A STUDY TO INVESTIGATE THE USE OF AGRICULTURAL RESEARCH AS A TOOL FOR POVERTY REDUCTION IN MURANGA COUNTY

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A research project submitted to the Department of Extra Mural Studies in partial fulfillment of the requirements of the Post Graduate Diploma in Project Planning and Management of the University of Nairobi.

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DECLARATION

I declare that this research is my own work, that all the resources used have been quoted, indicated and acknowledged by means of complete references, and that this research project has never been previously submitted by me or any other person as an academic paper in any institution.

Sign..... Date.....26TH NOVEMBER, 2010.....

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L42/60741/2009

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

Sign..... Date.....26/11/2010.....

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DEDICATION

This work is dedicated to my beloved fiancée Anne Muthoni Kagiri, without whose caring support it would not have been possible, and to the memory of my mother Faith Wanjiru Mutahi, who passed on a love of reading and respect for education.

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ABSTRACT

This study has attempted to explain that maximizing the contribution of agricultural research with a view of reducing poverty, requires focusing both on improving productivity and ensuring this use is sustainable and equitable. This means looking beyond direct impacts and to maximize agriculture's role in wider economic growth and as a source of livelihood for the impoverished people living in Muranga County. This study used the term sustainable agriculture to cover the productive use of land, water, and other natural resources. Thus it is not limited to crops and livestock but includes fisheries, aquaculture, forestry, and wildlife thus enhances opportunities for agricultural research to contribute to sustainable development, and ensures wealth creation and improved livelihoods for the people living in Muranga.

In Muranga, the poor spend much of their income on food, depend primarily on labor earnings, and tend to reside in marginal agricultural areas. To reduce poverty, agricultural research should aim to ensure adequate food supplies by developing yield-increasing agricultural technologies, to increase labor demand by developing labor-using agricultural technologies and to develop agricultural technologies suitable for marginal areas.

According to the IMF Investment Program for Economic Recovery Strategy for Wealth and Employment Creation in Kenya 2003-2007 report, increased agricultural productivity is closely related with the speed of poverty reduction. The direct effects through lower food prices, increased farm incomes, and more jobs on farms are well understood. Furthermore, the sustainable management and use of renewable natural resources is important for achievement of growth and livelihoods for poor people. This is through their direct productive use (e.g. forestry and fisheries), and also in terms of this impact on the environment – such as on water and energy, on which growth in other sectors is dependent.

This document will be organized as follows: The introductory chapter described the research background, problem definition, objectives of the study, significance of the study, research justification and the limitations. Chapter 2 focused on the literature review. Chapter 3 described the research methodology and data collection, in chapter 4 the data was analyzed and interpreted and in the final chapter I gave the summary of findings and the conclusions.

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

The Republic of Kenya covers an area of approximately 582,646 sq. km. comprising 97.8% land and 2.2% water surface. Of this land only 16% can be classified as medium to high potential and the remaining land is mainly arid or semi-arid.

The Kenyan population is 35 million people according to the 2010 census. About 80% of the Kenyan population lives in rural areas and derive their livelihood from agriculture. Even for the urban poor, a majority of them make a living on agricultural related activities. The sector is therefore the main source of national income and employment creation for over 80% of the population and contributes to poverty reduction and food security.

Muranga is one of the counties of Kenya. Its capital town is also now named Muranga but was called Fort Hall in colonial times (before 1963). It is inhabited mainly by and is considered the home of the Kikuyu, the largest tribe in Kenya. The district has a population of 942,841 (2010 census)

Small-scale farmers, mainly in the high potential areas, dominate Muranga's agriculture. The sub-sector accounts for 75% of total agricultural output and 70% of marketed agricultural production. Small-scale farmers produce over 70% of maize, 65% of coffee, 50% of tea, 80% of milk, 85% of fish and 70% of beef and related products. In Muranga, agricultural production is carried out on farms averaging 2-3 acres mainly for subsistence and commercial purposes. Currently, use of quality inputs and equipments such as hybrid seed, fertilizers and pesticides or machinery by the sub-sector is very low. Therefore to increase and or sustain productivity in the sub sector, there is need for enhanced efforts to encourage farmers to adopt modern farming practices brought about through agricultural research.

According to the Wikipedia, Agriculture is the second largest contributor to Kenya's gross domestic product (GDP), after the service sector. In 2005 agriculture, including forestry and fishing, accounted for about 24 percent of GDP, as well as for 18 percent of wage employment and 50 percent of revenue from exports. This paper will focus is on public and private research organizations, policy and successes in Kenya and will also compare with a more successful case study of agricultural research in Egypt.

The Government of Kenya is a signatory to the Millennium Declaration made at the United Nations Millennium Summit in September 2000 adopting the Millennium Development Goals (MDGS) with clear targets for reducing poverty, hunger, disease, illiteracy, environmental degradation, and discrimination against women by 2015. The success of the rural economy has been faced by a number of constraints. Land is one of the most important resource in Kenya as is the base upon which activities like Agriculture are carried out. Inconsistent policies and poor implementation have compromised food security, employment and income.

Agricultural research extension has evolved through improvements, development and adoption of more participatory systems such as Focal Area Approach (FAA), Farmers Field Schools (FFS) and Promoting Farmer Innovations (PFI). Kenyan women do over 70% of agricultural activities, and the ministry of agriculture in Kenya is enhancing their role in agricultural production, processing and marketing by mainstreaming gender issues in all programs. Some of the challenges faced by the extension services include HIV/AIDS pandemic and inadequate financing for the agricultural sector. The first challenge is addressed by development of an HIV/AIDS policy. In the Ministry of Agriculture, a HIV/AIDS unit has been created for sensitization, capacity building of staff and farmers to deal with issues of vulnerable groups and special nutrition requirements. The second challenge is being addressed through the strengthening of micro-finance institutions. Among others, necessary legislation, creation of department of Micro and Small-scale Enterprises Development (DMSED) and the establishment of a Micro Finance Trust Fund (MFTF) are watershed developments.

Environmental concerns remain a key consideration in order for current generation to enjoy sustainable environment without compromising the needs of the future generations.

Environmental concerns remain a key consideration in sustainable agriculture development. Towards this end, the Kenya government enacted a National Environmental Policy and National Environment action plan operational zed through a multi-sectoral approach in development. The government also established the National Management Authority (NEMA) through the Environmental Management and Co-ordination Act (EMCA) of 1999, to exercise general supervision and co-ordination over all matters relating to the environment. NEMA and other state institutions alone cannot address environmental issues and there is need for collaboration with other stakeholders.

