

**INFLUENCE OF SELECTED FACTORS ON RABBIT PRODUCTION AMONG
SMALLHOLDER FARMERS IN SUBUKIA, NAKURU COUNTY, KENYA**

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**A Thesis Submitted to Graduate School in Partial Fulfillment of the Requirements for
the Award of the Master of Science Degree in Agricultural Extension of Egerton
University**

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DECLARATION AND RECOMMENDATION

Declaration

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

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Recommendation

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DEDICATION

Dedicated to dear wife Wanjiru, and sons, Wambugu, Mwangi, Maina, and Macharia for their support and understanding

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ABSTRACT

The main producers of rabbits in the world are Italy, Russia, Ukraine, France, China, Spain, Southeast Asia, Nigeria, Ghana and Kenya. In Kenya, farmers have made an effort towards food self sufficiency by raising various livestock breeds such as cattle, sheep, goats, pigs and poultry, but the country remains food insecure. Rabbits are nonconventional source of protein and are increasingly being kept in Kenya to enhance household food security and income. However, despite the advantages of rabbit production such as the ease of starting the project compared to other livestock projects, the percentage of farmers who rear rabbits and the rabbit population in Subukia-Sub County is generally unsatisfactory. The factors influencing rabbit production among smallholder farmers in the Sub County are not adequately understood or documented, hence the need for this study which used a cross-sectional design. A sample of 110 smallholder rabbit keepers was selected from population of 250 rabbit farmers. Snowball sampling was used to arrive at the sample size drawn from Subukia, Kabazi and Mbogoini divisions. A semi-structured self-administered questionnaire was used to collect data. Validity of the instrument was ascertained by experts from Department of Agricultural Education and Extension of Egerton University. Reliability was established through a pilot test involving 30 farmers from Bahati Division of Nakuru North Sub-County, and a reliability coefficient of 0.81 α was obtained, which was above the 0.70 threshold for acceptable reliability. Data were analyzed using Chi-square at 0.05 α level of significance set *a priori*. Results indicated that the extent of rabbit production as a household enterprise in Subukia Sub-County was unsatisfactory as indicated by the small number of breeding rabbits kept by the farmers. Four hypotheses were tested by use of Chi-square. The findings indicated that rabbit production was significantly influenced by access to credit, access to extension services, access to market outlets, and access to breeding stock ($p \leq 0.05$). The findings also indicated that the scale of rabbit production, number of animals kept and income generated were low among the farmers. The study recommends that the Ministry of Agriculture, Livestock and Fisheries establishes a policy framework to guide on the training of farmers and extension agents on rabbit production.

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ABBREVIATIONS AND ACRONYMS

AU	African Union
ATC	Agricultural Training Centre
ATPC	African Trade Policy Centre
CTARC	Technical Centre for Agricultural and Rural Cooperation
DGDA	Dalberg Global Development Advisors
DLPO	Sub-County Livestock Production Officer
DRC	Democratic Republic of the Congo
EFSA	European Food Safety Authority
EPC	Export Processing Council
FAO	Food Agriculture Organization of United Nations
GDP	Gross Domestic Product
GoK	Government of Kenya
IFAD	International Fund for Agricultural Development
ILRI	International Livestock Research Institute
KES	Kenya Shillings
MDG	Millennium Development Goal
MoLD	Ministry of Livestock Development
NGOs	Non-Governmental Organizations
PDLP	Provincial Director of Livestock Production
SSA	Sub Saharan Africa
TPB	Theory of Planned Behaviour
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Smallholder livestock keepers represent almost 20 percent of the world population and steward most of the agricultural land in the tropics (McDermott, Staal, Freeman, Herrero & Van de Steeg, 2010). Over 80 percent of the rural poor in Sub Saharan Africa (SSA) partially depend on livestock to sustain their livelihoods (FAO, 2009). Livestock production contributes to poverty reduction in several ways. Livestock are important in asset accumulation and also act as a buffer against economic shocks among farmers. They are a crucial component of risk management strategies at the household level. Livestock and their products are the most important income earner in many smallholder mixed farming systems in SSA. Animals play an important role in nutrient cycling in both the developed and developing world.

Animals are a source of protein in human diets, employment and foreign exchange. They contribute around 12.9 percent of global calories and 27.9 percent of protein through provision of meat (Food and Agricultural Organization (FAO), 2011). Animal protein is critical for the growth, development and maintenance of human life especially because it contains all the essential amino acids needed for this purpose (European Food Safety Authority (EFSA), 2012). Increased livestock production promotes households' access to more animal-derived foods, which are chief sources of zinc, iron, and other minerals as well as of vitamin B12, all essential for children growth and their cognitive development. However, animal protein intake in developing countries is still far below the required standards (Obike & Ibe, 2010). To close up this gap, necessary and practical steps should be taken. One such initiative is the exploitation of rabbit which is unconventional protein source. Naandam, Padi, Bigol and Mensah-Kumi, (2012) reported that rabbits are prolific breeders, and have a faster rate of reproduction than cattle, pigs, goats and sheep.

The main rabbit world producers are Italy, Russia, Ukraine, France, China, Spain, and some areas in Central America, Southeast Asia, particularly Indonesia and some regions of Africa (Lebas, Coudert, Rochambeau & Thébault, 1997). In sub-Saharan Africa, the main producers are Nigeria and Ghana and to a lesser extent the DRC, Cameroon and Benin (Export Processing Council) (EPC), 2012). In developing countries such as Kenya, where enormous meat shortages exist affecting its affordability by the poor population, the potential for rabbit

production is great. However, rabbit production is still in its infancy in the country, in spite of its several attributes over other livestock species that can be exploited to provide the much needed animal proteins using local resources, raise incomes, and improve livelihoods of the rural population (Borter & Mwanza, 2011).

Rabbit production can be a significant subsystem where land is limited and parts of the community, mostly women and children, lack adequate income and nutrition. Rabbits are appropriate for rearing by women, old people and children, and even landless farmers (Wilson, 2012). In the high-rainfall areas, there is immense potential to develop the rabbit industry. In the wake of the deteriorating global economy, the spread of Avian Flu, and the decline of natural resources, the role of the rabbit to provide a steady supply of quality protein and income under sustainable systems that utilize renewable resources at minimal costs, is presently recognized as a major livestock species in many parts of the world.

Rabbits are useful for the poor because they require little start-up capital, are a relatively small financial risk, produce rapid returns on investment and allow for a flexible production process. Rabbits produce white meat that is high in protein, highly palatable and digestible, tender, low in fat and cholesterol. It is easy and cheap to rear rabbits since it has low production costs, easy handling, high growth and fecundity rates (Apata, Koleosho, Apata & Okubanjo, 2012). They also provide a steady source of food, income, generate employment, and are likely to be successful because they are numerous, and are efficient converters of waste vegetables to protein (Wilson, 2012). Other benefits include the use of crop residues as feeds, efficient use of space; easy management, and provide numerous by-products.

Salami, Kamara and Brixiova (2010) reported that the key challenge of the smallholder farmers is low productivity stemming from the lack of access to markets, credit, and technology. Livestock productivity is constrained by several factors, including, limited extension services, limited access to credit, lack of markets, limited application of technology and innovation, and weak policy and legal frameworks (McDermott *et al.*, 2010). According to the GoK (2008), some of the possible drawbacks in rabbit production are inadequate quality-parent stock and limited technical expertise. Other studies identified a number of factors that may influence rabbit production. A study by Kumar, Dogra and Guleria, (2010) found that rabbit production might be affected by financing, marketing and institutional factors. In a similar study by Oseni *et al.*, (2008), the identified factors were lack of

foundation stocks, finances, space, feed, vermin, and theft. Further, Mbutu (2013) identified farmer's attitude as a factor that influences rabbit production and reported that these are not static and can change as a result of social influence. Factors affecting rabbit production may therefore include the following; breeding stock, market, institutional factors such as policy and legal frame works, finances, farmer's attitude, production technology, space, feeds, vermin and theft. In my study area, the factors that are likely to affect rabbit production are; rabbit keeper's personal characteristics, access to credit, extension delivery services, breeding stock and markets.

1.2 Statement of the Problem

The largest producers of rabbits in the world are China, Italy, Spain, and France whereby they account for three quarters of the world production. In Africa, the leading rabbit producing countries are Morocco and Nigeria and these are reported to produce 20000 to 99000 tons meat per year (Moreki, 2007). Rabbit farming is also undertaken in Central America, the USA, Africa, and the Republic of Korea. With an estimated population of about 600,000 rabbits (Mutisya, 2014), Kenya is still in the initial stages of developing a vibrant rabbit sub-sector. Rabbit production enhances household food security and income, contributing to the first Millennium Development Goal of eradicating extreme poverty and hunger. In the past, farmers have made efforts toward food sufficiency by raising various livestock breeds of cattle, sheep, goats, pigs and poultry. Despite these efforts, Kenya remains food insecure. The Kenya Government has encouraged farmers to use rabbits as a source of food. Rabbits do not directly compete with humans for food. In Subukia Sub-County, farmers have started keeping rabbit because of their fast growth rate and high fecundity. Rabbits require low startup capital investment and feed on crop residues. Although rabbit production is easier to start than other livestock projects, the percentage of farmers who rear rabbits and the rabbit numbers in Subukia-Sub County are generally low. The factors responsible for this low level of production are not well understood, hence the need for this study.

