevance of the market prices in the maize production process. The findings are presented in the figure below:

Figure 4.1 Market prices



The findings indicated that 85.71% of the respondents agreed that the market prices help farmers know the best time to sell their produce, 73.47% noted the market prices provide information suitability of price compared to previous years and 71.43% were of the opinion that they help farmers know the markets they will sell their produce.

The findings were interpreted to mean that market prices assist farmers in making decisions on their produce. Sometimes farmers are forced to avoid selling their produce to the state of the market prices, for example farmers prefer selling their produce in a price that will bring returns and profits. In this case the market prices will assist them make decisions on which market they would wish to sell their produce.

Jones (2007) asserts that the biggest challenge facing Kenya's maize sub-sector (as well as the overall agricultural sector) is the market prices, it is advised therefore to continuously strive to raise productivity through reducing production and marketing costs. This strategy would raise net incomes of surplus maize producers and promote market for produce.

4.3.3 Market problems that affect maize farming

The study sought to establish the market problems that affect maize farming in turbo constituency. The findings are presented in the table below:

Table 4.8 Market problems

Statements	Frequency	Percentage
The price of the packing material is expensive	89	86%
The price of the packing material is not expensive	14	17%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
Rigorous grading systems by the buyer	87	85%
No rigorous grading systems by the buyer	16	15%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
Storage capacity of the buyer is a challenge	76	74%
Storage capacity of the buyer is not a challenge	27	26%
Total	**103**	**100%**

Source: Author

The findings indicated that 86% of the respondents agreed that the price of the packing material is a problem, 85% noted that the rigorous grading system by the buyer is a challenge, 74% agreed that the storage capacity of the buyer is a challenge to their maize farming. The study findings were interpreted to mean that farmers face diverse problems while marketing their farm produce. The inefficient maize production marketing system has contributed to economic stagnation and worsening levels of maize farming.

The findings are in line with Smith (1995), increased productivity, more efficient markets, and rational government policies can dramatically alter the economic contribution of the maize sub-sector from being a drag on the economy to becoming a key element in accelerated growth and increased maize production.

4.4 The Farm Input

The study sought to investigate the farm input as a factor of production. The findings are presented below:

4.4.1 Fertilizers used

The researcher sought to find out about the fertilizers used by respondents in Turbo constituency. The results were as presented on table 4.10

Table 4.9 Fertilizer used

Statements	Frequency	Percentage
The price of fertilizer fluctuates a lot	84	82%
The price of fertiliser does not fluctuate	19	18%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
Farmers are no aware of right fertilizers to use	88	80%
Farmers are aware of right fertilizers to use	15	20%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
Fertilizers affect soil fertility over time	74	72%
Fertilizers does not affect soil fertility over time	29	28%
Total	**103**	**100%**

Source: Author

The findings indicated that 82% were of the opinion that the price of fertilizer fluctuates a lot, 80% noted that farmers are not very aware of the right fertilizer used, while 72% of the respondents agreed that the fertilizers used affect the soil fertility over time. From the findings, it was established that the price of fertilizers fluctuate a lot. This could be because of the demand of the fertilizer hence there is fluctuation. It could also be because of the fact that unscrupulous businessmen tend to create an artificial shortage of fertilizers by buying the in bulk and as a result they add and reduce their prices at their pleasure hence the fluctuation of price.

4.4.2 Seeds used

The researcher sought to find out about the seeds used by respondents in Turbo constituency. The results were as presented on table 4.12

Table 4.10 seeds used

Statements	Frequency	Percentage
Seed are no always readily available	97	94%
Seed are always readily available	6	6%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
Seeds could be delivered late after planting has began	99	96%
Seeds is delivered early before planting has began	4	4%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
The prices of seeds varies a lot	92	89%
The prices of seeds do not varies a lot	11	11%
Total	**103**	**100%**

Source: Author

The findings also indicated that 96% of the respondents agreed that Seeds could be delivered late after planting has began, 89% agreed that the price of the seeds varies a lot and 94% noted that seeds are not always readily available.

This was interpreted to mean that, farmers have to access seeds at the correct time and at affordable prices so as to manage their maize production. Cases whereby seeds may delay on the planting season affects a lot the production of maize as it will alter the planting season which will be challenging for farmers who depend on rain for their crops.

4.4.3 Labour employed

The researcher sought to find out about the seeds used by respondents in Turbo constituency. The results were as presented on table 4.13

Table 4.11 Labour employed

Statements	Frequency	Percentage
Labour is generally expensive	99	96%
Labour is not generally expensive	4	4%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
Sometimes there is shortage of labour	70	68%
Sometimes there is no shortage of labour	33	32%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
Skilled labour to operate machinery is limited	85	83%
Skilled labour to operate machinery is not limited	18	17%
Total	**103**	**100%**

Source: Author

The study indicated that 70% of the respondents agreed that sometimes there is shortage of labour, 85% agreed that skilled labour to operate machinery is limited and 99% agreed that Labour is generally expensive.

This means that the labour is a vital factor which determines the production of maize in the area. Human and skilled labour is necessary to assist farmers in their farm operations. Efficient labour makes work easier and accomplished within datelines.

4.4.4 Pesticides used

The researcher sought to find out about the seeds used by respondents in Turbo constituency. The results were as presented on table 4.14

Tables 4.12 Pesticides use

Statements	**Frequency**	**Percentage**
Pesticides available are far away from the farm	74	72%
Pesticides available are near from the farm	29	28%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
Pesticides are expensive	97	94%
Pesticides are not expensive	5	6%
Total	**103**	**100%**
Statements	**Frequency**	**Percentage**
Farmers do not know the right pesticide to use	91	88%
Farmers do know the right pesticide to use	12	12%
Total	**103**	**100%**

Source: Author

The findings showed that 72% of the respondents agreed that pesticides are available away from the farm, 88% agreed that farmers do not know the best pesticides to use and 94% noted that pesticides are generally expensive. This means that farmers have to get pesticides for use for the management of their crops from a far distance which is a contributing determined factor that affects maize production in the region. Pesticides assists in killing pests which are harmful to the crops and hence proper management of pests will enhance crop production in the region.

4.5 Other activities

The study sought to identify other activities farmers engage in Turbo Constituency that affect maize production. The findings are presented in the table below;

Table 4.13 Other Activities

Descriptive Statistics							
Statements	Mean	% Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Engaging in other farming practices that have higher returns for example sugar farming	4.3673	87.346%	.44500	-.964	.365	2.541	.483
The need to diversify the risk in farming	4.2474	84.948%	.93574	-.758	.244	1.083	.485
The need for education resulting in most farmers being more with studies	3.9677	79.354%	.82858	-1.418	.245	2.943	.495
Formal employment that most farmers have resulted to in the urban centres	4.0833	81.666%	.88852	-.990	.246	1.244	.488
Lack of access to credit leading to engaging in other cheaper business ventures	4.1837	83.674%	.63246	-1.539	.244	2.809	.483

Source: Author

The findings showed that 87.3% of the respondents were of the opinion that engaging in other farming practices that have higher returns for example sugar farming, 84.94% agreed that the need to diversify the risk in farming, 83.674 % noted that lack of access to credit leading to engaging in other cheaper business ventures, 81.67% agreed that formal employment that most farmers have resulted to in the urban centres and 79.35% agreed that the need for education results in most farmers being more with studies. This implied that other activities destruct the concentration of a farmer in farming activities. This reduces the rate of farming in the area. Activities such as further education, formal employment and other activities takes away the idea of farming for farmers thus reduced rate of maize production. Smith (2005) asserts that farming is an activity which needs a lot of effort and concentration in order to achieve farming objectives. The actual farmer behaviour gives a reason to understand why some are able to achieve high levels of productivity (low costs per bag of maize produced) while other farmers in the same