The principal cash crops of Kenya are tea, horticultural produce, and coffee; horticultural produce and tea are the main growth sectors and the two most valuable of all of Kenya's exports. As such, being the backbone of Kenya's economy it plays enormous contribution towards poverty alleviation.

The goal of most public agricultural research organizations is to undertake research and development work that will ultimately improve the productivity and sustainability of the agricultural and food sector. In today's world of scarce public funding and greater accountability, governments, donors and research managers are increasingly demanding assessment of the economic returns to their investments in research.

1.2 Statement of the problem

Rural Kenya (which includes Muranga County) is home to more than 75 per cent of the Kenya's ultra poor. Most of this poor people lack the basic human needs such as water, clothing, shelter and food. But it is the lack of food and water that undermines the dignity to life.

According to the Wikipedia, The gross domestic product (GDP) of Kenya for the year 2010 is US$6.96 billion, and the GDP per capita is US$339. Official figures show services making up 52% of GDP, but given that most of the population is not employed and hence has no measurable wage these statistics probably do not give an accurate portrayal of most Kenyans' activities.

Agriculture accounts for 28% of GDP and 65% of exports: cash crops include coffee, tea and pyrethrum; food products include maize, sorghum, rice and sugarcane; livestock and livestock

products include beef, pork, poultry, dairy products, eggs. Unfortunately however, food output is not keeping pace with population growth and crop production has been extended into marginal land.

The reasons for poverty in rural Kenya may be caused by a number of factors which include climatic changes, lack of land, lack of sustainable economic activities and disease. This research is guided by the fact that 75% of Kenya's ultra poor live in the rural areas and 80% of the same people depend on agriculture. It is for this facts or reason that we have to agree that we cannot talk about fighting poverty in rural areas without looking at agriculture.

It is not only agriculture that we need to look at but sustainable agriculture that is able to provide food beyond security but also provide a source of income over time. It is important that have studied the role of agricultural research as a tool for identifying suitable sustainable agriculture that is well adopted and implemented could provide the end of the poverty problem experienced mostly by the rural dwellers in Kenya.

1.3 Purpose of the study

This study has aimed at understanding how agricultural research can be used as the foundation to generate these policies that if adopted, may lead agricultural growth which in an agriculture dependent economy such as Kenya will lead to development and consequently reduce or eliminate poverty.

1.4 Objectives of the study

1. To investigate why agricultural research should be used as the tool to fight poverty in the Muranga County of Kenya.

2. To investigate the benefits of agricultural research and how it can provide a mechanism to boost increased food production in Muranga County.

3. To identify the challenges faced by Kenya agricultural research initiatives and suggesting possible solutions in Muranga County.

4. To identify and describe the various forms of agricultural research that can be employed in Muranga County.

1.5 Research questions

1. How can agricultural research be used as a tool to fight poverty in Muranga?
2. Can the benefits of agricultural research be used to boost increased food production in Muranga?
3. Can the challenges of Agricultural research in Muranga have possible solutions?
4. What are the forms of agricultural research that can be employed in Muranga?

1.6 Scope of the study

This study covered Muranga which is one of the seven counties of Central Kenya. The county covers an area of 756 sq Km². It is bordered by Nyeri District to the north, Maragua District to the southwest, Nyandarua District to the wets and Kirinyaga District to the east. The district lies between latitudes 0°34′ and 1° 07′ South and longitudes 36°East and 37°27′ East. The district is divided into 4 constituencies namely Kiharu, Kahuro, Kangema and Mathioya. Kahuro, Mathioya and Kangema Divisions are the most densely populated with Kahuro having the highest. Kiharu Division has the lowest population density of 354 persons per km². Majority of people in Kiharu Division live below poverty line with the most vulnerable groups being the unemployed who are mainly the youth *Muranga District Strategic Plan (2010)*

1.7 Significance of the study

An estimated 70 percent of Kenyans living in Muranga, rely on agriculture for all or some of their household income *Muranga District Strategic Plan (2010)*. Farmers face a number of risks to their livelihoods, including unpredictable weather and crop price variation. These risks may also affect how they choose to borrow and invest to improve their business. This study seeks to find out how through agricultural research, poor farmers in the rural areas can increase productivity and deal with the risks inherent in farming with the view of reducing poverty by adopting agricultural research methods.

1.8 Definition of significant terms

Beetle Bank	In agriculture and horticulture is a form of biological pest control. It is a strip planted with grasses and-or perennial plants, within a crop field or a garden, that fosters and provides habitat for beneficial insects, birds, and other fauna that prey pests
Bird Scarer	Is any one of a number device designed to scare birds, usually employed by farmers to dissuade birds from eating recently planted arable crops
Bird Netting	Is a form of bird pest control. It is a net used to prevent birds from reaching certain areas.
Commercial fishing	Is the activity of capturing fish and other seafood for commercial profit, mostly from wild fisheries
Cover crops	Fundamental, sustainable tools used to manage soil fertility, soil quality, water, weeds, pests, diseases, and diversity
Disease resistance	Often defined as reduction of pathogen growth on or in a plant or animal.
Disease tolerance	Describes plants or animals that exhibit less disease damage despite similar levels of pathogen growth
Disease Triangle	The three-way interaction of the pathogen, the plant or animal, and the environmental conditions
Genetic Engineering	It is also called **genetic modification**, is the human manipulation of organisms genetic material in a way that does not occur under natural conditions
Germplasm	Is a collection of genetic resources for an organism. For plants, the germplasm may be stored as a seed collection or, for trees, in a nursery.
Insecticide	It is a pesticide used against insects. They include ovicides and larvicides used against the eggs and larvae of insects respectively.
Herbicide	It is commonly known as a weed-killer is a substance used to kill unwanted plants.
Mariculture	Is a specialized branch of aquaculture involving the cultivation of marine organisms for food and other products in the open ocean, an enclosed

section of the ocean, or in tanks, ponds or raceways which are filled with seawater.

Monitoring, control and surveillance In the context of fisheries, is defined by the Food and Agriculture Organization (FAO) of the United Nations as a broadening of traditional enforcing national rules over fishing, to the support of the broader problem of fisheries management.

Pest Include insects, plant pathogens, weeds, molluscs, birds, mammals, fish, nematodes (roundworms), and microbes that destroy property, spread disease or are a vector for disease or cause a nuisance.

Pesticide It is any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. A pesticide may be a chemical substance, biological agent (such as a virus or bacterium), antimicrobial, disinfectant or device used against any pest.

Plant breeding It is the art and science of changing the genetics of plants for the benefit of mankind.