1.3 Purpose of the Study

The study sought to determine the influence of five factors on rabbit production in Subukia Sub-County. These factors include: livestock keepers access to credit, extension delivery services, breeding stock, markets and personal characteristics.

1.4 Objectives of the Study

The objectives of the study were to:

- i. Establish the extent of rabbit production among smallholder farmers in Subukia Sub-County.
- ii. Establish how demographic factors influence rabbit production among smallholder farmers in Subukia Sub-County.
- iii. Determine the influence of access to credit on rabbit production among smallholder farmers in Subukia Sub-County.
- iv. Determine the influence of access to extension services on rabbit production among smallholder farmers in Subukia Sub-County.
- v. Determine the influence of access to markets on rabbit production among smallholder farmers in Subukia Sub-County.
- vi. Determine the influence of access to breeding stock on rabbit production among smallholder farmers in Subukia Sub-County.

1.5 Research Questions

The study was guided by the following research questions:

- i. What is the level of rabbit production in Subukia Sub-County?
- ii. How do demographic factors influence rabbit production among smallholder farmers in Subukia Sub-County?

1.6 Hypotheses

The study had four null hypotheses as follows;

- H0₁: Access to credit has no statistically significant influence on rabbit production among smallholder farmers in Subukia Sub-County.
- H0₂: Access to extension services has no statistically significant influence on rabbit production among smallholder farmers in Subukia Sub-County.
- H0₃: Access to market has no statistically significant influence on rabbit production among smallholder farmers in Subukia Sub-County.
- H0₄: Access to breeding stock has no statistically significant influence on rabbit production among smallholder farmers in Subukia Sub-County.

1.6 Significance of the Study

The findings of the study may enable Ministry of Agriculture, Livestock and Fisheries, NGOs, donors and development agencies have a better understanding of factors that influence rabbit production. This would enable them take appropriate intervention measures to improve levels of production among smallholder farmers in Subukia Sub-County leading to improved household food security and livelihoods. This could be achieved through enhanced extension services on rabbit production among other intervention measures. The findings may also form basis for further research on other factors that may influence rabbit production among smallholder farmers in Subukia Sub-County.

1.7 Scope of the Study

This study was carried out among smallholder rabbit farmers in Subukia Sub-County of Nakuru County. The study focused on the influence of the following factors on rabbit production: demographic factors, access to credit, access to extension services, access to market, and access to breeding stock.

1.8 Assumption of the Study

The study assumed that the respondents would be cooperative and would provide accurate and honest responses to the researcher's questions.

1.9 Limitations of the Study

The study had the following limitations:

- i. The respondents included some illiterate farmers. In such cases, the researcher read, interpreted and assisted in filling the questionnaire.
- ii. Due to the purposive and snowballing sampling procedures used in data collection, the findings of the study were only generalized to the smallholder farmers in Subukia Sub-County.

1.10 Definition of Terms

This section outlines the definitions of various terms used in this study.

Access to Breeding Stock - Breeding stock is defined as a pool of animals, often of superior genetic merit which are then bred to produce meat, fur, skins or other end products (Wilson, 2012). In this study, access to breeding stock refers to farmers' ability to obtain purebred rabbits for multiplication.

Access to Credit - refers to the availability of finance, whether from formal and/or informal financial institutions, on the basis of convenience, continuity, flexibility and guaranteed terms as well as willingness to repay at all times, (Manganhele, 2010). In this study, access to credit refers to ability of rabbit farmers to obtain funds from financial institutions, and other sources to finance rabbit farming.

Access to Market - refers to adequate infrastructure, affordable transport cost, adequate market information and subsidies offered by governments in order to improve the ability of farmers to compete in the local, national and international markets (IFAD, 2006). In this study, access to markets referred to the ability of the rabbit farmers to find customers for rabbits and their products. This was determined by the number of rabbits sold.

Agricultural Credit - refers to loans and other types of credit extended for agricultural purposes (Wise, 2012). In this study, agricultural credit refers to any form of credit that rabbit farmers' access for use in their farms as inputs or financial services and was determined by the frequency of loans borrowed.

Agricultural Extension - describes the services that provide rural people with the access to knowledge and information they need to increase productivity and sustainability of their production systems and improve their quality of life and livelihoods which also includes, but is not limited to, the transfer of knowledge generated by agricultural research (Christoplos, 2010). In this study, access to agricultural extension services refers to the farmers' ability to obtain knowledge and information generated by agricultural research and was measured in terms of the number of trainings/farmer-extension worker contact.

Influence –the effect that a thing has on the way something happens (The Macmillan Online Dictionary, 2013). In this study, influence is the positive, negative or non-effect that a specific factor has on rabbit production among smallholder farmers. This was

determined through a relationship study between the selected factors and rabbit production.

Rabbit Production - refers to rabbit farming (Shaeffer, Farm, Kime & Harper, 2008). In this study, it refers to rearing of rabbits and was measured in terms of number of rabbits kept.

Selected Factors – A factor is something that actively contributes to the production of a result (Webster, 2012). For the purpose of this study, selected factors are the few variables of researcher's interest that influenced rabbit production among smallholder farmers, which in this case are access to credit, access to extension services access to market and access to breeding stock.

Smallholder Farmers - refer to their limited resource endowments relative to other farmers. In Kenya, a small holder farmer has an average farm of 0.2 to 3 hectares (GoK, 2010). A smallholder farmer is also referred to as a small scale or peasant farmer (Murphy, 2012). In this study, smallholder farmers have an average farm size of 0.2 to 3 hectares.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter comprises a summary of literature on livestock production. It also includes topics on rabbit production, importance of rabbit production, role of smallholder farmers in rabbit production and factors influencing rabbit production among smallholder farmers in Subukia Sub-County. It finally presents the theoretical and conceptual framework for this study.

2.2 Importance of Livestock Production

Livestock contribute 40 percent of the global value of agricultural output and support the livelihoods and food security of almost a billion people (FAO, 2011b). At the global level, livestock contribute 15 percent of total food energy and 25 percent of dietary protein (FAO, 2010b; 2012c). Proteins from animal sources provide the highest quality rating of food sources (FAO, 2009c; FAO, 2012a). Livestock are one of the few assets owned by poor households and can be crucial in maintaining household survival in times of crisis (Nouala, Pica-Ciamarra, Otte & N'guetta, 2011). In many third world countries, animal production is a multifunctional activity. Apart from being source of food and income, livestock are important asset thus serve as wealth, security for credit and safety net during times of economic shocks (FAO, 2009a). In many African societies, livestock are the basis for traditional social support systems and are essential part of the African way of life.

The incorporation of animal agriculture offers substantial advantages for it allows to increase agricultural yields by means of nutrient recycling and to obtain animal feed from crops by-products. The livestock sector contributes between 20 to 50 percent to agricultural valued added in African countries with a continental average of 26 percent and is expected to become the largest contributor to agriculture as economic development progresses because of a growing demand for high-value food items, including meat (Nouala *et al.*, 2011). Livestock productivity in Sub-Saharan Africa remains low and average yields per animal are lower than those in other developing regions (Mirkena *et al.*, 2010). In Kenya, livestock subsector contributes significantly in food supply and creation of employment in the rural areas. It contributes over 30% of the Agriculture Gross Domestic Product (GDP) and employs more than 50% of the agricultural labour force (KARI, 2012). Lusaka (2010) further reported that

the livestock sub-sector contributes about 10% of GDP and accounts for over 30% of farm gate value of agricultural commodities of which a substantial portion of the income arises from trade both local and international. This subsector also provides raw materials for meat, hides and skins, wool and hair processing industries.

2.3 Importance of Rabbit Production

The domestic rabbit (*Oryctolagus cuniculus*) is a descendent of the European wild rabbit that is a popular game animal and source of food in many countries. Slower reproductive rate of other livestock breeds and the danger from Avian Influenza in poultry justifies rabbit as an alternative animal for source of protein (Plague, 2010). The potential benefit from rabbit production includes, boosting food security, raising farmer's income, creating employment opportunity and producing high quality meat (Mailafia, Onakpa & Owoleke, 2010). The superior nutritional value of rabbit meat is appealing to the changing diet and health concerns of Kenyans where incidence of lifestyle related diseases is on the rise (Borter & Mwanza, 2011). Rabbits produce white meat that is high in protein, highly palatable, low in fat and cholesterol (Hecimovich, 2010; Local Harvest, 2011).