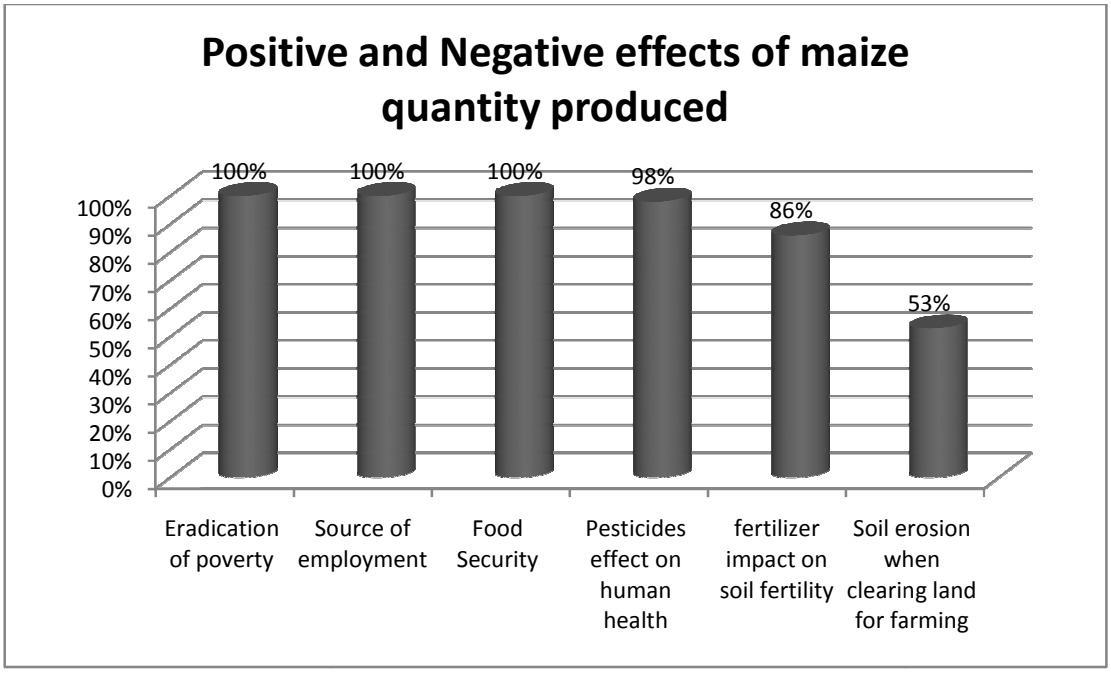
area are achieving much lower productivity (i.e., higher costs per bag of maize produced).

4.6 Quantity

The study sought to identify the effects of the quantity of maize produced in the region. The findings are presented in the figure below:

4.6.1 Quantity of maize produced

The study sought to identify the effects of the quantity of maize produced in the region. The findings are presented in the figure below:



Source: Author

Figure 4.2 Positive and Negative effects of maize production

It can be deduced from the study that the quantity of maize produced brings along with diverse effects to the wellbeing and the economy of the country. The problem of poverty will be eradicated. Creates employment opportunities and enhances food security in the country.

4.7 Anova analysis on the effect of climatic change on the quantity of maize produced

In its simplest form, ANOVA provides a statistical test of whether or not the means of several groups are equal, and therefore generalizes test to more than two groups. Analysis of variance (ANOVA) is a collection of statistical models used to analyze the differences between group means and their associated procedures (such as

"variation" among and between groups). In ANOVA setting, the observed variance in a particular variable is partitioned into components attributable to different sources of variation. In its simplest form, ANOVA provides a statistical test of whether or not the means of several groups are equal, and therefore generalizes t-test to more than two groups**.**

In this case therefore, the effect of climatic conditions on the quantity of maize produced found to the groups as per the independent and dependent variables hence the researcher sought to test their significant relationship.

Table 4.14 Anova analysis

ANOVA[b]				
Rainfall amount	Sum of Squares	Mean Square	F	Sig.
Anova	9.733	2.433	12.465	0.128[a]
Residual	27.331	0.195		
Total	37.064			
Temperature				
Anova	1.553	3.195	29.56	0.249[a]
Residual	27.331			
Total	37.064			
Wind				0.393[a]
Anova	1.553	4.285	42.54	
Residual	27.331			
Total	37.064			

Source: Author

4.7.1 Rainfall amount

The findings indicated that there is no significant variation between the amount of rainfall and the quantity of maize produced (p=0.128). This was interpreted to mean that there is a relationship between the climatic conditions (rainfall) and the quantity of maize produced. Crops such as maize require average rainfall in order to grow. Absence or too much of rainfall will affect the growth of maize hence lower quantity of maize to be produced.

In order to optimize the use of available rainfall, the crop water requirements for the different representative crops need to be determined in order to assess their suitability for a particular area. Other factors like soil moisture content and recharge, potential evapotranspiration, soil type, planting seasons and cropping methods all need to be considered. It is therefore necessary to give adequate attention to rain fed agriculture as a key element in food security.

Alternatives to meet additional water requirements, by irrigation, can subsequently be considered so that crop production can be increased appropriately. Herein, the rainfall reliability with respect to meeting crop water requirements. Knowledge of the rainfall characteristics will facilitate the improvement of crop scheduling and irrigation where necessary.

4.7.2 Temperature

The findings also indicated that there no significant variation between temperature and the quantity of maize produced (p=0.249). This implies that there is a relationship between the amount of temperature and the quantity of maize produced. Crops require a certain temperature condition in order to sustain growth.

All stages of development of crops are sensitive to temperature. It is the main factor controlling the rate of crop development. Development generally accelerates as temperature increases, a phenomenon that is often described as a linear function of daily average temperature.

The most influential factors in the climate are temperature and moisture. Plants can grow only within certain limit of temperature. For each species and variety there are not only optimal temperature limits, but also optimal temperatures for different growth stages and functions, as well as lower and upper lethal limits. Temperature determines which species can survive in a particular region.

Temperature greatly influences germination of seeds. The inhibition phase of germination is primarily physical and shows low sensitivity to temperature. The subsequent phases of germination (hydration and enzyme activation, enzymatic degradation of storage material, in research project and growth of embryo) are temperature dependent due to biochemical processes involved

4.7.3 Wind

The findings also indicated that there no significant variation between wind and the quantity of maize produced (p=0393). The study also indicated that there is no significant variation between wind and the quantity of maize produced. It was interpreted to mean that the quantity of maize produced has a relationship with the density of wind in the area. Wind can be in form of erosion which affects the growing of crops such as maize. Strong winds can break the stems of maize thus affecting their growth.

Wind also increases the turbulence in atmosphere, thus increasing the supply of carbon dioxide to the plants resulting in greater photosynresearch project rates.

Wind alters the balance of hormones; wind increases the ethylene production in maize. Wind decreases gibberillic acid content of roots and shoots in maize. This will affect the quantity of the maize.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of findings

The study indicated that 75(72.8 %) of the respondents were male and 28(27.2 %) were female. This implies that most of those who participated were male and are the most likely to be participating in maize farming. This also implies that the community around the wards is culture oriented which brings forth gender inequality.