Trap crop It is a plant that attracts agricultural pests, usually insects, away from nearby crops. This form of companion planting can save the main crop from decimation by pests without the potential issues and controversy involved in using pesticides.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Agricultural Research is a broad multidisciplinary field which provides scientific information and theories for the explanation of nature and the properties of the world around us while encompassing natural, economic and social sciences that are used in the practice and understanding of agriculture making practical applications possible *Beynon (1998).*

In this chapter we shall describe why agricultural research should be used as a tool to fight poverty, benefits, challenges and the various forms of agricultural research.

2.2 Why should agricultural research be used as tool to fight poverty in Muranga

Agricultural productivity is dropping in Kenya (which includes Muranga). For example, per capita agricultural production fell by about 5% over the last 20 years while increasing by 40% in other developing countries *Beynon (1998).*

As the focus of development assistance shifts towards export-led growth and state support for agriculture is progressively withdrawn, the productivity of small farmers has declined and therefore leading to poverty due to:

Lack of access to land and resources (See 2.3.2 Factors influencing land problems in Kenya) and degradation of natural resources such as forests have led to inadequate rainfall and drying of rivers.

Poor access to markets leading to low agricultural related income and low investments in public infrastructure have also led to the need for newer agricultural breeds that can withstand longer storage periods.

HIV/AIDS is reducing life expectancy and the productive capacity of farming households – in the past two decades 7 million farmers and agricultural workers have died of AIDS in the most affected countries. As a result most children have been orphaned and farming activities abandoned.

Climate change, in the form of increased extreme weather patterns and particularly more frequent and prolonged droughts, is expected to have a further detrimental effect on Africa's agriculture leading to the need for agricultural research.

2.3 Benefits of agricultural research

The economic returns on investment in agricultural research benefit producers and consumers in several tangible ways.

First, adoption of new technologies generated by research leads to reduced costs per unit of production and expanded supplies of food and fiber. Expanded supplies put downward

Pressure on prices, thus benefiting the consumer. This benefit is particularly important for low-income consumers who spend a higher proportion of their budget on food than do high-income consumers *Braha and Tweteen (1986).*

Secondly, improvements in agricultural productivity have enabled farmers to remain competitive in world markets and to expand exports.

Third, agricultural advances have a multiplier effect on the rest of the economy by generating jobs and incomes in the nonfarm sector. This in turn expands tax revenues, thus offsetting the initial public expenditures on research.

Fourth, agricultural research has led to improvements in food quality, food safety, and nutrition. Researchers have developed more nutritious foods with less waste. Food processing, packaging, and preparation research has led to reduced spoilage and contamination.

Fifth, agricultural research has contributed technical and institutional solutions to improve environmental quality. For example, minimum tillage farming systems conserve energy and

reduce erosion; integrated pest management research is showing the way to less pesticide-intensive farming.

Sixth, the complementary relationship among research, teaching, and extension programs in our universities means that students, farmers, government officials, and agribusiness leaders have received more sophisticated up-to-date training than if our university teachers and extension workers just regurgitated the knowledge they were taught.

Seventh, agricultural research has eased the drudgery and extended the productive work-life of the farmer. Machines, equipment, and chemicals now perform tasks formerly completed in a backbreaking manner.

Eighth, agricultural research has generated information that can be used to improve government policies or other institutional arrangements that affect the well-being of producers and consumers.

2.4 Challenges of agricultural research in Developing Countries

Poor Attitude or Lack of Interest: Everyone carries with them both explicit and implicit models of the way the world works, or the way the world should be.

These "framings" are important when priorities are decided for the allocation of limited research funds, or when scientists decide on what will be the focus of their experiments *Braha and Tweeten (1986)*. Such perspectives often remain unchallenged, yet they stick with great tenacity therefore meaning that in most cases Africans adopt agro research models used elsewhere while forgetting that situations may differ leading to failure.

Institutional Bureaucracies: If the broad framings of research and the emerging narratives of problems and solutions are deeply affected by who is involved and their bureaucratic and political setting, then it becomes essential to think critically about participation (in its broadest sense) in agricultural research, both upstream (in terms of defining priorities, questions and framing assumptions) and downstream (in terms of adaptive, applied research, as well as extension and implementation) *Braha and Tweeten (1986)*.

Disregard of Field based research and inadequate technical know how: Complex innovations, involving agro-ecological responses and skill-based management, are often not amenable to conventional research protocols and organizational arrangements. Thus, experiential, field-based learning and adaptive technology design is not seen as legitimate as lab-based experimentation or randomized block designs for well-controlled, station-based trials. The innovators whether farmers, extension workers or researchers are not given as much credit, with their results not being written up or accepted by agricultural journals.

2.5 Forms of Agricultural research

In this subtopic I looked at the various forms of agricultural research methods practiced all over the globe. These are described below:

Animal Health:

Veterinary Medicine is the branch of science that deals with the application of medical, surgical, public health, dental, diagnostic, and therapeutic principles to non-human animals, including wildlife and domesticated animals *Aaron (2006).* It is important to understand how antibiotics are used in humans and in food animals and how these uses affect the evolution of antibacterial resistance. Appropriate use of antibiotics for food animals will preserve the long-term efficacy of existing antibiotics, support animal health and welfare, and limit the risk of transfer of antibiotic resistance to humans.

Animal Health research enhances understanding of the epidemiology of antimicrobial resistance which allows for the development of preventive strategies to limit existing resistance and to avoid emergence of new strains of resistant bacteria *Aaron (2006).* Researchers use risk assessments as a regulatory tools to assess potential risk to humans resulting from antibiotic use in food-producing animals and to then develop microbial safety policies to protect the public health.

The veterinary public health scope, in addition to the control and eradication of zoonoses, also includes the development and supervision of food hygiene practices, laboratory and research activities, and education of the public. Thus, it may be seen that there are many ways in which veterinary medicine plays a very important role in public health.

Aquaculture/Fish genetics research:

Also known as aqua-farming, aquaculture involves cultivating aquatic populations under controlled conditions, and can be contrasted with commercial fishing, which is the harvesting of wild fish. Commercial aquaculture supplies one half of the fish and shellfish that is directly consumed by humans. Aquaculture comprises diverse systems of farming plants and animals in inland and coastal areas and often complements other food production systems. In the context of the rural poor, aquaculture often complements catches from traditional fisheries. Often, the capture or culture of aquatic species forms the basis of food security, enabling the use of livestock or cultured fish as a source of income generation *Aaron (2006).*

Crop protection research:

Crop protection is the branch of horticulture concerned with protecting crops from pests, weeds, disease and theft.