The rabbit, when raised with proper technologies can contribute significantly to improve the diet of low-income rural and urban families, and eventually providing such families with employment and a source of regular income. Rabbit farming is a very suitable small livestock project for rural areas and town suburbs, particularly in developing countries like Kenya where majority of the people are poor. Wilson (2012) reported that small animal production could be an important subsystem where land is scarce and parts of the community, particularly women and children, lack adequate income and nutrition.

In most countries of the world, rabbit production is mainly done by limited-resource farmers who maintain small-scale operations with the aim of producing more meat and income (Lukefahr, 2007; Moreki, Sentle, Chiripasi, Seabo, & Bagwasi, 2010). Rabbits fit well into smallholder farming system since they complement well with crop production. They feed on kitchen wastes and most of the other vegetable materials from the garden. Rabbit urine contains a lot of ammonia and uric acid which can be diluted with water and applied on crops as a fungicide that helps to control most fungal diseases in plants (The Organic Farmer, 2007). The urine also acts a foliar feed due to its high ammonia content. Rabbit droppings are rich in nitrogen and phosphorus thus helps to fertilize the soil. They provide quality pelts

which are used in fur garments industry and making of art crafts thus can create small rural-based industries. Rabbits are also useful in teaching, training, and medical research laboratories.

The continuous rise in the cost of production of sheep, cattle and poultry has implored researchers to explore other less common but potential sources of animal protein to man. With escalating grain prices, rabbits are the most suitable livestock species because of their lower demands on grain as compared to other livestock species (Ruhul, Taleb, & Rahim, 2011). Rabbit production ensures use of cheap local resources to supply animal proteins to rural families. Rabbits provide white meat which is a recommended source of protein for people with Diabetes mellitus, and those with risk of obesity and hypertension due to its low-fat content, less saturated fatty acids and cholesterol when compared to other meats (Maghsoudi, & Azadbakht, 2012). There is also reduced risk of cancer incidences with consumption of white meat (Dutt, Kumar, Bhat, Bhat, & D S'ouza, 2012).

Investment in rabbit production, including breeding stock, can be quite low. Expansion is much simpler than other livestock alternatives because a large range of existing facilities can be modified for rabbits and land requirements are negligible (KenyaPlex.com, 2012). Rabbit, which are mainly kept by people as a source of food and/or as a source of income could bridge the supply-demand protein gap and it is by far the most suitable system for a country to achieve self-sufficiency in meat and also improve their livelihoods (Olagunju & Sanusi, 2010). Dietary diversity has been shown to be linked to household food security and diet quality (Stephenson, Amthor, Mallowa, *et al.*, 2010).

All over the world, there is a renewed interest in rabbit production. It is speculated that reduction in land-size holdings has necessitated farmers to choose livestock enterprises which have low demand on land and feed resources (Borter, 2011). In addition, a rising awareness of the advantages of rabbit production is also likely to contribute to its popularity. These advantages include high prolificacy, early maturity, fast growth rate, high genetic diversity, efficiency in feed conversion and economic utilization of space (Mailafia *et al.*, 2010). Rabbits have limited competition with humans over food sources. They can be fed successfully on leftover vegetables and other foods.

Despite the growing interest, rabbit production in Kenya is still dominated by ultra small and smallholder producers with minimal investment in housing, feeding and other management practices (Borter, 2011). The commercial rearing of rabbits is a relatively new industry in Kenya.

Table 1
Value of Rabbit Meat Export to Sudan (in KES.)

Year	Commodity	Quantity (in Kgs)	Value (in KES.)
2007	Rabbit meat, fresh, chilled or frozen	251	61,644
2008	Rabbit meat, fresh, chilled or frozen	1,722	494,485

Source: EPC, (2014)

As indicated in Table 1, Kenya has only recorded exports of rabbit meat to Sudan over the period 2007 – 2008 with highest export value being Kshs 0.49 million in 2008. This implies that the commercial rearing of rabbit may be confined to the local market and the development of the export of this commodity may be in the infant stages and may develop over time with the necessary interest and acceptable returns on investment in the industry. Probably the most important limitation to the success of rabbit production in developing countries is lack of knowledge on rabbit husbandry (Moreki, *et al.*, 2011).

2.4 Rabbit Production Globally

Rise in world human population has intensified the demand for food including meat (Telemann, MacDevette & Manders, *et al.*, 2009). In 2005, world's production of rabbit meat was estimated to be 1.5 million tons per annum with China, Italy and France being the major producers at 500 680, 225 000 and 87 200 tonnes, respectively (FAO, 2011a). Over 75% of 326 million rabbits reared across European Union countries are farmed in France, Italy and Spain, representing a large and growing industry in these countries. Rabbits are reared in the Mediterranean countries of Northern Africa while in the Sub-Saharan Africa, the two main producers are Nigeria and Ghana and to a lesser extent the DRC, Cameroon, and Benin (EPC, 2014). Morocco and Nigeria are reported to produce 20,000 to 99,000 tons of meat per year (Moreki, 2007). In Sudan, rabbits are kept mainly in the backyards of houses and being reared as small-scale business (Elamin, Elkhairy, Ahmed, Musa & Bakhiet, 2011). A study

by Moreki *et al.*, (2011) reported that rabbit farming in Botswana is in its infancy and the population of farmed rabbits is very small. They further reported that nearly all rabbit farming is at subsistence production. In Uganda, the rabbit population is estimated at 370,000 rabbits where a paltry 1.1 % of households own rabbits (Republic of Uganda, 2009).

2.5 Rabbit Production in Kenya

Rabbit production in Kenya is still in its infancy despite the Governments' effort to promote it. In 1982, Kenya Government in a bilateral agreement with German revamped the industry by rolling out a national program on rabbit production where the National Breeding Station at Ngong and other multiplication centres at Machakos, Embu, Wambugu and Kilifi Agricultural Training Centres (ATCs) were established to supply the breeding stock to rabbit farmers (Mailu, Muhammad, Wanyoike & Mwanza, 2012). Other institutions like Egerton University, Kijabe Mission Center and ILRI also supplied rabbit breeding stock. The Government aimed at eradicating malnutrition and poverty worsened by challenges of diminishing land sizes. The program did not succeed since many Kenyan communities considered rabbit farming an issue of young boys. As a result, rabbit breeding units in Machakos, Embu, Wambugu and Kilifi ATCs were closed down (Borter & Mwanza, 2011). A study by Mutisya (2014) on factors influencing adoption of commercial rabbit production among farmers in Kenya found that the population of farmed rabbits stood at 600,000 in the whole country. In Nakuru County, rabbit production is gaining acceptance among adult farmers though its actual population and distribution has not been determined (PDLP, 2011). Rabbit production in Subukia Sub-County is being carried out by few farmers mainly at subsistence level.

2.6 Role of Smallholder Farmers in Rabbit Production

Globally, most rural poor are smallholder farmers (IFAD, 2011a). They dominate most farming systems of developing countries and account for most food production. Smallholders represent a large number of holdings in many emerging economies and their numbers have increased in the last two decades. Most smallholders have varied sources of livelihood including significant off-farm income, yet are still vulnerable to economic and climatic shocks. Most of the world's 450 million smallholder farmers are found in Africa, Asia, and Latin America (Carroll, Stern, Zook, Funes, Rastegar & Lien, 2012). Smallholder farmers form majority of the two-thirds of population that resides in the rural areas in Sub-Saharan Africa. In Kenya, smallholder production accounts for 75 percent of the total agricultural

output (IFAD, 2011a). They have small farm holdings of an average of 0.2 to 3 hectares (GoK, 2010). In high potential areas with high population densities, they often cultivate less than one hectare of land.

Smallholder agriculture accounts for a large proportion of agricultural production, it is a source of economic activity, and also constitutes an important part of rural culture and social organization. Rural poverty reduction and inequality is linked to smallholder farming because growth in smallholders' incomes reduces rural poverty. Action Aid (2011a) reported that empowering smallholder farmers to produce more food for local consumption and local markets is the best way to economic recovery and resilience from food crisis. The term 'smallholder' refers to their limited resource endowments relative to other farmers in the sector (FAO, 2007; Folkema & Ontaine, 2011; Murungu, 2012).

Livestock production plays a major role in the life of smallholder farmers in developing countries particularly as farmers evolve from subsistence to commercial agriculture (Sugiyama, Iddamalagoda, Oguri & Kamiya, 2003). It provides food, income, employment and many other contributions to rural development. But despite the increasing contribution of the livestock sector, it has not yet achieved the level needed to provide sufficient meat for the growing population. Nutrition is a major constraint to increased livestock productivity since land sizes are constantly decreasing with each new generation inheriting land, making it difficult to keep cattle or larger ruminants in high potential mixed crop-livestock production systems in Kenya (GoK, 2010).