According to the findings, 14(13.6%) were aged between 18-30 years, 27(26.2%) were aged between 31-40, 31(30.1%) were aged between 41-45 years while 31(30.1%) were aged above 51 years. The reasons why majority of the respondents were aged above 41 years could have been because they are group of people who own farms hence are able to practice maize farming.

The study indicated that 7(6.8%) had practiced farming for less than 2 years, 24(23.3%) had practiced farming for between 2-5 years, 31(30.1%) had practiced farming for between 5-10 years while 41(39.8%) had practiced farming for over 10 years. The study evidently revealed that most of the respondents had practiced farming for over 10 years. This could be because they hold enough experience in farming and because this is an activity they are well familiar with.

The study revealed that 51(49.5%) had less than 25 acres, 27(26.2%) had between 26-50 acres, 12(11.7%) had 51-100 acres while 13(12.6%) had over 100 acres. The reason why majority of the respondents had less than 25 acres could have been because they consist of a group of small scale farmers hence do not own large tract of land. This also implies that small scale farmers are the majority in the constituency.

The study findings indicated that 41(39.8%) of the respondents had no formal education, 16.(15.5%) had O-level education, 10(9.7%) had acquired training in college, 5(4.9%) had acquired polytechnic education, 12(11.7%) had reached middle school, 8(7.8%) had A- level of education, 6(5.8%) had reached university, middle school and polytechnic level of education, 5(4.9%) had reached a technical school.

The finding implies that most farmers in the area (41.80%) had no formal education on maize farming. This could be because farming does not need more of

educational knowledge but in the real sense may be they do not know information on right farming techniques thus production decline.

The findings indicated that 64(62.1%) of the farmers in the area sell their produce to NCPB, 15(14.6%) sell their produce to millers 10(9.7%) % sell theirs to wholesalers while 14(13.6%) sell their products to retailers. The findings imply that most farmers prefer selling their produce to NCPB this could be due to the benefits in terms of fair price they gain from them.

The findings indicated that 76.53% (mean= 0.7653) noted that the road the market is in a very bad state, 73.20% (mean=0.7320) noted that they use their own vehicles to transport their produce to the market and 70.41% (mean=0.7041) indicated that the markets are located very far from the market. The results were positively skewed and kurtosis under normal distribution.

This implies that the state of transport in the area is a factor that becomes a challenge to the farmers. Most farmers undergo difficulties in transporting their produce to the market due to the state of roads in the area and the distance to the market. This challenge may affect farmers from delivering their produce to the market and thus the few who have their means will have better delivery.

The findings indicated that 85.71% of the respondents agreed that the market prices help farmers know the best time to sell their produce, 73.47% noted the market prices provide information suitability of price compared to previous years and 71.43% were of the opinion that they help farmers know the markets they will sell their produce.

The findings were interpreted to mean that market prices assist farmers in making decisions on their produce. Sometimes farmers are forced to avoid selling their produce to the state of the market prices, for example farmers prefer selling their produce in a price that will bring returns and profits. In this case the market prices will assist them make decisions on which market they would wish to sell their produce.

The findings indicated that 86% of the respondents agreed that the price of the packing material is a problem, 85% noted that the rigorous grading system by the buyer is a challenge, 74% agreed that the storage capacity of the buyer is a challenge to their maize farming. The study findings were interpreted to mean that farmers face diverse problems while marketing their farm produce. The inefficient

maize production marketing system has contributed to economic stagnation and worsening levels of maize farming.

The findings indicated that 82% were of the opinion that the price of fertilizer fluctuates a lot, 80% noted that farmers are not very aware of the right fertilizer used, while 72% of the respondents agreed that the fertilizers used affect the soil fertility over time.

The findings, it was established that the price of fertilizers fluctuate a lot. This could be because of the demand of the fertilizer hence there is fluctuation. It could also be because of the fact that unscrupulous businessmen tend to create an artificial shortage of fertilizers by buying the in bulk and as a result they add and reduce their prices at their pleasure hence the fluctuation of price.

The findings also indicated that 96% of the respondents agreed that Seeds could be delivered late after planting has began, 89% agreed that the price of the seeds varies a lot and 94% noted that seeds are not always readily available. This was interpreted to mean that, farmers have to access seeds at the correct time and at affordable prices so as to manage their maize production. Cases whereby seeds may delay on the planting season affects a lot the production of maize as it will alter the planting season which will be challenging for farmers who depend on rain for their crops.

The study indicated that 70% of the respondents agreed that sometimes there is shortage of labour, 85% agreed that skilled labour to operate machinery is limited and 99% agreed that Labour is generally expensive.

This means that the labour is a vital factor which determines the production of maize in the area. Human and skilled labour is necessary to assist farmers in their farm operations. Efficient labour makes work easier and accomplished within datelines.

The findings showed that 72% of the respondents agreed that pesticides are available away from the farm, 88% agreed that farmers do not know the best pesticides to use and 94% noted that pesticides are generally expensive. This means that farmers have to get pesticides for use for the management of their crops. Pesticides assists in killing pests which are harmful to the crops and hence proper management of pests will enhance crop production.

The findings showed that 87.3% of the respondents were of the opinion that engaging in other farming practices that have higher returns for example sugar

farming, 84.94% agreed that the need to diversify the risk in farming, 83.674 % noted that lack of access to credit leading to engaging in other cheaper business ventures, 81.67% agreed that formal employment that most farmers have resulted to in the urban centres and 79.35% agreed that the need for education results in most farmers being more with studies.

This implied that other activities destruct the concentration of a farmer in farming activities. This reduces the rate of farming in the area. Activities such as further education, formal employment and other activities takes away the idea of farming for farmers thus reduced rate of maize production. It can be deduced from the study that the quantity of maize produced brings along with diverse effects to the wellbeing and the economy of the country. The problem of poverty will be eradicated. Creates employment opportunities and enhances food security in the country.

The findings indicated that there is no significant variation between the amount of rainfall and the quantity of maize produced ($p=0.128$). This was interpreted to mean that there is a relationship between the climatic conditions (rainfall) and the quantity of maize produced. Crops such as maize require average rainfall in order to grow. Absence or too much of rainfall will affect the growth of maize hence lower quantity of maize to be produced. In order to optimize the use of available rainfall, the crop water requirements for the different representative crops need to be determined in order to assess their suitability for a particular area.

Other factors like soil moisture content and recharge, potential evapotranspiration, soil type, planting seasons and cropping methods all need to be considered. It is therefore necessary to give adequate attention to rain fed agriculture as a key element in food security. Alternatives to meet additional water requirements, by irrigation, can subsequently be considered so that crop production can be increased appropriately. Herein, the rainfall reliability with respect to meeting crop water requirements. Knowledge of the rainfall characteristics will facilitate the improvement of crop scheduling and irrigation where necessary.

The findings also indicated that there no significant variation between temperature and the quantity of maize produced ($p=0.249$). This implies that there is a relationship between the amount of temperature and the quantity of maize produced. Crops require a certain temperature condition in order to sustain growth.