Crop post harvest research:

Post-Harvest Research: This is concerned with research, development, consultancy and training in the post harvest storage, processing and utilization of tropical and temperate cereals, legumes, fruits and vegetables. In the developing world, three quarters of all seed planted is derived from stocks maintained on-farm by farmers. Although these stocks provide farmers with a degree of food security, they are susceptible to losses or damage caused by insects, rodents, fungal attack, environmental changes, some of which are exacerbated by market forces and political interventions, which destabilize grain production and markets. Commercial grain stock-holders and processors are also subjected to the same spectrum of loss-causing agents *Belcher and Hawtin (1999).*

Plant Science:

The main aim of plant science research is to study Plant Disease Resistance, Tolerance and Disease Triangle. It covers a wide range of scientific disciplines concerned with the study of plants, algae and fungi, including structure, growth, reproduction, metabolism, development, diseases, chemical properties, and evolutionary relationships between taxonomic groups. Botany

began with early human efforts to identify edible, medicinal and poisonous plants, making it one of the oldest sciences *Belcher and Hawtin (1999).*

The high degree of structural complexity of plant cell wall polysaccharides has led to suggestions that some components might function as latent signal molecules that are released during pathogen infections and elicit defensive responses by the plant. However, there has been a paucity of genetic evidence supporting the idea that variation in cell wall composition plays a role in the outcome of host–pathogen interactions. Recently, several genetic studies have provided new lines of evidence implicating cell wall polysaccharides as factors in host–pathogen interactions.

Fishery Science:

Fisheries management research seeks to find ways to protect fishery resources to ensure possibility of sustainable exploitation. Modern fisheries management is often referred to as a governmental system of appropriate management rules based on defined objectives and a mix of management means to implement the rules, which are put in place by a system of monitoring control and surveillance *Belcher and Hawtin (1999).*

Forestry management science:

Forestry management research emphasizes the development of farm forestry as a way of increasing the low forest cover, diversifying subsistence products and incomes while contributing to soil and water conservation.

This form of research emphasizes the need to support farmers with sound management and utilization principles, incentives, information, better germ-plasm and marketing strategies. Farmers need to have a list of priority products from multipurpose trees in order to optimize production. Vision 2030 has also put similar emphasis on the contribution of forestry in conservation of water resources.

To achieve these objectives, the research programme should strengthen linkages amongst extension agents' researchers and farmers through development of effective extension approaches as well as production of appropriate management guidelines. Research focus will be on development of fast growing species with high market demand and their management

practices, market research, facilitating establishment of on-farm tree seed sources, evaluation of traditional tree management practices, developing on-farm efficient wood conversion technologies for promotion of small and medium enterprises and policy research.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Research Design

This study used the explanatory case study research design. Agricultural research in Muranga was chosen for the case study due to the extent to which it agricultural research has been successfully adopted. A comparative case study design of agricultural research in Egypt was chosen for the main reason of comparison. Egypt was chosen because its one of the most advanced countries in Agricultural Research in the continent. The main reason why I chose to use the Case Study design was because the type of the research questions were both qualitative and quantitative and there was little possibility to control the events due to general circumstances of the contemporary phenomenon that was studied. I also used questionnaires to gather data from a group of 15 respondents in four administrative divisions of Muranga county.

The theoretical framework was based on multiple cases in terms of the forms of agricultural research methods employed in different regions and different agricultural commodities.
The unit of analysis was embedded design which included multiple units of analysis with main smaller units on different levels looking for consistent patterns of evidence across units but within a case.

3.2 The Study Area

The study area was the Muranga County. The county is divided into 4 administrative divisions namely Kiharu, Kahuro, Kangema and Mathioya. It has three local authorities namely; Muranga Municipal Council; Muranga County Council and Kangema Town Council.
The largest Division is Kiharu followed by Mathioya and Kahuro. The smallest division is Kangema with an area of 127.7km^2. The county is quite densely populated but with diverse distribution varying from one division top the other and from region to region.
Kahuro, Mathioya and Kangema Divisions are the most densely populated with Kahuro having the highest. Kiharu Division has the lowest population density of 354 persons per km^2. Majority of people in Kiharu Division live below poverty line with the most vulnerable groups being the

unemployed who are mainly the youth. This study focused on all the four administrative boundaries which formed the sampling zones.

3.3 Study Population

The research comprised of to main explanatory case studies of Agricultural research in Kenya and Egypt. The case studies were embedded in design comprising several sub units or specific cases. In Kenya's case study, I analyzed 4 cases while in Egypt's case study I analyzed 6 cases.

3.4 Sampling Procedure and Method

The study used the random sampling method to select the 4 embedded units in Kenya and 6 embedded units in Egypt to form a sampling zone of 10 cases. The reason for selecting this sampling method was due to the fact that there were several success cases of agricultural research in Africa and around the world.

3.5 Data collection methods used

The study used case explanatory case studies of agricultural research in both Kenya and Egypt. In Kenya, the study looked at what shaped agricultural research, lessons learned from past research efforts, current agricultural research policies and emerging trends. The study also analyzed success stories in agricultural research such as the case of transgenic sweet potato, the case of weed resistant sorghum genes, the case of genetically modified napier grass and the case of drought resistant maize. In Egypt, the study looked at Egypt's history, geography and agriculture, what led to agricultural research in Egypt and factors leading to agricultural research success. Success stories were also analyzed such as the case of soil and water research, cotton research, horticulture research, genetic engineering, agro economic research and food technology.

CHAPTER 4

DATA ANALYSIS, PRESENTATION AND INTERPRETRATION

Introduction

In this chapter, data collected was presented using statistical analysis and interpretation done as per the corresponding questions in the questionnaire. The obtained data was also compared against the literature review and existing facts.

4.1 Gender Distribution

Table 4.1 Gender Distribution

Gender	Frequency	Percentage
Male	10	66.7
Female	5	33.3
Total	15	100

Out of the total 15 respondents, 10 of them were male which represented 66.7% and 5 of them were female which represented 33.3%. The regional distribution of male was as follows; Kahuro 2 (20%), Kiharu 2 (20%) , Kangema 2 (20%), and Mathioya 4 (40%). The regional distribution of the female was as follows; Kahuro 1 (20%), Kiharu 1 (20%), Kangema 2 (40%) and Mathioya 1 (20%). The above statistics represented respondents for both gender in all the regions of the county.