FAO (2009a) noted that all sound alternatives must be considered and appraised in order to increase food production in developing countries. Amongst these is the use of livestock species whose poverty alleviation potential has not been fully exploited such as rabbits (Moreki & Seabo, 2011). Rabbit meat consumption is much easier to develop where people are already used to eating widely different kinds of meat, as from hunting as would be generally true of Sub-Saharan Africa (FAO, 1997). Thus, there is enormous potential for increasing productivity for smallholder farmers with diversification through rabbit production. Rabbits will produce 6 pounds of meat on the same feed and water as a cow will produce 1 pound of meat on the same feed and water (EPC, 2014). Borter (2011) noted that rabbit production is one of the fastest growing livestock enterprises in Kenya.

2.7 Factors Influencing Rabbit Production

There are a number of factors that influence rabbit production. A study by Kumar, Dogra and Guleria,(2010) found several factors that may affect rabbit production key among them being financial, marketing and institutional constraints. In similar studies by Oseni *et al.*, (2008), and Sanusi (2010), the identified factors were lack of foundation stocks, finances, space, feed, vermin, and theft. A study by Moreki *et al.*, (2011) reported that a number of factors including religious taboos and lack of knowledge on rabbit husbandry affect rabbit production. A study by Mbutu, (2013) pointed out that farmer's attitude also influences agricultural production. Attitude can change as a result of social influence since it is very dynamic. All these studies seem to have a congruent on major factors that are likely to influence rabbit production. This study therefore focused on demographic factors (age, gender, marital status and education), access to credit, access to extension services, access to market and access to breeding stock. These factors are discussed below:

2.7.1 Demographic Factors

Demographic factors are human characteristics associated with gender, age, education and marital status.

Gender

Women are major contributors in the agricultural economy. Of the 600 million poor livestock keepers, two- thirds are women (Njuki & Sanginga, 2013). They face various constraints that limit them from achieving optimal livestock production. These constraints include limited access to credit, technology, and market information and prices. Women are also less likely than men to be served by formal financial institutions (Njuki & Sanginga, 2013). Women are more likely to own, and therefore benefit more from small livestock rather than larger animals that are commonly owned by men. Livestock development programmes offer an opportunity to reduce gender disparities, especially in ownership of assets and market participation. Blaai (2009) notes that women receive limited training while their developmental responsibilities demand more skills and more extension services. It was postulated that gender would influence rabbit production in Subukia Sub County.

Age

A study by Baiyegunhi (2009) showed that age of the household head, is an important factor considered in determining the creditworthiness of a household. The study further showed that

younger household heads who own any kind of collateral security are less constrained in credit access. A study by Ogunniyi, Adepoju, Olagunju, Ojedokun, and Ganiyu (2014) found that older farmers tend to be more economically efficient than younger farmers. Asiedu-Darko, (2014) found that age influences farmers' decision on farming methods. Age could be an indicator of length of experience of the farmer in farming. Older farmers could easily be able to select type of farming business since they have had long experience with farming of various crops and livestock. According to Umar, Musa, and Kamsang, (2014), older farmers with accumulated years of experience may be able to select farming enterprises that are most suitable to their fragile environment. This study hypothesized that age would influence rabbit production in Subukia Sub County.

Education

Education is an enlightening experience. The purpose of education (formal and informal) as stated by Rad, Ates, Delioglan, Polatoz, and Ozcomlekci, (2009) is to communicate accumulated wisdom and knowledge from one generation to the next. Education also boosts participation in innovation and the development of new knowledge. The level of education influences farmers' decision on farming methods (Asiedu-Darko, 2014). Education has a positive relationship with agricultural development. Educated farmers are able to understand written information on new and improved animal breeds and crop varieties. According to Koskei R., Langat, Koskei C., and Oyugi (2013), access to basic education increases the likelihood to access and utilize agricultural information. Education enhances farmer's ability to decode extension messages and use that information to increase production. Amaza, Abdoulaye, Kwaghe, and Tegbaru, (2009) also cited that education increases agricultural productivity and improves the livelihood of farmers. In this study, it was hypothesized that education would influence rabbit production in Subukia Sub County.

Marital Status

According to Olusanya, Fabusoro, and Talabi (2014), married farmers take up agricultural production more seriously than their unmarried colleagues since they have more responsibilities of providing for their families. Ogunniyi, Adepoju, Olagunju, Ojedokun, and Ganiyu (2014) found that married people are more involved in livestock production in order to earn more income to cater for their families. A study by Umar, Musa, and Kamsang (2014) reported that married farmers have more responsibilities to shoulder in terms of meeting the basic needs of their family members and thus could easily engage in a farming enterprise that

has promising returns. They further noted that family labour would be more available where the farmers are married. This study postulated that marital status would influence rabbit production in Subukia Sub County.

2.7.2 Access to Agricultural Credit

Adequate access to credit for farmers is crucial for sustainable agricultural production. Rota, Calvosa, Rispoli, and Anderson (2009) noted that improving the access of the rural poor to relevant financial services is a vital tool in poverty alleviation and sustainable rural development. The provision of credit is important in raising the incomes of smallholder farmers, mainly by mobilizing resources for more productive uses. Carroll *et al.*, (2012) found that smallholder production is characterized by little access to finance. Anyiro and Oriaku (2011) further found that the chances of a smallholder farmer taking agricultural credit decreases with advancement in age, level of formal education and reduction in farm size.

Formal credit is used far less often for the acquisition of efficiency-improving inputs for livestock development when compared to crop farming (Rota *et al.*, 2009). Access to agricultural credit enhances the ability of farmers to access breeding stock and inputs. Sebopetji and Belete (2009) reported that access to affordable credit by smallholder farmers remains the major problem affecting their production capacity and level. Low prices for products in the markets limit farmers' ability to get ahead without credit. A study by Moreki and Seabo, (2012) noted that rabbit farming could not easily attract funding compared to other livestock species since it was relatively new in Botswana. In this study, it was hypothesized that access to agricultural credit influences rabbit production among smallholder farmers.

2.7.3 Access to Extension Services

Extension is a non-formal education that aims at helping rural people to improve their livelihoods by gaining useful knowledge and skills. Christoplos (2010) has defined extension as systems that facilitate the access of farmers, their organizations and other market actors to knowledge, information and technologies; facilitate their interaction with partners in research, education, agribusiness, and other relevant institutions; and assist them to develop their own technical, organizational and management. Effective extension involves adequate and timely

access by farmers to relevant advice, with appropriate incentive to adopt the new technology if it suits their socioeconomic and agro-ecological circumstances (Anderson & Feder, 2004).

Agricultural extension provides farmers with the access to knowledge and information needed to enhance productivity and sustainability of their production systems. Farmers get advice and training which enable them to use new inputs and methods to farm more productively (Action Aid, 2011b). In developing countries, extension has been treated seriously by agricultural researchers in spite of evidence that the otherwise excellent technologies never reach the farmers if extension is weak. Extension acts as a bridge between research and farmers. Smallholder farmers in developing countries, especially the resource poor do not receive adequate extension and advisory services (Moreki, *et al.*, 2011; Technical Centre for Agricultural and Rural Cooperation (TCARC), 2011). In this study, it was hypothesized that access to extension services among smallholder farmers influences rabbit production

2.7.4 Access to Market

Market access is a necessary condition for agricultural and rural development in Africa. Improved access to markets is a key precondition for the transformation of the agricultural sector from subsistence to commercial production (Salami *et al.*, 2010). For most agricultural products, however, market access is a major constraint that restricts rural development in Africa (Hammouda, Karingi, Oulmane, Lang & Jallab, 2006; UNDP, 2012). Farmers residing in the more remote rural areas are largely cut off from accessing markets and other services, with obviously adverse implications for farm productivity, growth and poverty reduction (Chamberlin & Jayne, 2009).

Access to remunerative and reliable produce markets can enable farming households to commercialize their production systems and increase their farm incomes (IFAD, 2011a). Mailafia *et al.*, (2010) noted that the single most important step before building a rabbitry or beginning commercial rabbit production is to develop a market for the rabbits. They further reported that rabbit producers in most cases must develop their own markets. According to IFAD, (2011a), only a limited number of crop and animal products are produced for the market despite the varieties of crops and livestock that have evolved over time in Africa. IFAD (2003) reported that assisting rural poor people in improving their access to markets must be a critical element of any strategy to enable them to enhance their food security and

increase their income. In this study, it was hypothesized that access to markets for rabbits and their products influences rabbit production among smallholder farmers.