All stages of development of crops are sensitive to temperature. It is the main factor controlling the rate of crop development. Development generally accelerates as temperature increases, a phenomenon that is often described as a linear function of daily average temperature. The most influential factors in the climate are temperature and moisture. Plants can grow only within certain limit of temperature. For each species and variety there are not only optimal temperature limits, but also optimal temperatures for different growth stages and functions, as well as lower and upper lethal limits. Temperature determines which species can survive in a particular region.

Temperature greatly influences germination of seeds. The inhibition phase of germination is primarily physical and shows low sensitivity to temperature. The subsequent phases of germination (hydration and enzyme activation, enzymatic degradation of storage material, in research project and growth of embryo) are temperature dependent due to biochemical processes involved.

The findings also indicated that there no significant variation between wind and the quantity of maize produced ($p=0.393$). The study also indicated that there is no significant variation between wind and the quantity of maize produced. It was interpreted to mean that the quantity of maize produced has a relationship with the density of wind in the area. Wind can be in form of erosion which affects the growing of crops such as maize. Strong winds can break the stems of maize thus affecting their growth.

Wind also increases the turbulence in atmosphere, thus increasing the supply of carbon dioxide to the plants resulting in greater photosynresearch project rates. Wind alters the balance of hormones; wind increases the ethylene production in maize. Wind decreases gibberillic acid content of roots and shoots in maize. This will affect the quantity of the maize.

5.2 Conclusions

The study the quantity of maize production is determined by several factors of production in agriculture. The input used for example the fertilizer used, labour available, seeds and other factors determine the production of maize in the area.

Unfavourable weather conditions have been a problem, but inadequate policies and weak agricultural institutions are the main reasons for this fall in production. Central to this is a reduction in government involvement and

expenditure on agriculture, resulting in low investment and support for farmers. Maize is still cheaper to produce than buy, but production is far below national consumption, meaning Kenya imports maize in most years. Despite this, government purchasing of Kenyan maize is low: most farmers sell to private markets. Most farmers undergo difficulties in transporting their produce to the market due to the state of roads in the area and the distance to the market. This challenge may affect farmers from delivering their produce to the market and thus the few who have their means will have better delivery. Due to rough terrain and bad roads, most farmers have been affected hence delaying the timing of sales of the produce which in turn will delay the production of the next produce thus affecting maize production. Market prices assist farmers in making decisions on their produce. Sometimes farmers are forced to avoid selling their produce to the state of the market prices, for example farmers prefer selling their produce in a price that will bring returns and profits. In this case the market prices will assist them make decisions on which market they would wish to sell their produce. Farmers also face diverse problems while marketing their farm produce. The inefficient maize production marketing system has contributed to economic stagnation and worsening levels of maize farming.

The price of fertilizers fluctuates a lot. This could be because of the demand of the fertilizer hence there is fluctuation. It could also be because of the fact that unscrupulous businessmen tend to create an artificial shortage of fertilizers by buying the in bulk and as a result they add and reduce their prices at their pleasure hence the fluctuation of price. Farmers have to access seeds at the correct time and at affordable prices so as to manage their maize production. Cases whereby seeds may delay on the planting season affects a lot the production of maize as it will alter the planting season which will be challenging for farmers who depend on rain for their crops. Human and skilled labour is expensive to acquire although is necessary to assist farmers in their farm operations. Efficient labour makes work easier and accomplished within datelines. There is a need by the farmers to employ different kind of labour in order to ensure there are high yields.

Farmers have to get pesticides for use for the management of their crops. Pesticides assists in killing pests which are harmful to the crops and hence proper management of pests will enhance crop production as most of the crops in the area

have been found to be pesticide infested hence there is a need to use pesticide in order to produce more quality crops.

Other activities have been found to destruct the concentration of a farmer in farming activities. This could reduce the rate of farming in the area as people will tend to divert from farming. Activities such as further education, formal employment and other activities takes away the idea of farming for farmers thus reduced rate of maize production. It can be deduced that the quantity of maize produced brings along with diverse effects to the wellbeing and the economy of the country. The problem of poverty will be eradicated. Creates employment opportunities and enhances food security in the country.

5.3 Recommendation

Following the findings and conclusions from the study, the following recommendations were drawn:

i. Measures should be put across by the government to ensure that the farmers get farm inputs in time and at a reasonable price in order to enable them produce more crops. This will assist in the building of economy and also address the cases of unemployment experienced especially in the rural areas.
ii. The government should allocate more funds for the agricultural sector within the national budget to ensure there is an easy working channel by the farmers to improve maize production. This will have a more positive impact in the economy of the country as there will be more products sold.
iii. The agricultural sector should improve the storage of crops by investing in both on-farm and off-farm storage facilities. Most of the agricultural produce has been found to spoil due to poor storage facilities. This has impacted in loss by the farmers and as a result down trend in the economy. To curb this, better storage facilities should by enacted in order to address storage issues
iv. The government should address the lack of incentives for farming communities by improving access to credit, strengthening agricultural institutions and developing policies to reduce market risks
v. The agricultural sector should develop new technologies that will help reduce soil erosion and conserve water and soils. This will ensure crops are produced in large quantities and there is a stable food in terms of mass production of crops

vi. This study can provide a basis on which agricultural policy makers can plan for irrigation in particular regions and provide a strategy for combating drought.

vii. The government should also be very keen to follow up on the United National policy on environmental conservation mechanisms to curb on issues of global warming and climatic change in general.

5.4 Further research

Future studies should focus on the study on soil fertility and its effect to maize production. It should also study the effects of maize varieties and change of policies on the maize production in Turbo Constituency.

REFERENCES

Akande, S.O., 1994. "*Comparative Cost and Return in Maize Production in Nigeria*". NISER Individual Research Project Report, NISER, Ibadan, pp: 1-35.

Anderson, S. & Baland, J. (2002). "*The economics of ROSCAs and intra household resource allocation.* 117(3) 963-995. Oxford University Press

Armstrong, W., and Drew, M. C. (2002). *Root growth and metabolism under oxygen deficiency*. In plant roots: the hidden half (3rd edition)' Y waisel, A. Eshel and U. Kafkafi, Eds), pp. 729-761, Marcel Dekker, New York

Byerlee, D., and López-Pereira, M.A., (1994). *Technical Change in Maize Production*: A Global Perspective. CIMMYT Economics Program Working Paper 94-02. Mexico, D.F.: CIMMYT.

Byerlee D. and Eicher C.K. (eds.). (1997). *Africa's Emerging Maize Revolution*. Boulder, CO: Lynne Rienner Publishers.

Bourdieu, Pierre. 1984. *Distinction: A Social Critique of the Judgement of Taste*. New York: Cambridge University Press.

Cobb-Douglas -Wikipedia. http://en.wikipedia.org/wiki/Cobb Douglas

Clover, J. 2003. *Food security in sub-Saharan Africa*. African Security Review 12 (1): 5–15.

Cooper, D., & schindler, p.s.(2003*). Business Research Methods (*8th ed). new delhi: tata mcgraw-hill publishing company. India.

De Groote, H., G. Owuor, C. Doss, J. Ouma, L. Muhammad and K Danda (2005). The *Maize Green Revolution in Kenya Revisited*. e Journal of Agricultural and Development Economics , 32-49.

Doyer, O. T., D'Haese, M. F., Kirsten, J. F., & van Rooyen, C. J. (2007). *Strategic focus areas and emerging trade arrangement in the South African agricultural industry since the dimese of the marketing board*. Agrekon , 46 (4), 494-513.