4.2 Age Groups Distribution

Table 4.2 Age Groups

Age Group	Frequency	Percentage
18-22	3	20
23-27	3	20
28-32	3	20
33-37	3	20
38 and Above	3	20
Total	15	100

The targeted respondents were all adults ranging from the ages of 18 to above 38. The ages were all fairly distributed with each age group getting equal distribution of three respondents which represented 20%.

4.3 Knowledge and Awareness of Agricultural research in Muranga County

Table 4.3 Respondents' Knowledge in Agricultural Research

Response	Frequency	Percentage
Yes	12	80
No	3	20
Total	15	100

The research firstly sought to find out if the respondents had any knowledge of what agricultural research is. The majority of the respondents that is 12 out of the total 15 which represented 80% had knowledge of agricultural research while 3 of them which represented 20% had no knowledge of what agricultural research was.

4.4 Methods of Agricultural Research used in Muranga County

Table 4.4 Methods of Agricultural Research used in Muranga County

Method	Frequency	Percentage
Animal Health	4	26.7
Fish Genetics	2	13.3
Crop Post Harvest/Protection	5	33.3
Forestry Research	1	6.7
Plant Science	3	20
Total	15	100

From the above table most people had knowledge of crop post harvest research and animal health and plant science which represented 5, 4 and 3 respondents that is 33.3%, 26.7% and 20% respectively. Few people had knowledge about forestry research and fish genetics which represented 1 and 2 respondents that is 6.7% and 13.3% respectively. Respondents were also requested on the questionnaire to outline some of the causes that shaped the initiatives.

4.4.1 What shaped agricultural research in Muranga County

On the whole, the agricultural research policy-shaping environment in Kenya has not been pro-poor and few incentives have existed for the Kenyan political elite to listen to the poor. Historically, the agricultural policy environment has been shaped by:

The influence of the patrimonial State: Kenya's political system concentrates power in the Presidency which as an institution holds the power to key decision making which in many occasions tend to ignore or be misinformed of the need for agricultural research especially in rural areas as a tool for poverty reduction *Anyang and Shiundu (1999).*

The relationship between ethnicity and agricultural practices: Policy formulation processes have tended to be biased in favor of particular ethnic groups, whilst penalizing others, for example through the selective allocation of trade licenses.

Economic rent and patronage: Rent in the agricultural sector is created by artificial shortages through licensing and restrictions applied to the production and marketing of agricultural commodities inputs and services.

Political economy of agriculture and dominance of donor assistance priorities: Post independence, agricultural policy was demand-driven responding to local stakeholders needs.

Subsequent policy was supply driven and significantly influenced by donors from the mid 1970's, peaking with the introduction of Structural Adjustment and Integrated Rural development programmes. This was followed by the 'donor-do-nothing' phase of early 1990s to the 1994 Agricultural Sector Investment Program (ASIP) *Anyango and Shiundu (1999).*

4.5 Challenges faced by Agricultural Research initiatives in Muranga County

Table 4.5 Response on the challenges faced by agricultural research

Response	Frequency	Percentage
Yes	15	100
No	0	0
Total	15	100

As per the table above all the 15 respondents representing 100% confirmed that there were challenges facing agricultural research initiatives in the area. Respondents were also requested on the questionnaire to name some of the challenges and lessons learned from their past initiatives.

4.5.1 Lessons from past agricultural research efforts in rural Kenya

Despite the failure of past agricultural research policy initiatives to bring about agricultural development and poverty reduction in Muranga, a number of lessons for donors can be drawn from past experience, particularly:

Cultivating the need for local ownership and commitment to agricultural policy reforms within government and the wider community.

Emphasizing that local factors such as political economy are crucial for successful implementation of proposed policy reforms.

Importance of identifying and establishing access to key decision making and implementation structures influential in policy formulation.

The importance of establishing fully costing policy proposals and formulating methods to integrate the proposals into the budgetary process.

The need to appreciate capacity gaps in civil service and the necessity of introducing a phased approach to complex agricultural policy issues.

4.6 Case studies on Agricultural Research success in Muranga

4.6.1 The case of the transgenic sweet potato in Muranga

Sweet potato has been cultivated in Muranga since the end of the 19th century and is the second most important and widely distributed food security crop after maize. It is considered a staple food crop for many rural families and is increasingly becoming an important cash crop for urban markets *Gibbons (2000).* The crop is mainly grown by poor farmers and is cultivated on about 75,000 ha spread over various agro ecological zones in the country.

With financial assistance from USAID/ABSP, a collaborative research project between Kenya Agricultural Research Institute (KARI) and Monsanto was launched in 1991 to develop a virus

resistant sweet potato. The initiative was an innovative undertaking based on public/private partnerships. The project is considered to be a groundbreaking initiative for the introduction of the first transgenic crop in Kenya.

4.6.2 The case of genetically modified napier grass in Muranga

Also called elephant grass, Napier grass is a tall fast growing species averaging 3.5metres. In the savannas of Africa, it grows along lake beds and rivers where the soil is rich. In Muranga, it is planted on farms as a source of feed for dairy cows constituting between 40 to 80% of forages used by smallholder dairy farmers.

The emergence of two major diseases; Napier smut, a fungal disease caused by *Ustilago kamerunesis*, and Napier grass stunt, caused by phytoplasma, has become a serious threat to Napier grass with the potential of causing significant reduction in yields and threatening an industry with most varieties susceptible to the diseases and thus the need for coming up with a more resistance breed *Aaron (2010)*.

The far reaching implication of this is that farmers may be forced to sell their dairy cows or graze them on sparse communal pastures, which exposes them to the risk of other diseases.

4.6.3 The case of drought resistant Maize

Maize production in Muranga relies on the small-scale farmers who contribute about 75% of the overall production, with the remaining 25% being contributed by the large-scale farmers.
The ammonia-like smell and slimy texture of soybeans fermented with bacteria is a combination that agricultural researchers in Kenya working with those in Japan now indicate that the natto bacterium may be key to one of Africa's biggest problem – food insecurity. Research has shown that the Natto bacterium known as Bacillus Subtilis has a gene that helps plants to cope with the stress of drought. GM varieties of maize produced through tissue culture and Marker Assisted Selection (MAS) contain both the herbicide-tolerant and insect-resistance traits.

4.7 The comparison case study of agricultural research in Egypt

Egypt is in the midst of a dynamic agricultural transformation, highlighted by unprecedented yield gains and production of its major crops. For a country that has limited arable lands and water supplies and that already enjoys high crop yields, this is a tremendous accomplishment.