2.7.5 Access to Breeding Stock

Low genetic potential in livestock production is a serious constraint in emerging economies. Yisehak (2008) identified the high cost of exotic breeds as one of the constraints to livestock productivity among smallholder farmers in developing countries. Exotic breeds of rabbit have been introduced into many third world countries. The most common of exotic breeds are the Californian, the Chinchilla, the Flemish Giant and the New Zealand White. Breeds are selected based on the purpose; either for meat, fur or leather. Rabbit best suited in size and conformation for producing meat are the medium-sized breeds and this makes the New Zealand and Californians very popular (Travis, Aulerich, Ryland & Gorham, 2012).

The sustainability of small livestock production largely depends on the availability of breeding stock (Wilson, 2012). Waddill (1990) reported that success in rabbit production starts with quality purebred stock. In Kenya, the current demand among farmers for quality breeding stock may be great. Eady (2001) also noted that the scarcity of animals pushes the industry into a speculative stage where cost of breeding stock escalates as those investing considerable capital to import animals, seek to maximize returns. Thus, new livestock industries are often faced with the challenge of inadequate breeding stock. In this study, it was hypothesized that access to quality breeding stock influences rabbit production among smallholder farmers.

2.8 Theoretical Framework

This study was based on the Theory of Planned Behaviour (TPB) as postulated by Ajzen (1991). The theory explains that people perform certain actions because they form an intention to carry out the action. Intentions are influenced by the person's beliefs, social pressure to conform to the wishes of others, and perceived ability to carry out the action.

This theory postulates three conceptually independent determinants of intention. The first is the attitude toward the behavior and refers to the degree to which a person has a favorable or unfavorable evaluation or appraisal of the behavior in question. The second predictor is a social factor termed subjective norm; it refers to the perceived social pressure to perform or not to perform the behavior. The third antecedent of intention is the degree of perceived

behavioral control which refers to the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles. As a general rule, the more favorable the attitude and subjective norm with respect to a behavior, and the greater the perceived behavioral control, the stronger should be an individual's intention to perform the behavior under consideration.

The theory deals with the antecedents of attitudes, subjective norms, and perceived behavioral control, antecedents which in the final analysis determine intentions and actions. The theory postulates that behavior is a function of salient information, or beliefs, relevant to the behavior. People can hold a great many beliefs about any given behavior, but they can attend to only a relatively small number at any given moment. It is these *salient* beliefs that are considered to be the prevailing determinants of a person's intentions and actions.

Three kinds of salient beliefs are distinguished: behavioral beliefs which are assumed to influence attitudes toward the behavior, normative beliefs which constitute the underlying determinants of subjective norms, and control beliefs which provide the basis for perceptions of behavioral control. Each belief links the behavior to a certain outcome, or to some other attribute such as the cost incurred by performing the behavior. Since the attributes that come to be linked to the behavior are already valued positively or negatively, an attitude towards the behavior is automatically acquired. Behaviors believed to have largely desirable consequences are favoured and form unfavorable attitudes toward behaviors associated with undesirable consequences. Normative beliefs are concerned with the likelihood that important referent individuals or groups approve or disapprove of performing a given behavior.

Among the beliefs that ultimately determine intention and action there is, according to the theory of planned behavior, a set that deals with the presence or absence of requisite resources and opportunities. These control beliefs may be based in part on past experience with the behavior, but they will usually also be influenced by second-hand information about the behavior, by the experiences of acquaintances and friends, and by other factors that increase or reduce the perceived difficulty of performing the behavior in question. The more resources and opportunities individuals believe they possess, and the fewer obstacles or impediments they anticipate, the greater should be their perceived control over the behavior. Thus, just as beliefs concerning consequences of a behavior are viewed as determining attitudes toward the behavior, and normative beliefs are viewed as determining subjective

norms, so beliefs about resources and opportunities are viewed as underlying perceived behavioral control.

A farmer will engage in rabbit production if he/she finds the venture profitable and worth investing the resources and time in it. The other factors to consider are the acceptance of the enterprise by people who are close to him/her including the immediate family members. Thus, any enterprise has to be in harmony with the socio-cultural set up of the community. The farmers' intentions to keep rabbits are also informed by the knowledge he/she possesses on the said enterprise. A farmer carries out the cost-benefit analysis in relation to the acceptance of the enterprise by the neighbors. If he is positive on the enterprise, then he is likely to participate in rabbit production.

2.9 Conceptual Framework

The dependent variable in this study was rabbit production and was measured by the number of rabbits kept and the monthly income from rabbits. Rabbit production is influenced by several factors (the independent variables) which in this study were demographic factors (age, education, gender and marital status), access to credit, access to extension services, access to markets and access to breeding stock. Indices of access to each of the variables were developed from the items that captured information on a particular variable. Cross tabulation was used to compare the index of access to each variable with level of rabbit production and Chi-square tests used to test the relationship between the independent and dependent variables.

The relationship between the dependent and independent variables was likely to be influenced by intervening variables. An intervening variable is a factor mediating the relationship between dependent and independent variables (Chandler & Munday, 2012). In this study, the intervening variable was the farming experience of the rabbit farmers. This was built into the study so that its effect could be determined. The study was conceptualized as indicated in Figure 1.

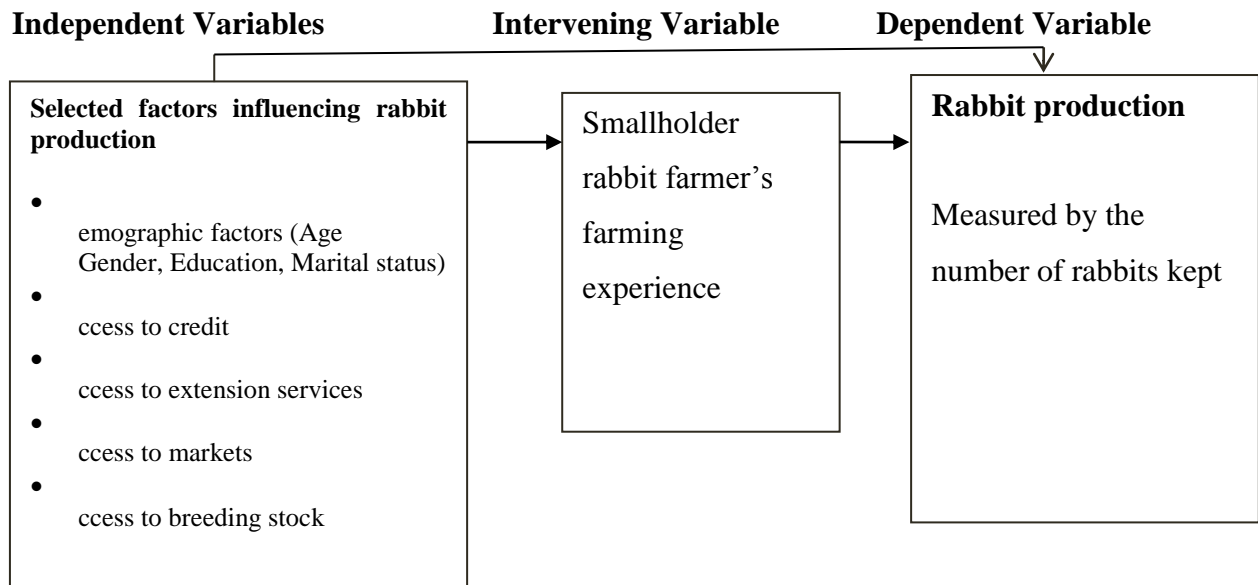


Figure 1. Factors influencing rabbit production among smallholder farmers in Subukia Sub-County

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research design and procedures that were used to carry out this study. It gives an overview of the research design, location of the study, the target population, sampling procedure and sample size, as well as the tools and procedures that were used in data collection and analysis.

3.2 Research Design

The study adopted a cross-sectional research design. Cross-sectional studies obtain data on several variables from a given population or a sample of the population at a single point in time (Bowling & Ebrahim, 2005). They are perfect for assessing or describing current situations making it possible to study self-reported facts about the respondents, their feelings, opinions, attitudes and beliefs (Kendall, 2007; Kumar, 2005). Cross-sectional design is economical and takes a short duration in comparison to other designs (Oslo & Onen, 2011). The design enabled the researcher to gather detailed information that describes the influence of selected factors on rabbit production among smallholder farmers in Subukia Sub-County.

3.3 Location of the Study

The study was conducted in Subukia Sub-County of Nakuru County which lies within the Great Rift Valley. The Sub-County covers an area of 424.2km² with 18,409 households. It borders Bahati North Sub-County to the West, Nyahururu Sub-County to the East, Rongai Sub-County to the North, and Nyandarua West Sub-County to the South. The Sub-County has three divisions namely; Subukia, Kabazi and Mbogoini. The soil types are clay-loam. The rainfall received is approximately 1200 mm per year. There are two rainy seasons with long rains received between March and June while short rains fall between October and November. This area was chosen for the study because farmers had recently shown interest in rabbit farming.