FAOSTAT, (2006). *FAO Statistical Data* [online]. FAO. Available at http://www.fao.org/faostat/foodsecurity

FAO/WFP, (2007) . *Swaziland drought flash appeal*. field Consolidated Appeals Process, pp: 29.

FAOSTAT. (2010) *Food and Agricultural Organization of the United Nations (FAO),* FAO Statistical Database, 2010, from http://faostat.fao.org

Farm Management Handbook of Kenya (2007) Vol. II– *Natural Conditions and Farm Management Information* –2nd Edition part A, B and C. German Agency for Technical Cooperation (GTZ). Nairobi. Kenya.

Feder, G., Just, R.E. and Zilberman, D., (1985). *Adoption of Agricultural Innovations in Developing Countries:* A Survey. Economic Development and Cultural Change, sUniversity of Chicago Press, vol. 33(2), pp.255-98.

Fernandez, A. F., (2011). *"The World: A History",* p.470. Penguin Academics, London. ISBN 0-205-75930-0

Food and Agriculture Organization of the United Nations (FAO), 2006. *Fertiliser Use by Crop. FAO Fertiliser and Plant Nutrition Bulletin* 17.

Food and Agricultural Organization of the United Nations (FAO). (1994) a. *Cereal Policies Review,* 1993-94. Rome.

Food and Agricultural Organization of the United Nations (FAO). (1994) b. *Medium-term Prospects for Agricultural Commodities, Projections to the Year 2000*. FAO Economic and Social Development Paper No. 120. Rome.

Gittinger, J. P. 2008 Economic analysis *of agricultural projects Economic Development Institute of the World Bank*, 1982 the University of California ISSN 1564-6645

GoK, (2010). *Agricultural sector development strategy (ASDS) (2010-2020)* . Agricultural sector ministries, Nairobi. Kenya

Government of Kenya. (2010). *Kenya Economic Survey Highlights*. Ministry of State for Planning National Development and Vision 2030. Nairobi: Kenya Government Printers.

Government of Zimbabwe. 1995. Zimbabwe's agricultural policy framework 1995-2020. Harare.

Gudeman, Stephen. 1986. *Economics as Culture*. London: Routledge.

Heisey, P. W., and Edmeades, G.O. (1999). *Maize Production in Drought---Stressed Environments: Technical Options and Research Resource Allocation*. Part 1 of CIMMYT 1997/1998 World Facts and Trends; Maize Production in Drought---Stressed

Heisey, P.W., and Smale, M., (1995). *Maize Technology in Malawi*: A Green Revolution in the Making? CIMMYT Research Report No. 4. Mexico, D.F.: CIMMYT.

Huang, J. and S. Rozelle. 1996. *Technological change: rediscovering the engine of productivity growth in China's agricultural economy*. Journal of Development Economics 49:337-369.

InterAcademy Council. (2004). *Realizing the Promise and Potential of African Agriculture*. Report for InterAcademy Council, Amsterdam, the Netherlands

International Assessment of Agricultural Knowledge, Science and Technology for Development. (2009). *Agriculture at a Crossroads*. Washington, D.C.: Island Press.

International Maize and Wheat Improvement Center. (2008). Annual Report 2007-2008. Mexico, D.F.: CIMMYT.

IPCC., (2007). *New Assessment Methods and the Characterisation of Future Conditions: In Climate change 2007:* Impacts, adaptation and vulnerability,pp: 976. Contribution of working group II to the fourth assessment report of the Intergovernmental panel on climate change. Cambridge university press, Cambridge, UK.

Jones, M. Mukumbu, and S. Jiriyengwa. (2007). *"Maize Marketing and Price Policy in Eastern and Southern Africa.*" In D. Byerlee and C.K. Eicher (eds.), Africa's Emerging Maize Revolution. Boulder, Colorado: Lynne Rienner Publishers.

Joshi, P.K., N.P. Singh, N.N. Singh, R.V. Gerpacio, and P.L. Pingali. 2005. Maize in India: *Production Systems, Constraints, and Research Priorities*. Mexico, D.F.: CIMMYT.

Kaliba, A., Verkuijl, H., Mwangi, W., Moshi, A., Chilagane, A. and Kaswende, J.; 1998. *Adoption of maize production technologies in Eastern Tanzania.* Tanzania: International Maize and Wheat Improvement Center (CIMMYT) and e Southern Africa Center for Cooperation in Agricultural Research (SACCAR). Pp 35-47.

Kamau and FAO (2009). *Current status of fruits and vegetables production and consumption in francophone African countries* - Potential impact on health. Acta Horticulturae:, 841, 249–256.

Kang'ethe, W. Gitu (2008).*Agricultural development and food security in Kenya. Building a case for more support.* Food and Agriculture Organization (FAO). Rome. Italy

Karanja, D.D., Thomas S. Jayne, and Paul Strasberg. 1998. *Maize Productivity and Impact of Market Liberalization in Kenya*, Tegemeo Working Paper.

Kaplinsky, R. and M. Morris. (2010). *A Handbook for Value Chain Research. Paper for IDRC. Brighthton*: Institute of Development Studies (IDS)

Kenya Maize Handbook. (2009). *Kenya Market Development Programme*. Nairobi Kenya: Government of Kenya.

Kimenju, S. and Tschirley. D., (2008). Agriculture *and Livelihood Diversification in Kenyan Rural Households*. Tegemeo Working Paper No. 29. Nairobi: Tegemeo Institute of Agricultural Policy and Development, Egerton University. Online at: www.tegemeo.org.

Kombo and Tromp (2006). *Sample determination,* New analysis procedures ISBN 32/32 2 Nairobi University publishers: Nairobi.

Kombo, (2006). *Sample techniques methods and general analysis Building blocks of the future analysis.*

Kothari, (1990). *Sample design and sample technique*, The analysis revolution of 21st Century and adoption of techniques .Kenyatta University, Nairobi.

Krejcie and Morgan's (1970*) sample design technique*

López-Pereira, M.A., and Morris, M.L., (2004). *Impacts of International Maize Breeding Research in the Developing World*, 1966-90. Mexico, D.F.: CIMMYT.

Martin,I.F.,et al(1991)*maize breeding for four Australian environments*.pp77-80 in Moran, J.(ed) 'Maize in Australia-Food,Forage and Grain',proceedings of 1st Australian Maize Conference, Moama/echuca, April 1991

Martinez, A.(2000). *Fertilizer Use Statistics and Crop Yields*. Muscle Shoals, Alabama: IFDC.

Mearns, L.O. 1995. Research *issues in determining the effects of changing climate variability on*

crop yields. In: C. Rosenzweig, L.H. Allen, L.A. Harper, S.E. Hollinger, and J.W. Jones

(eds.), Climate change and agriculture: Analysis of Potential International Impacts.

Madison, Wisconsin: American Society of Agronomy, Inc. pp. 123–143.

Meyer, F. H. (2006). *Model closure and price formation under switching grain market regimes in South Africa. University of Pretoria.* Pretoria: Published Phd thesis.

Michele. B, (2001). Linkages *between FAO Agroclimatic Data Resources and the Development of GIS Models for Control of Vector-borne Diseases.* Acta Tropica 79, pp.21–34.

Ministry of Agriculture. (2009). *Strategic Plan 2008-2012*. Nairobi: Kenya Ministry of Agriculture.