This progress has resulted, primarily, from effective research programs and significant policy reform during the past 10- to 15-year period. Yield growth in major Egyptian crops can only be described as phenomenal over the past decade. Productivity gains for many crops have been exceptionally great since the early 1980s. Moreover, since 1981 Egypt's agricultural performance far exceeds the average for the rest of the world in rate of gain in the indices of total agricultural production, agricultural production per capita, total food production, and food production per capita *Cline (1979).*

It should be noted, as well, that with 31 of 32 major crops, Egypt exceeded world average yields. With two crops, Egyptian yields were the highest in the world. For several other crops, Egypt ranked second or third in the world in average yield.

4.7.1 Egypt history, geography and agriculture

The Arab Republic of Egypt is in 2 continents, Africa and the Sinai Peninsula in Asia. It is the 15th most populous country in the world and the second most populous in Africa after Nigeria.

In Egypt 88 percent of the water is consumed in agriculture. About 96 percent of the economically active population in Egypt is engaged in agriculture and Egyptian agriculture is entirely dependent on irrigated land. Egypt's desperate need for enormous quantities of water is therefore abundantly clear as is its need for efficient use of its limited land suitable for crop production

To discuss Egypt is to discuss the Nile. It is formed by three tributaries, the Blue Nile, the White Nile, and the Atbara. The White Nile rises from its source in Burundi, passes through Lake Victoria, and flows into southern Sudan. There, near the capital city of Khartoum, the White Nile meets up with the Blue Nile which has its source in the Ethiopian highlands, near Lake Tana.

The river then flows north through Lake Nasser, the second largest man-made lake in the world, and the Aswan Dam before splitting into two major distributaries just north of Cairo. In ancient times, the number of distributaries was much greater, but slow water flow, human interference, and the accumulation of silt had led to the disappearance of many of the distributaries. This has effectively led to the desertification of large stretches of Egyptian land *Cline (1979).*

Conflict has never been far from the banks of the Nile. Its source is in central Africa; its value to the 10 countries through which it flows and the total dependence of Egypt and Sudan on this life line have always made the political and biological life of the river a source of conflict.

In 1959 an agreement for the full utilization of the Nile water was signed between Egypt and the Sudan allocating 55.5 billion cubic meters per year for Egypt and 18.5 for the Sudan.

4.7.2 Why study agricultural research in Egypt

Egypt is a country that is based on the philosophy that the growth of the country's economy and the employment of the people will be based on the success of its agriculture.

Over the years, there have been many changes in the economy, structure, scientific basis and international standing of agriculture in Egypt. These serve as examples of what can be done in developing an agricultural economy with severely limited land, arid conditions, and cooperation with the support of western countries including Canada, Germany, France and the United States. The events of this period provide a background for agricultural research and should be a foundation for the continued development of agriculture in Kenya.

Egypt is the story of people and the management of natural resources through the dimension of time. The value of the analysis given here transcends the boundary of a nation and time. It forms a model/modality for the goal of sustainable development and use of resources which are meaningful globally.

In Egypt, the leaders and people are attracted by the miracles of technology and its potential to solve all the problems of a society. These miracles are important but no more so than the knowledge of a country's basic resources, its history and its culture.

4.3.3 The food gap problem that led to agricultural research in Egypt

By the middle of the 20th century, it became obvious that Egypt's food supply was in serious trouble. In 1960, for example, Egypt had been almost self-sufficient in wheat production. By 1980, the country was importing about three-fourths of its wheat needs *Cline (1979).* This alarming gap, resulted in increased attention being devoted to agriculture. The 1982 U.S. Presidential Mission on Agricultural Development in Egypt (PMADE) focused major attention on the rapidly widening food gap in Egypt, and recommended a number of specific actions to deal with the problem. These actions included the following:

Major emphasis was placed on the need for strengthened research and extension programs aimed at increasing agricultural output. This recognition resulted in the initiation of a new cooperative project financed by USAID and called the National Agricultural Research Program (NARP).

Recommendations were made for significant policy reforms that would have an impact on the problem by making conditions more favorable for enhanced food production and, slowing down the rate of gain in food demand. It was pointed out that cheap food, made possible by extensive government subsidies, was, in part, responsible for increasing per capita utilization by contributing to excessive waste. This would be countered by Permitting agricultural output and input prices to move toward world price levels and correcting distortions in relative prices received and paid by farmers thereby using resources in the agricultural sector more efficiently and reducing Egypt's growing dependence on imported food.

4.7.4 Factors that led to agricultural research success in Egypt

Agriculture technology utilization and transfer: ATUT developed new crop varieties that had improved resistance to pests, tolerance to environmental stress and efficient use of water. ATUT also aimed to improve agricultural technologies in Egypt by identifying and transferring to the private sector improved agricultural production, post harvest handling and marketing technologies, by developing a carefully focused, improved collaborative strategic research program aimed at resolving the major constraints to increased productivity of selected staple

crops such as rice, corn, wheat and bean, and by supporting the expansion of research and use of biotechnology *Cline (1979).*

Agriculture led export business: ALEB was designed to provide technical assistance and support to Egyptian food processing companies, ancillary service firms, and trade associations. ALEB attempted to capitalize on unexploited export marketing, particularly in the European Union and the Gulf and Middle East, and helped to develop processed food for exports and for producers who sell only domestically.

Agriculture policy reform program: The APRP has helped the Egyptian Government maintain progress on liberalizing agricultural markets and removing policy barriers to private sector participation in agriculture. The government has moved from being the major actor in all realms of economic activity to a role of providing the legal and regulatory framework necessary for the private sector and to the support of market driven trade and investment.

Agribusiness and research linkages: A glink increased the productivity, efficiency and sustainability of large commercial, medium and smallholder clients by providing technical assistance and training in basic technologies such as animal nutrition, health and farm management, trade development, association development and facilitating access to credit.

Agricultural exports and rural income: This program worked to provide flexible and appropriate technical assistance and grants to support agriculture trade associations that are of critical importance for expanding volumes of high quality agriculture products (dairy and fresh or processed horticulture) for export and the domestic market.

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Similarities of agricultural research in Muranga and Egypt

In both Muranga and Egypt, agricultural research is mainly driven by government initiative through flagship government funded agricultural research corporations which are KARI (Kenya Agricultural Research Institute) and NARP (National Agriculture Research Program) in Kenya and Egypt respectively.

In both Muranga and Egypt, the objectives of agricultural research are reduction of poverty through creation of more sustainable agriculture related income activities and for food security.

Both Muranga and Egypt are agriculture oriented economies and are guided by the same philosophy that it is only through agriculture that Africa can pull out of the developing to developed economies.