3.4 Target Population

The study was targeted at smallholder rabbit farmers in Subukia Sub-County. The Sub-County has a population of approximately 124,000 with 18,409 households. Majority (15,126) of households engaged in farming of both crops and livestock. Females constituted

51.4 percent and males 48.6 percent with density of 43.4 persons /km². The literacy levels stood at 65 percent who practice both livestock and crop production (DLPO, 2012). The target population consisted of 250 smallholder rabbit farmers.

3.5 Sampling Procedure and Sample Size

Purposive sampling was first used to identify 10 initial rabbit farmers in the three divisions of Subukia Sub-County, who formed part of the sample. Snowball sampling was then applied using the purposively identified cases to identify more rabbit farmers until the desired sample size was attained. The sample distribution was 37 respondents each for Subukia and Kabazi divisions and 36 for Mbogoini Division. Kothari (2008) reported that this procedure is much less complicated, time saving and inexpensive. This method is useful when the population that possesses the characteristics under study is not well known and there is need to find subjects. Kathuri and Pals (1993) recommend a minimum sample size of 100 for a survey research. The sample was increased by 10 % to 110 to compensate for attrition and respondents' refusal or inability to participate, as recommended by Balian (1988).

3.6 Instrumentation

The researcher collected primary data using a self-administered semi-structured questionnaire (Appendix A). The questionnaire had six sections, A-F. Section A contained items that captured the demographic information of the respondent. Items in section B captured information on the level of rabbit production. Section C contained items that captured information on the influence of access to credit on rabbit production. Sections D, E and F contained items that captured information on the influence of access to extension services, access to market, and access to breeding stock on rabbit production respectively.

3.6.1 Validity

Validity indicates the degree to which an instrument measures what it is supposed to measure (Kothari, 2008). According to Gall, Borg and Gall (1996) validation of an instrument is improved through expert judgment. Content validity refers to whether an instrument provides adequate coverage of a topic. Thus, the focus was on face and content validity. To ensure that the instrument accurately measured the variables of interest to the study, each of the items in the questionnaire was discussed with the supervisors from the Department of Agricultural Education and Extension, to ascertain the questionnaires face and content validity. Attention

was given to how each of the specific study objectives was captured in the questionnaire and modifications made accordingly.

3.6.2 Reliability

A measuring instrument is reliable if it provides consistent results (Kothari, 2008). To ensure consistency of the questionnaire, the instrument was pilot-tested in Bahati Division of Nakuru North Sub-County with 30 rabbit farmers who had similar characteristics with the farmers in the study. According to Kathuri and Pals (1993), a minimum sample of 30 is recommended to ensure effective statistical analysis. The reliability of the instrument was estimated using Cronbach's Alpha Coefficient which is a measure of internal consistency. The minimum acceptable reliability was set at 0.70α . Adjustments were made accordingly to improve the instrument and hence a co-efficient of 0.81α was achieved.

3.7 Data Collection

A research permit was obtained from the National Commission for Science, Technology and Innovation in the Ministry of Education, Science and Technology, Nairobi, through the Egerton University Graduate School. Official request to undertake the study and to access the information from the farmers in their respective divisions was sought from Subukia Sub-County Livestock Production Office. To make the exercise easier, faster and more efficient, the researcher contacted potential respondents through their respective division officers to work out logistics for meeting the respondents. The researcher then explained the purpose of the study and gave clear instructions before administering the questionnaire. The researcher was also available throughout the exercise to explain to the respondents any issues that bothered them. For the farmers who were unable to read and write, the researcher administered the questionnaire in the form of an interview and filled in the information himself.

3.8 Data Analysis

The responses from the farmers were checked for accuracy, coded, and then entered into the computer and analyzed using the Statistical Package for the Social Sciences (SPSS version 20). The research questions were analyzed through frequencies and percentages. The descriptive statistics were used to summarize and present the data in a narrative, graphical and tabular form, while inferential statistics were used to test for relationships between the variables. The Chi-square statistical tests at 95 % level of confidence were used to determine

the influence of selected factors (independent variables) on rabbit production (dependent variable) among smallholder farmers. The summary of the data analysis is given in Table 2.

Table 2
Summary of Data Analysis

Hypotheses	Independent Variable	Dependent Variable	Statistical test(s)
H0 ₁ : Access to credit has no statistically significant influence on rabbit production among smallholder farmers in Subukia Sub-County	Access to credit	Rabbit production <ul style="list-style-type: none"> • Measured in number of rabbits kept by farmers 	Chi-square
H0 ₂ : Access to extension services has no statistically significant influence on rabbit production among smallholder farmers in Subukia Sub-County	Access to extension services	Rabbit production <ul style="list-style-type: none"> • Measured in number of rabbits kept by farmers 	Chi-square
H0 ₃ : Access to markets has no statistically significant influence on rabbit production among smallholder farmers in Subukia Sub-County	Access to market	Rabbit production <ul style="list-style-type: none"> • Measured in number of rabbits kept by farmers 	Chi-square
H0 ₄ : Access to breeding stock has no statistically significant influence on rabbit production among smallholder farmers in Subukia Sub-County	Access to breeding stock	Rabbit production <ul style="list-style-type: none"> • Measured in number of rabbits kept by farmers 	Chi-square

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Introduction

This chapter presents the results and discussion based on the objectives, research questions and hypotheses. The aspects analyzed and discussed include characteristics of the farmers keeping rabbits, extent of rabbit production in Subukia Sub-County, influence of access to credit on rabbit production, influence of access to extension service on rabbit production, influence of access to markets on rabbit production, and influence of access to breeding stock on rabbit production, among others.

4.2 Respondents' Personal Characteristics

The respondents were asked to provide information about their personal characteristics which included; gender, age, level of education and marital status, and the findings were as follows:

4.2.1 Gender

Male farmers in the study area were 51.8%. This indicates that there was gender parity in rabbit production in the study area. The results contradict the findings by Baruwa (2014) that rabbit enterprise is male dominated in Osun State, Nigeria. He further observed that the low women participation in rabbit production could have been due to involvement in the household chores that probably took most of their time. Oluka *et al.*, (n.d) concluded that small stocks are suited to the resource-poor smallholder system due to their high growth and reproductive rates and adaptive characteristics to variety of feeds and diseases tolerance. The results imply that rabbit production offers an opportunity to reduce gender disparities in incomes and wealth creation.

4.2.2 Age

Majority of the rabbit farmers (30%) were in the 28 to 37 years age category, followed by the 38 to 47 years age category (27.3%), then the 48 to 57 (16.4%), the 58 to 67 years (7.3%), and finally the 18 to 27 years category (5.5%) as shown in Table 3.

Table 3
Respondents' Age Categories (n=110)

Age categories (years)	Frequency	Percentage
18-27	15	13.6
28-37	33	30.0
38-47	30	27.3
48-57	18	16.4
58-67	8	7.3
≥68	6	5.5
Total	110	100.0

Source: Survey Data, 2013

The results concur with Olagunju and Sanusi (2010) who found that the mean age of rabbit farmers in Nigeria was 34 years. Oseni, Ajayi, Komolafe, Siyanbola, Ishola, Madamidola (2008) also found that the highest proportion (34%) of rabbit farmers belong to the age category of 30-50 years. The results imply that young farmers have been attracted into rabbit farming. The ageing farmers are being replaced by the more productive middle aged farmers. The middle age category also implies that these are the heads of the households with young families, versatile and in need of diverse sources of protein and income. In contrast, Hungu, Gathumbi, Maingi and Ng'ang'a (2013) found that majority of rabbit farmers (45%) in Kenya are aged 50 years and above, which is a likely indicator that interest in rabbit husbandry among adults has increased in recent years. This implies that rabbit farming can be carried out by both the young and the aged since it is an enterprise that is not laborious.

4.2.3 Education Level

The respondents who had attained primary level of education were 38.2 percent, 15.5 percent had no-formal education, 32.7 percent had attained secondary education, 8.2 percent had attained certificate education while only 4.5 percent and 0.9 percent had diploma and university education respectively as indicated in Table 4

Table 4
Respondents' Highest Level of Education (n=110)

Level of education	Frequency	Percentage
No formal education	17	15.5
Primary	42	38.2
Secondary	36	32.7
Certificate	9	8.2
Diploma	5	4.5
University	1	0.9
Total	110	100.0

Source: Survey Data, 2013

The results agree with the findings of Olagunju and Sanusi (2010) who found that the average number of years spent in school by the rabbit farmers in Nigeria was 12 years, a period enough for completion of both primary and secondary school education. This implies that these categories of farmers are likely to be more flexible than those without education and will take up rabbit farming as one of the emerging livestock enterprises being promoted by the Kenyan Government. However, farmers with post secondary education who raise rabbits are fewer which imply that these farmers are likely to have other off- farm sources of income. This implies that rabbit can be considered a small livestock breed which is likely to create employment to the poor segment of the population.