Ministry of Trade and Industry. (2010). Ministry *of Trade and Industry data files shared with authors*. Nairobi: Government of Kenya.

Miracle, M. P. (1965). *The introduction and spread of maize in Africa*. The Journal of African History,6(1):39

Morris, M. (2001). *Assessing the benefits of international maize breeding research*: An overview of the global maize impacts study. Part II of the CIMMYT 1999-2000 world maize facts and trends.

Mude, A., Kumar, P., (2006). *Estimating the welfare impacts of maize price policy in Kenya.* Study presented at the World Bank Workshop on Poverty and Economic Growth, Washington, DC.

Mugenda, O.M and Mugenda, A.G. (2003). *Qualitative and Quantitative approaches. Research Methods Africa Center for Technology Studies* (Acts) Press. Nairobi Kenya

Mutunga, N. and James. O.,(2003). Kenya: *July 2002 – 2003 Annual Harvest Assessment*. FEWS NET.

Muyanga, M., T.S. Jayne, G. Argwings-Kodhek, and Ariga, J. (2005). *Staple Food Consumption Patterns in Urban Kenya: Trends and Policy Implications.* Tegemeo Working Paper No.19. Tegemeo Institute of Agricultural Policy and Development, Egerton University. Online at: www.tegemeo.org

Nahapiet, J. and Ghoshal, S. 1998. *Social capital, intellectual capital and the organizational advantage*. Academy of Management Review.23(2): 242-266.

Nigussie, M., Tanner, D. and Twumasi-Afriyie S. (eds.). 2002. *Enhancing the Contribution of Maize to Food Security in Ethiopia*: Proceedings of the Second National Maize Workshop of Ethiopia, 12-16 November 2001, Addis Ababa, Ethiopia.

Nyoro J, Ayieko M and Muyanga M. 2007. *The Compatibility of Trade Policy with Domestic Policy Interventions Affecting the Grains Sector in Kenya.* Tegemeo Institute, Egerton University.

Nyoro, J. K., Lillian Kirimi and T.S. Jayne. 2004. *Competitiveness of the Kenyan and Ugandan Maize Production:* Challenges for Future. Tegemeo Working Paper.

OECD (2001). *Putting the Young in Business: Policy Challenges for Youth Entrepreneurship, the LEED Programme*, Territorial Development Division, Paris.

Pardey, P.G., J. Roseboom, and J.R. Anderson (eds.) 1991. *Agricultural Research Policy: International Quantitative Perspectives*. Cambridge: Cambridge University Press.

Pingali, P.L., (Ed.), 2001. CIMMYT 1999-2000 *World maize facts and trends: Meeting world maize needs: Technological Opportunities and Priorities for the Public Sector,* CIMMYT, D.F, Mexico.

Robinson, J. B. D. 1956. *The influence of fertilisers and manure on the pH reaction of a coffee soil.* East African Agriculture Journal 22, 76-80 E.A.A.F.R.O. Muguga, Kenya.

Rubey, L. 1995. *Maize Market Reform in Zimbabwe: Interactions Between Consumer Preferences, Small-Scale Enterprise Development and Alternative Marketing Channels.* Ph.D. dissertation, Michigan State University.

Russell K. Schutt,(2005). *Sample design techniques and methods of planning analysis*

Shenggen Fan, Press Statement, Director General, *International Food Policy Research Institute (IFPRI)* August 06, 2012

Smith, B. (1995). *The Emergence of Agriculture. Scientific American Library.* London. Longman

Todaro, Michael P. 1997. *Economic Development*. London/New York, Longman

USAID 2009. *Food Insecurity*. Situation Report Bureau of Democracy Conlict and Humanitarian Assistance (DCHA) Office of U.S Foreign Disaster Assistance (OFDA).

Weber, M., D. Tschirley, R. Varela, A.P. Santos, and H.F. De Murrule. 1992. *"Reflections on Relationships Between Food Aid and Maize Pricing/Marketing in Mozambique."* Draft Paper. East Lansing, Michigan: Michigan State University.

Weiss, R.S. (1994).*Learning from strangers, the art and method of qualitative interview studies*. New York, NY. Free Pr.

World Meteorological Organization, SWMO. 1996. *Climate, Weather and Agriculture*. A paper presented at World Food Summit-Rome, 13-17th November 52: 112-126. (1996).

World Food Program (2005). *World Hunger Kenya*. Rome: World Food Program of the United Nations.

World Bank, (2007). *World Development Report 2008: Agriculture for Development.* Washington, D.C. UBOS, 2007. Uganda National Household Survey: Agricultural Module Report. Kampala, Uganda.

Wiebe, K.D., Soule, M.J. and Schimmelpfennig, D., 2001. *Agricultural Productivity for Sustainable Food Security in Sub-Saharan Africa.* In Zepeda L (ed), *Agricultural Investment and Productivity in Developing Countries*, FAO, Rome.

APPENDIX I: TABLE SAMPLING TABLE (KREJCIE AND MORGAN, 1970)

Table for Determining Sample Size from a Given Population

N	***S***	***N***	***S***	***N***	***S***
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size.

S is sample size.

APPENDIX II: PERMISSION TO CONDUCT RESEARCH

Michael Kimeli Chumo
P.O Box 8908- 00100
Nairobi

The Ministry Of Agriculture,
P.O Box 45,
Eldoret

Dear Sir/Madam,

REF: APPLICATION FOR PERMISSION TO CONDUCT RESEARCH

My name is Michael Kimeli Chumo and I am pursuing a Master of Arts in Project Planning and management at the University of Nairobi. As a requirement of the same and in partial fullfilment of the requirements for the course I am to submit a research report. I therefore intend to carry out a study on the factors affecting maize production in Turbo Constituency, Uasin Gishu County. The purpose of the study is to make possible recommendations for on factors affecting maize production and the possible solutions to the region. This study is mainly for the intention of research and not for any other purpose.

For this I am kindly requesting for permission to conduct the research in Turbo Constituency to both small scale and large scale farmers.

Yours faithfully,

Michael Kimeli Chumo
Registration number: L50/75767/2012

APPENDIX III: INTRODUCTORY LETTER

Dear Respondent,

I am a Master Student at University of Nairobi (UoN) Conducting a study on **FACTORS AFFECTING MAIZE PRODUCTION IN TURBO CONSTITUENCY**

I therefore wish to request you to kindly spare some time and answer the questions below as honestly as possible by ticking or filling in the spaces provided. The information given will be purely for academic purposes and will be treated confidentially. Ultimately, the findings of the study will make suitable recommendation to assist the farmers get insight into the maize farming activities and the relevant institutions

Thank you for your cooperation.

MICHAEL KIMELI CHUMO

APPENDIX IV: QUESTIONNAIRE FOR FARMERS

Background Information

SECTION A Kindly tick where appropriate (√).

i. Gender

Male ☐

Female ☐

ii. Age

18 – 30 years ☐

31 – 40 years ☐

41 – 50 years ☐

51 years and above ☐

iii. For how long have you been practicing maize farming

Less than 2 years ☐

Between 2 – 5 years ☐

Between 5 – 10 years ☐

Over 10 years ☐

iv. Size of Land where you practice maize farming

Less than 25 ☐

26 – 50 acres ☐

51 – 100 acres ☐

Over 100 acres ☐

v. Educational background:

No formal education ☐ Middle school ☐

'O' level ☐ 'A' level ☐

Training college ☐ Polytechnic ☐

Technical school ☐ University ☐

SECTION B: Kindly answer the following questions to the best of your ability by ticking (√) where appropriate.