In both Muranga and Egypt, there have been milestone achievements in technology based agricultural research with the adoption of genetic engineering in both Kenya and Egypt.
Lastly, in both Muranga and Egypt agricultural research includes animal and plant science research.

5.2 Differences of agricultural research between Muranga and Egypt

While agricultural researchers in Egypt focus mostly on drought resistant crop varieties, Muranga's researchers are more inclined towards convectional crop varieties.

Due to the fact that Egypt is mostly a desert with only 1 main river basin, agricultural research has focused more on water conservation methods than in Muranga.

While irrigation is almost fully adopted by the Egyptian rese archers as a farming method, Muranga researchers still focus mostly on rain fed agriculture.

Through ATUT program, Egyptian researchers have created a practical link between laboratory and field scientists and farmers leading to easier agricultural technology adoption which is not clearly the case in Muranga where we have research extension programs conducted by Ministry of Agriculture officials and not necessarily scientists.

While there is a clear linkage between agricultural research and business through AGRILINK program that maps agricultural research towards viable commercial reasons, that is clearly not the case in Muranga where most research works have failed or are yet to produce commercial results.

By increasing agriculture production through research, Egypt is able to feed all its citizens and remain with adequate surplus for trade while in Kenya, millions of people die annually as a result of malnutrition and poverty and the government relies on imports to feed its people.

In Egypt, agricultural research is embraced and practiced adequately well by the leaders and the people (farmers) while in Muranga, agricultural research is purely a scientist affair.

5.3 Why use agricultural research as a tool to fight poverty in Muranga county

This study has clearly shown that agricultural development through research is fundamental for any broad-based economic development in Muranga. Agriculture has been shown to produce more equitable growth in personal income than other forms of development in Muranga and therefore generating and extending research, knowledge and technology, building the human capacity to conduct research and supporting the capacity of institutions to produce creative and productive people is essential to the process.

In summary, Muranga faces a multitude of challenges that will affect how successful development efforts will be. Clearly, agriculture is key to making that development successful.

Successful agricultural research is most directly achieved through investment in human and institutional capacity that will generate the knowledge, technologies and leaders to eradicate famine and food shortages, and build economies that support stable and democratic societies in Africa.

This study shows that agriculture is truly an important engine of growth for Muranga. While its role may vary among countries depending on a diversity of conditions, agriculture is an especially strong force in poverty reduction, because it affects the rural poor who are a large component of the poor of Africa.

Food security is achieved by addressing a wide range of constraints. Some of these constraints are more obvious than others and more amenable to our development approaches. While connection to markets, trade policy and other components of what is termed an "enabling environment" are important elements to national development they will depend on two factors. First and foremost, they depend on well-trained, visionary indigenous people to design, implement and support them. In short, highly educated human capital is essential.

Second, we need to increase agricultural productivity through research. Most of the recent gains in agricultural research in Africa especially by looking at the Egypt case studies have resulted in increased production per unit and not expanding the area of land cultivated. The implications are an increase in per acre production efficiency and a use of less marginal land with a decrease in negative impacts on the natural resource base.

The sustainable way to increase efficiencies is to create Kenyan farmer capacity to generate new technologies; that is build the human capacity and build the institutions that generate that capacity which include the universities and the agricultural research institutes. We need to make such investments. Evidence from Egypt indicates that public investments in agricultural R&D had the highest impact on poverty reduction of development investment. In addition to financial resources, agricultural innovation requires human capital and, therefore, sustaining and improving upon advances in agricultural R&D requires concurrent investments in general education.

The study concludes that Muranga cannot significantly reduce poverty, increase per capita income, and transform into a modern economy without focusing on agricultural research which will in turn reduce poverty and inequality by increased agricultural productivity.

APPENDIX I

Questionnaire

i. This questionnaire is meant to collect the following data: usefulness of agricultural research as a tool for poverty reduction in Muranga, how can agricultural research be used as a mechanism to boost increased food production, what challenges are faced by agricultural research initiatives in Muranga county and what forms of agricultural research methods are suitable for the county.

ii. Gender

a) Male

b) Female

iii. Age Group;

a)18-24

b)25-34

c)35 and Above

iv. Occupation .....

v. Division;

a)Kiharu

b)Kahuro

c)Kangema

d)Mathioya

1. Do you know what is agricultural research?

a)Yes

b)No

2. Do you think that agriculture is the biggest economic activity in the county?

a)Yes

b) No

3. In your opinion can agricultural research be used as a way of increasing food production?

a) Highly Likely

b) Likely

c) Unlikely

d) Highly Unlikely

e) Do not know

If your answer is highly likely, likely, unlikely or highly unlikely give comments

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.....

.....

.....

4. What is your opinion about the agricultural research initiatives in the county?

a) Satisfactory

b) Non-satisfactory

c) Do not know

5. What are the main agricultural research initiatives in the county?

a) Animal Health

b) Fish Genetics

c) Crop Protection/Post Harvest

d) Forestry Research

e) Plant Science

Kindly outline what factors shaped the need for the research initiatives

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6. Are there challenges faced by agricultural research initiatives in the region?

a) Yes

b) No

If yes mention some.....

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7. What is the level of community involvement in agricultural research?

a) Fully Involved

b) Partially Involved

c) Not Involved

8. Other than agricultural research, do you think there are other ways to improve on food production?

a) Yes

b) No

If yes mention some.....

.....

.....