4.2.4 Respondents' Marital Status

Majority of the rabbit farmers (76.4 %) were married, while 10.9 percent were single, 8.2 percent were widowed, 2.9 percent were divorced and 0.9 percent was separated as indicated in Table 5.

Table 5
Marital Status of the Respondents (n=110)

Category	Frequency	Percent
Single	12	10.9
Married	84	76.4
Widowed	8	7.3
Divorced	4	3.6
Separated	1	0.9
Total	110	100.0

Source: Survey Data, 2013

The results agree with Dairo, Abi and Oluwatusin (2012) that rabbit farming can effectively engage different categories of family status for economic benefits if given policy direction, focus and promotions. Oseni *et al.*, (2008) found that among majority (61%) of rabbit farmers, all members of the family provide labour. This implies that married farmers are more likely to practice rabbit production than their counterparts since there could be more labour provision. Married farmers also have more obligations of providing food and income for their families which could be partly met through rabbit production.

4.3 Descriptive Findings of the Study

This section discusses the findings based on the six objectives that guided the study.

4.3.1 The Extent of Rabbit Production in Subukia Sub-County

This section describes the extent of rabbit production in Subukia Sub-County. The main aspects that were covered in this study included; the scale of the enterprise, the amount of rabbit income generated, and rabbit income in relation to total income.

Scale of the Enterprise

Rabbit production in Subukia Sub-County was assessed based on the size of the enterprise at the household level. The variable was operationalized as the number of rabbits that were being kept by the households. The rabbit farmers were asked to state the number of rabbits that they kept in their system. The reported numbers were then placed into four categories related to the level of production: low level with less than 6 animals, moderate level with between 6 and 15 animals, high level with between 16 and 50 animals, and very high level

with above 51 animals. The descriptive statistics of the number of rabbits kept by the households is given in Table 6.

Table 6

The Level of Rabbit Production (n=110)

Scale of Production	Frequency	Percent
Low level of production	83	75.5
Moderate level of production	20	18.2
High level of production	4	3.6
Very high level of production	3	2.7
Total	110	100.0

Mean 8.5 ± 0.882, Std. dev. 9.2, median 5, mode 2, minimum 2, maximum 52

Source: Survey Data, 2013

The average number of rabbits kept by the households in the study area was nine, with a mode of two, minimum of two and a maximum number of 52.

The majority of the households' level of rabbit production (75.5 %) could be termed as low level, which was followed by the moderate level (18.2 %), the high level (3.6 %) and finally the very high level (2.7 %). This finding agrees with Oseni, *et al.*, (2008) that smallholder farmers with less than 10 breeding does in Southwestern Nigeria constituted 80% of all the rabbit farmers, medium units (>10 does and ≤50 does) was 15% while large holder units (>50 does) was 5%. The study by Ozor and Madukwe (2005) further revealed that majority of the rabbit producers in Nigeria kept 1 – 5 rabbits. Lukefahr (2007) reported that the rabbit industry in the developing world is dominated by small scale units.

Farmers with low production (75%) were more than the medium (18.2%) and the high producing farmers (3.6%). The results concur with Oseni *et al.*, (2008) that small family rabbitries averaging four does or less, based on local resources for feeding and housing is the usual pattern in many parts of the developing countries. Galal and Khalil (n.d) also found that an estimated 88-90% of rabbit population in Egypt is in the hands of smallholders while the rest belongs to the commercial sector. They further reported that rabbits are mainly bred

by families as backyard farming where small breeding units are conveniently set up, both in villages and towns. The implication of low production of rabbits was that farmers would rarely make any significant income and productivity.

Amount of Income Generated from Rabbit Production

The second factor used to describe the extent of rabbit production in Subukia Sub-County was the amount of monthly income generated from the enterprise by the households. The farmers were asked to give the average amount of money they received per month from the sales of rabbits. The findings showed that the average monthly income received by the rabbit farmers in Subukia Sub-County was KES 208.18 ± 39.10. A large variation in the income received existed as was shown by the high standard deviation of KES 410.10. The minimum income was KES 0 and the maximum income was KES 2,500. This implied that some rabbits were not sold but probably consumed by the households.

Comparison of Income from Rabbit Production and Other Household Farm Income

The average amount of income generated by the farmers in farm ventures was compared with that which was received from rabbit enterprise. The aim of this comparison was to see the importance of rabbit production in relation to the total farm income generating activities in the households of farmers in Subukia Sub-County. The average monthly income from rabbit enterprise was found to be KES 208.18 while the total household farm income was KES 5065.45. The results were as shown in Table 7.

Table 7

Monthly Income from Rabbit and Other Farm Enterprises

	Average Monthly Income from Rabbit Enterprise (KES)	Average Monthly Household Farm Income from other Enterprises (KES)
Mean	208.18	5065.45
Mode	0.00	2000.00
Minimum	0.00	300.00
Maximum	2500.00	21500.00

Source: Survey Data, 2013

While the mean earnings of rabbit farmers were KES 208.18, the mode was zero and the maximum KES 2500. The paired *t* test was used to compare the two means and the result of the comparison is given in Table 8.

Table 8

Comparison of Income from Rabbit and Other Farm Enterprises Using the T-Test

Mean	means	<i>t</i> -test	r
Mean of monthly income from rabbit production	208.18	12.355*	0.418*
Mean of monthly income from all farm income generating activities	5065.45		

Chi square=751.251, df. =360, P-value .000.

Source: Survey Data, 2013

The mean comparisons revealed that the income from other household income generating activities was significantly higher ($p = .000$) than the income from rabbit production. Thus, the monthly contribution of rabbit production to the household income is minimal and this was due to the low level of production which was at the mode of two rabbits per farmer as shown in Table 8. Oseni *et al.*, (2008) found a dominance of small- and ultra-smallholder rabbit production units in developing countries such as Nigeria.

Purpose for Starting the Rabbit Enterprise

Farmers gave various reasons for starting the rabbit enterprise. The frequency distributions of reasons for starting the enterprise are given in Table 9.

Table 9

Purpose for Starting the Rabbit Enterprise (n=110)

Reason	Frequency	Percent
Sale of breeding animals	90	81.8
Sale of meat to hotels and other consumers	78	70.9
Home consumption	51	46.4
Sale of by-products (manure, skins)	12	10.9
Sale of animals and meat to export market	1	0.9

Source: Survey Data, 2013

Majority of the farmers (81.8%) started rabbit enterprise with an intention of selling to other farmers as a source of breeding stock while 70.9% intended to sell rabbit meat to hotels and other consumers. Farmers who kept rabbits for home consumption were 46.4%, those who intended to sell the byproducts (manure, skins) were 10.9% and a paltry 0.9% targeted export market for both live animals and meat. The findings contradict Oseni *et al.*, (2008) who found that the primary reason for keeping rabbits by majority of the farmers (60%) in Southwestern Nigeria was for family consumption, with occasional sales for excess rabbits. However, a more recent study in the same region by Dairo *et al.*, (2012) found that majority of the farmers (66.7 %) keep rabbits for sale. Hungu *et al.*, (2013) in a similar study found that majority of farmers (31%) in Central, Nairobi and Rift Valley areas of Kenya kept rabbits for food and breeding. This implies that rabbit farming is likely to be a good source of supplemental protein to the household and also provide employment to the breeder farmers particularly with aggressive promotional campaigns.

Figure 2 shows Venn diagrams showing the point of intersections on response of purpose for starting the rabbit enterprise. The intersections show that one farmer selected all the alternative reasons for starting the enterprise.