MARKET CONDITIONS

i. Where do you sell your produce?

a. NCPB [ ]

b. Millers [ ]

c. Wholesalers [ ]

d. Retailers [ ]

e. Others: _____

ii. Comment about the transport to the market?

	Yes	No
a. I use my own vehicle to transport my own produce to the market	[ ]	[ ]
b. The road to the market is in a very bad state	[ ]	[ ]
c. The markets are located very far from my farm	[ ]	[ ]

iii. How relevant are market prices in the maize production process?

	Yes	No
a. They help farmers know the best time to sell their produce	[ ]	[ ]
b. They help farmers know in what markets to sell	[ ]	[ ]
c. They provide information on suitability of price compared	[ ]	[ ]

iv. Kindly rate the following statement on some of the market problems that affect maize farming

	Yes	No
a. The price of the packing material	[ ]	[ ]
b. Rigorous grading systems by the buyer	[ ]	[ ]
c. Storage capacity of the buyer	[ ]	[ ]

INPUT

i. Which of the following statements is most true about the fertilizer used;

	True	Not True
The price of fertilizer fluctuates a lot	[ ]	[] Farmers are not
very aware of the right fertilizers to use	[ ]	[ ]
The fertilizers affect the soil fertility over time	[ ]	[ ]

v. Which of the following statements is most true about the seeds used;

	True	Not True
Seeds are not always readily available	[ ]	[ ]
Seeds could be delivered late after planting has begun	[ ]	[ ]
The price of the seeds varies a lot	[ ]	[ ]

vii. Which of the following statements is most true about the labour used;

True Not True

Labour is generally expensive [ ] [ ]
Sometimes there is shortage of labour [ ] [ ]
Skilled labour to operate machinery is limited [ ] [ ]

viii. Which of the following statements is most true about the pesticides used;

True Not True

The pesticides are expensive [ ] [ ]
Pesticides are available far away from the farm [ ] [ ]
Farmers do not know the best pesticides to use [ ] [ ]

OTHER ACTIVITIES

Kindly rate the following statement as to some of the other activities farmers engage in that affect maize production

Statements	**Agree**	**Disagree**
Engaging in other farming practices with higher returns for e.g. sugar farming		
The need to diversify the risk in farming		
The need for education resulting in most farmers being more with studies		
Formal employment that most farmers have resulted to in the urban centres		
Lack of access to credit leading to engaging in other cheaper business ventures		

QUANTITY

What are some of the effects of the quantity of maize produced in the region?

Positive Effects	**Negative Effects**
1. Eradication of poverty [ ]	1. Pesticides effect on human health [ ]
2. Source of Employment [ ]	2. Fertilizer impact on soil fertility [ ]
3. Food Security [ ]	3. Soil erosion -clearing farm [ ]
Other:	Other: =

APPENDIX V: DATA SHEET ON CLIMATIC CHANGE

APPENDIX III:

DATA SHEET ON CLIMATIC CONDITIONS

YEAR / CONDITION	Quantity of maize produced (Bags)	Rainfall Amount (mm) Per year	Temperature (°C)	Wind
2008 Floods	566,656	1650MM	24°(C)	Heaftorms Lonely
2009 Drought	593,600	820 MM	29°(C)	No wind
2010 Delayed rainfall	368,000	1150 mm	26°(C)	Averagely wind
2011 Average rainfall	57671	1200 MM	24°(C)	Averaged wind
2012 Floods	744,000	1520 MM	23°(C)	Very windy

Notes: (Year: 2008)

Floods, 60% of farmers used harvest for light, Pressure gusts were leading, hailstones, Mass Soil erosion, Logging and rating, Expected bags was 369,776

Notes: (Year: 2009)

Drought: Scarcity of rainfall at Tasling Stage, Impact Hunger, Started the community received relief food from the government. Expected bags was 651,900

Notes: (Year: 2010)

Delayed rainfall: The delayed onset of rainfall caused delayed harvest season here was longer in the months of June, July. Expected bags was 593600

Notes: (Year: 2011)

Average rainfall: The harvest was good. Expected bags 639935

Notes: (Year: 2012)

Floods: That caused erosion on highly areas but very good harvest in the that areas Expected bags 744000

SALLY BULIENGI
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TAPCHAI LOCATION (TURBO)
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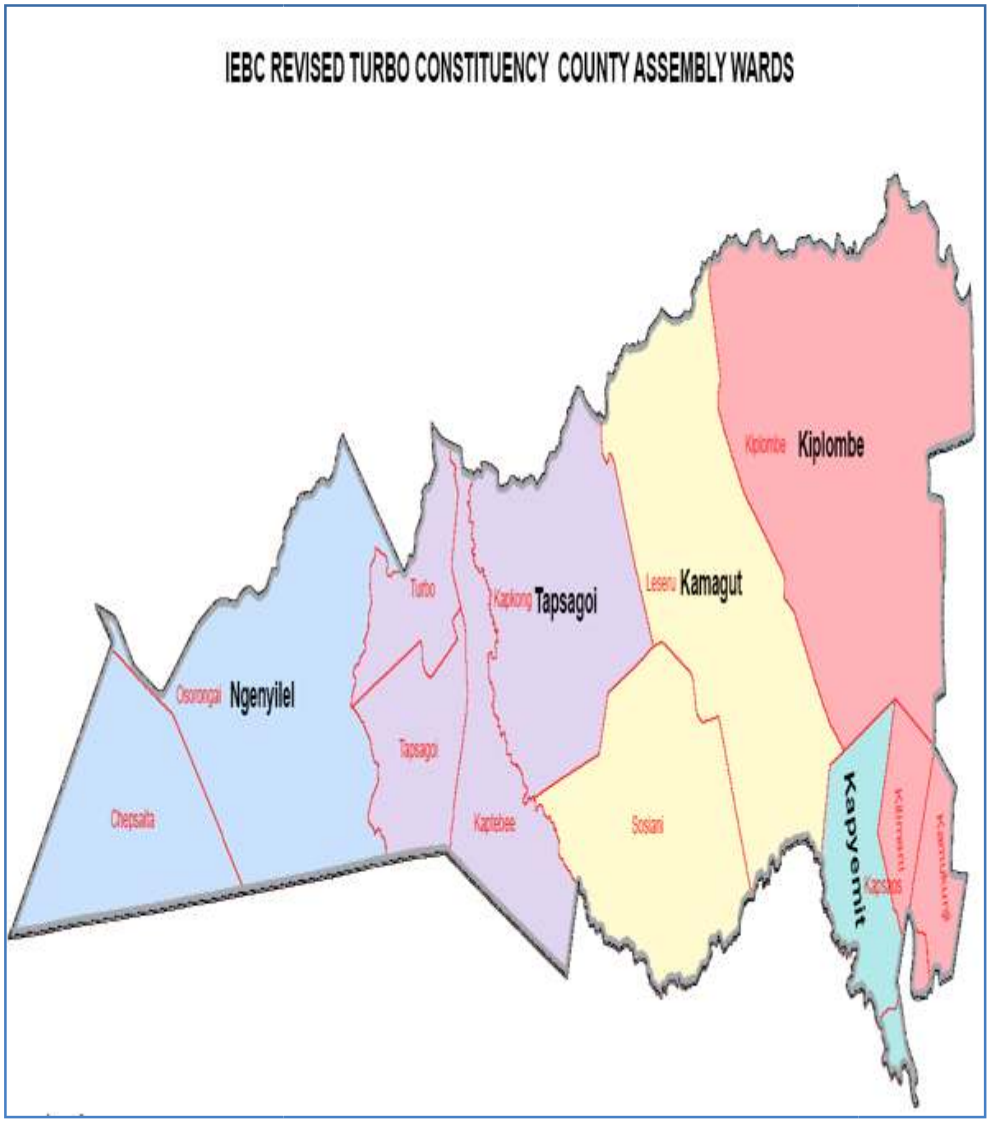
ELDORET