9. Have the above ways/opportunities been exploited?

a)Yes

b) No

10. Give suggestions to improve the current agricultural research methods in the county

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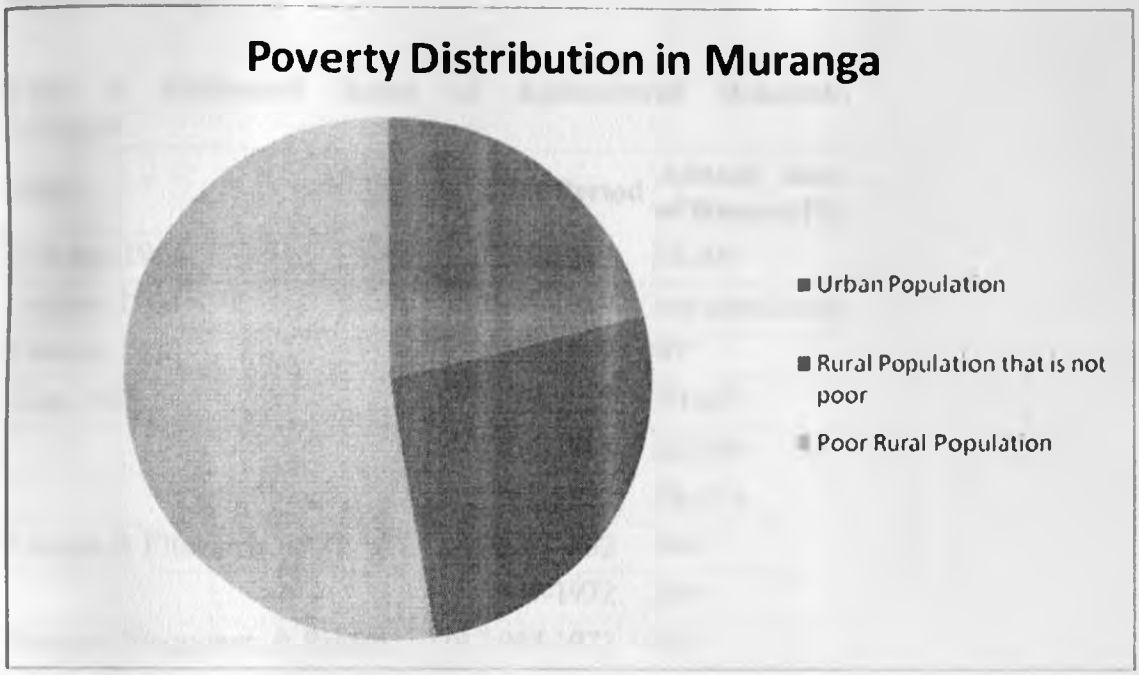
APPENDIX II



Population, total (2008)	**534,087**
Rural population (2008)	**210,724**
Number of rural poor (2008)	**323,363**

APPENDIX III

Table 1: Estimated Rates of Agricultural Research for Egypt

Study	Time Period	Annual Rate of Return(%)
Griliches, 1964	1949-1959	35-45+
Lattimer, 1964	1949-1959	not significant
Evenson, 1968	1949-1959	47
Cline, 1975	1949-1958	39-47+
	1954-1968	32-39+
	1967-1972	28-35+
Peterson & Fitzharris, 1977	1957-1962	49+
	1967-1972	34+
Evenson, Waggoner, & Ruttan, 1979	1948-1971	45+
Davis, 1979	1949-1959	
	1964-1974	
White, Havlicek, & Otto, 1979	1942-1957	48
	1958-1977	42
Lyu, White, Liu, 1984	1949-1981	66
Braha & Tweeten, 1986	1959-1982	47
Huffman & Evenson, 1989	1950-1982	43
Norton & Ortiz, 1992	1987	30

+ Return to research and extension combined.

APPENDIX IV

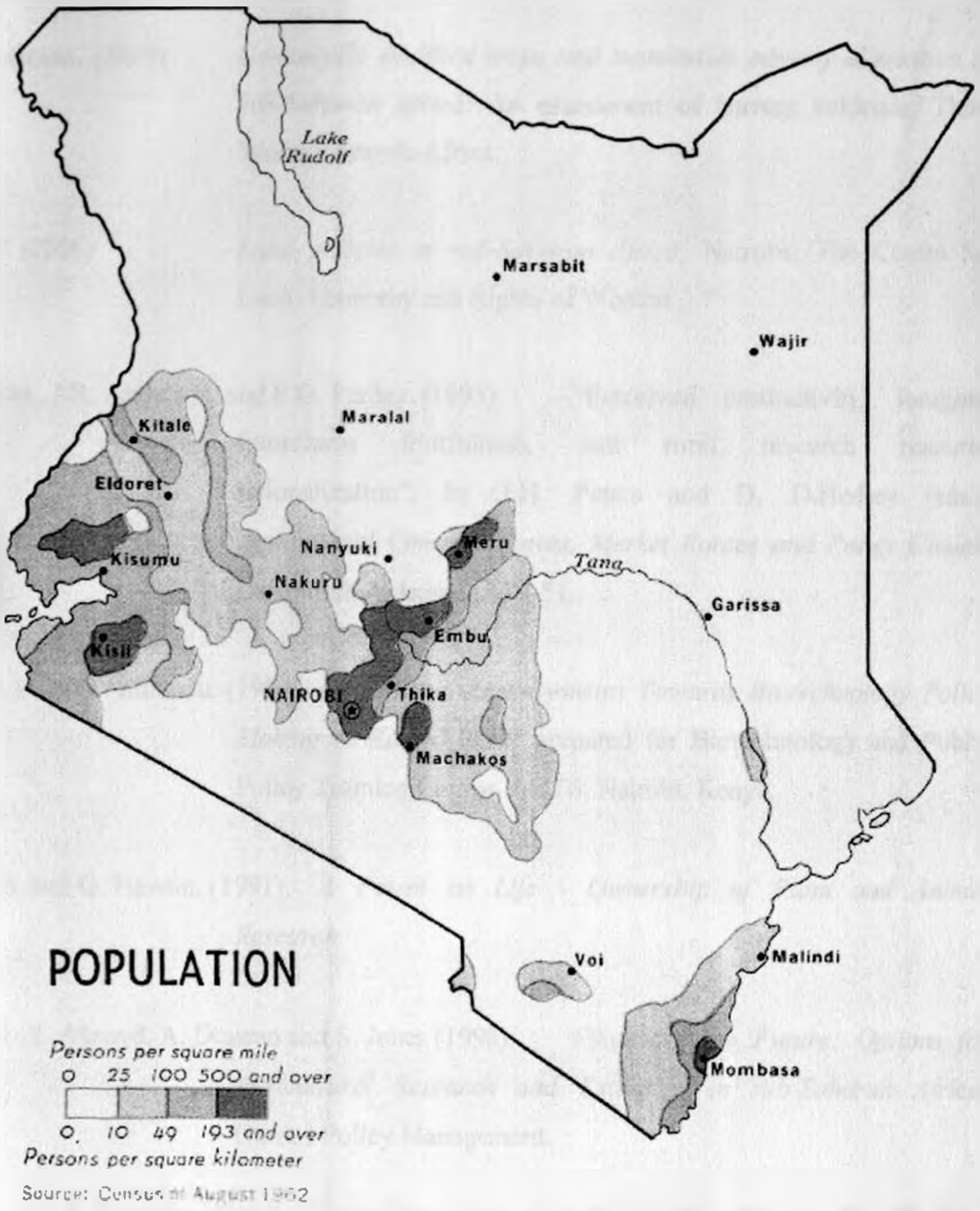


Diagram 2.5.1 illustrates population distribution in Kenya.

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