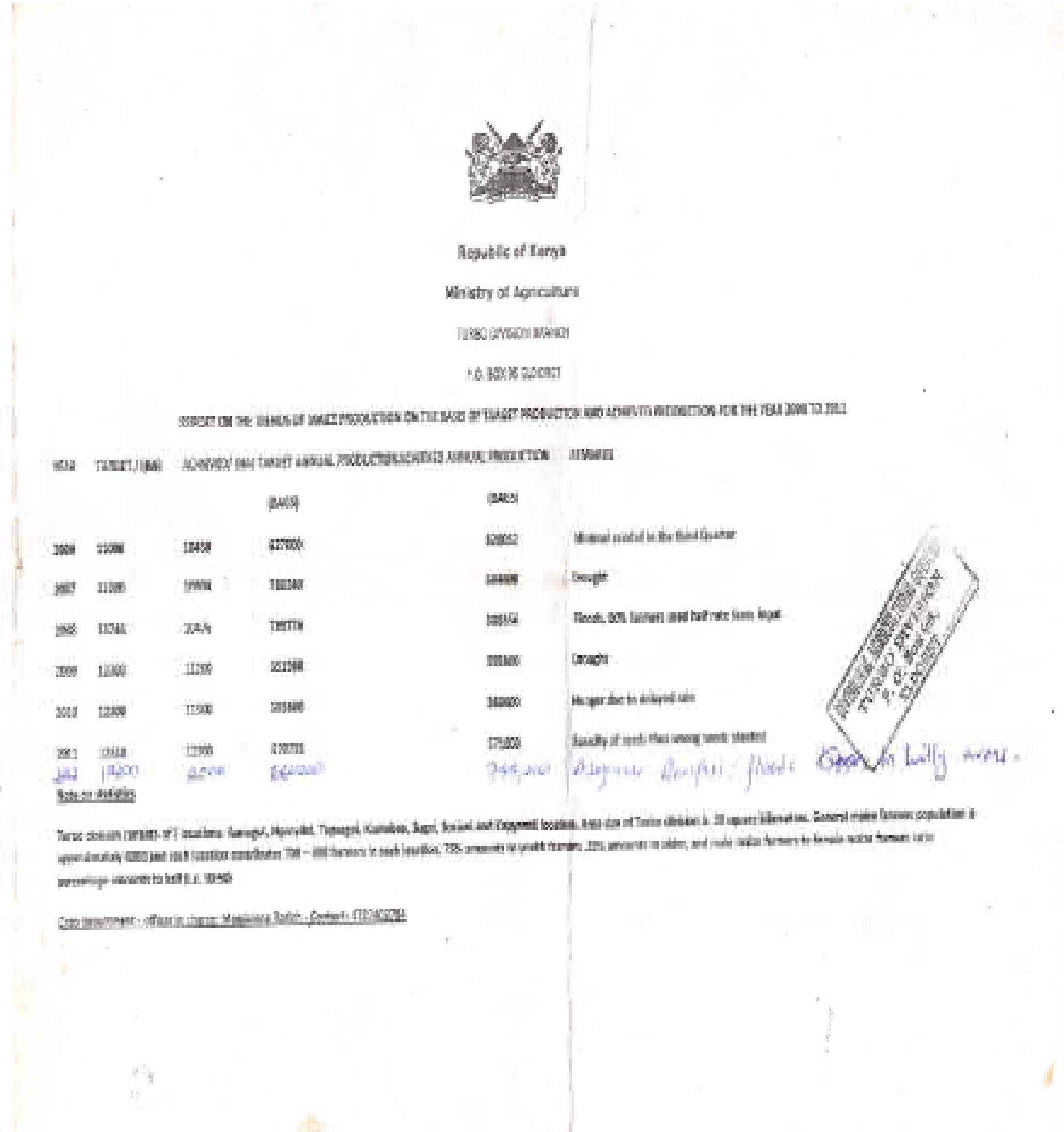
APPENDIX VI: BUDGET

Activity	Description	Amount (Kshs)
Training Research Assistants	Venue and Material	**3,000**
Pre -Testing Instrument using trained Research Assistants	Supervision	**8000**
Development of Dummy Tables using pre-testing data.	Supervision	**3000**
Collect Data in the Field Work	Paying Research Assistants	**3500**
Data Analysis and Interpretation	Data Analysis	**15,000**
Writing of Draft Research Report.	Typing Costs and additions	**10,000**
Submit Final Report in hard Copy and CD form	Printing Copies	**1500**
Total		**44,000**

APPENDIX VIII: TURBO CONSTITUENCY MAP



APPENDIX VIII: REPORT ON MAIZE PRODUCTION IN TURBO CONSTITUENCY



Republic of Kenya

Ministry of Agriculture

TURBO DIVISION BRANCH

P.O. BOX [illegible] ELDORET

REPORT ON THE TRENDS OF MAIZE PRODUCTION ON THE BASIS OF TARGET PRODUCTION AND ACHIEVED PRODUCTION FOR THE YEAR 2006 TO 2012

YEAR	TARGET / (HA)	ACHIEVED/ (HA)	TARGET ANNUAL PRODUCTION (BAGS)	ACHIEVED ANNUAL PRODUCTION (BAGS)	REMARKS
2006	[illegible]	[illegible]	627000	[illegible]	Minimal rainfall in the third quarter
2007	[illegible]	[illegible]	[illegible]	[illegible]	Drought
2008	[illegible]	[illegible]	[illegible]	[illegible]	Floods, 80% farmers used half rate farm input
2009	12000	11200	[illegible]	[illegible]	Drought
2010	12000	11500	[illegible]	360000	Meager due to delayed rain
2011	[illegible]	12000	[illegible]	[illegible]	Quality of seeds [illegible]
2012	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Note on statistics

Turbo division consists of 7 locations: [illegible]. Area size of Turbo division is [illegible] square kilometres. General maize farmers population is approximately [illegible] and each location contributes [illegible] farmers in each location. [illegible]

Crop department - officer in charge: [illegible] - Contact: [illegible]

APPENDIX VIII: TIME FRAME

Gantt chart illustrating the Work Plan to be Observed by the Study																					
Topic Selection																					
Development of Research Objectives																					
Consultations with Supervisor																					
Development of Proposal Draft 1																					
Consultations with supervisor																					
Corrections																					
Consultations with Supervisor																					
Defense of Proposal																					
Proposal corrections																					
Research Instruments Piloting																					
Data Collection																					
Data Analysis																					
Development of Research project																					
Consultations with Supervisor																					
Project Corrections																					
Final Defense																					
Final Project correction																					
Submission of final copies																					
	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk	Wk
	MARCH				APRIL				MAY				JUNE				JULY				