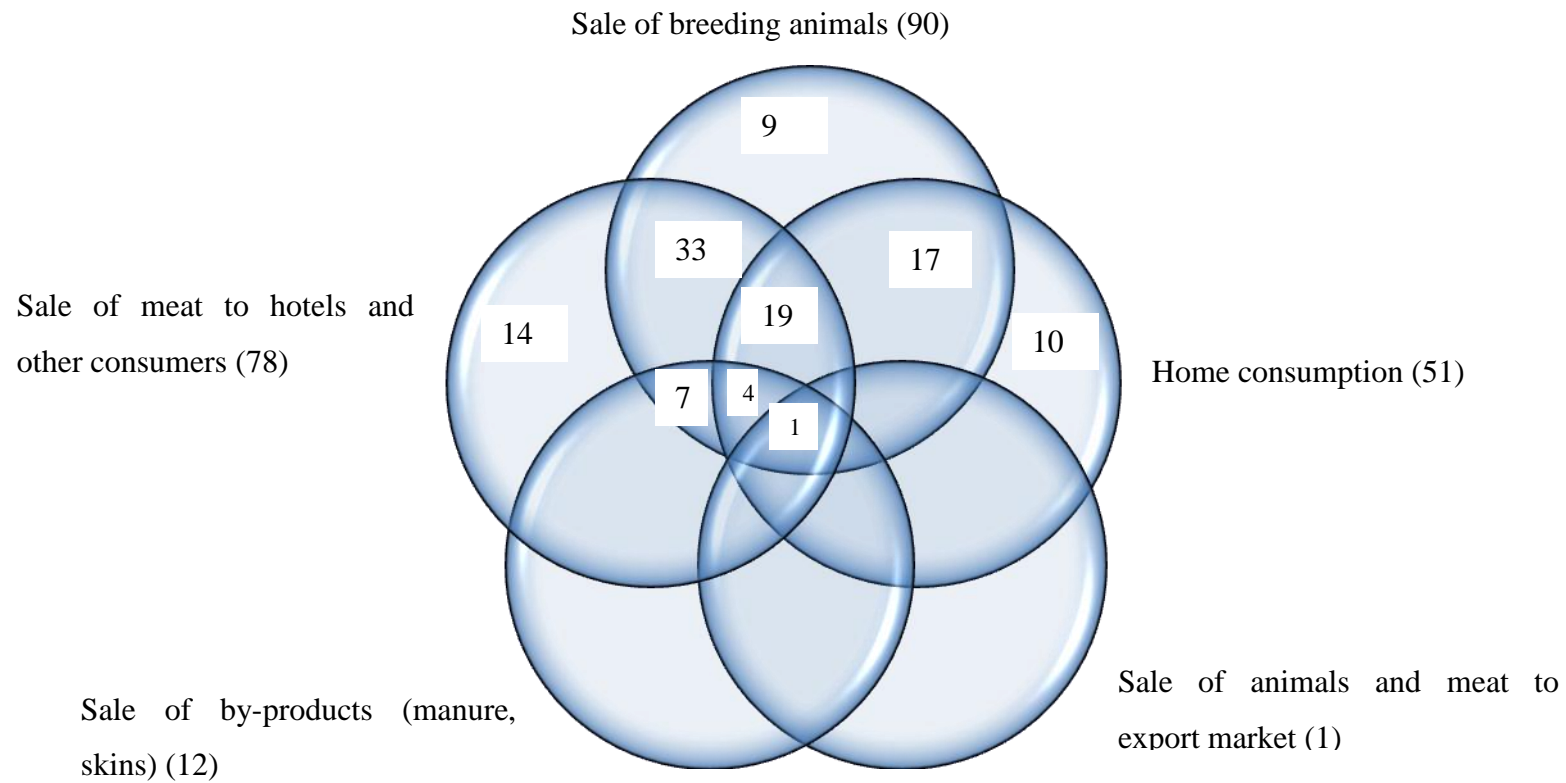


Figure 2. Venn diagrams showing the point of intersections on response of purpose for starting the rabbit enterprise

4.3.2 Farmers' Access to Agricultural Credit

Majority of the farmers (92.7%) had never borrowed credit for rabbit production while a paltry 7.3% had done so. The results were as shown in Table 10

Table 10

Respondents Who Had Borrowed Credit for Rabbit Farming (n=110)

Borrowed	Frequency	Percent
Yes	8	7.3
No	102	92.7
Total	110	100.0

Source: Survey Data, 2013

Majority of the farmers (92.7%) had not borrowed credit for rabbit farming. This agrees with Oseni *et al.*, (2008) who found that one of the major constraints identified by the rabbit farmers in Nigeria included start-up capital at 18 percent. This implies that farmers were likely to have lacked information on sources of credit or there were other challenges in accessing the credit that deterred the would-be beneficiaries from borrowing.

Sources of Finance for Rabbit Production

This was a multiple response item and the responses given were not mutually exclusive. Farmers had various sources of finance to support rabbit production. Majority of farmers (96.4 %) in Subukia Sub-County relied more on personal savings to support rabbit production while 8.2 % of the farmers borrowed from relatives, 1.8% from financial institutions and 0.9% from friends as shown in Table 11. This implied that rabbit farmers who did not access credit depended on their own saving to support rabbit production.

Table 11

Respondents' Sources of Finance (n=110)

Source of Finance	Frequency	Percent
Personal savings	106	96.4
Relatives	9	8.2
Financial institutions	2	1.8
Friends	1	0.9

Source: Survey Data, 2013

The results concur with Olagunju and Sanusi (2010) that 50% of the rabbit farmers in Oyo State Nigeria got their capital through personal savings. A study by Hungu, *et al.*, (2013) in some parts of Kenya found that rabbit farmers lacked adequate capital as reflected in the poor house structures. This finding implies that farmers are likely to have inadequate funds for large scale rabbit production.

Figure 3 shows Venn diagrams showing the point of intersections on response of various sources of finance. The points of intersections indicate the overlap of respondents who selected both alternatives as their sources of finance for rabbit enterprise.

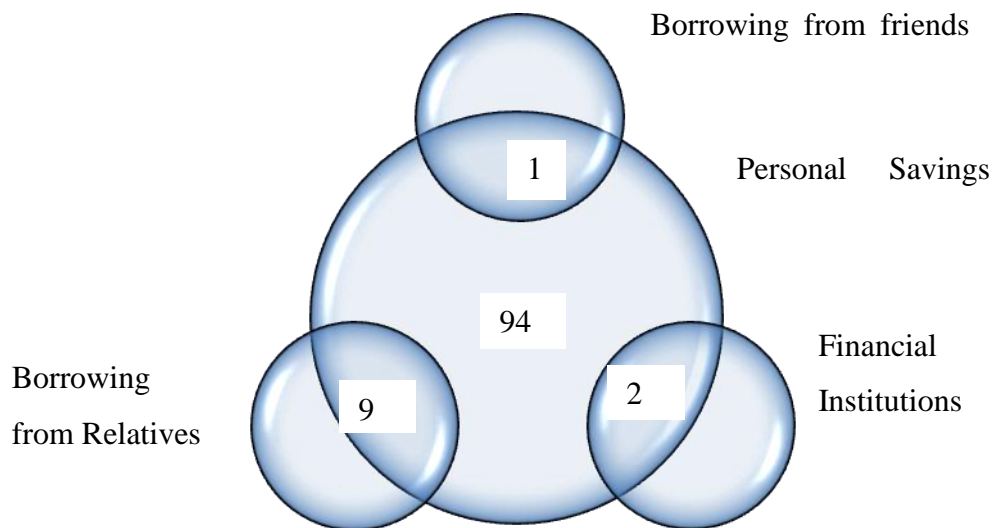


Figure 3. Venn diagrams showing the point of intersections on response of various sources of finance

Challenges Faced by Farmers in Borrowing Agricultural Credit

Farmers encountered several challenges in borrowing agricultural credit to finance rabbit farming as shown in Table 12. Majority (73.6%) of the farmers was challenged by high interest rate, 69.1% lacked guarantors, and 50% had no collateral.

Table 12
Challenges Faced by Farmers in Borrowing Agricultural Credit (n=110)

Challenges of Borrowing	Frequency	Percent
High interest rate	81	73.6
Lack of guarantors	76	69.1
Lack of collateral	55	50.0
Writing business plan	42	38.2
Delay in loan processing	21	19.1
Applied but not successful	13	11.8
Not sure of sources of credit	8	7.3

Source: Survey Data, 2013

This implied that most of the farmers (87%) had no access to credit facilities; hence, they were unable to fund large scale agricultural production. This finding is in agreement with Ugwumba and Omojola (2013) who found that Nigerian agriculture involves small scale farmers with low capitalization, and low yields per hectare. They further observed that most subsistence crop farmers in Ikole Local Government Area of Ekiti State, Nigeria were unable to access credit to improve their production, income and wellbeing. This was due to high interest rates charged by financial institutions, cumbersome loan processing procedures; lack of collaterals and inadequate information about loan-availability (Phillip, Nkonya, Pender & Oni, 2008).

4.3.3 Access to Extension Services

Farmer's acquisition of knowledge on agricultural production enhances their production systems and increases the sustainability of their livelihoods. The extension service provides the farmers with knowledge through various methods: visits, mass media and demonstrations, among others. The study set out to determine whether this was true concerning the rabbit farmers in Subukia Sub-County.

Farmers Trained within the Last Three months

Only 29.1% of the farmers had been trained within the last three months while 70.9% had not been trained as shown in Table 13

Table 13

Farmers Trained in Rabbit Production (n=110)

Trained	Frequency	Percent
Yes	32	29.1
No	78	70.9
Total	110	100.0

Source: Survey Data, 2013

Kaddi, Djellal and Berchiche (2013) found that lack of technical knowhow hampers rabbit production. Ozor and Madukwe (2005) concur that when farmers lack technical skills, they are not effective in carrying out various husbandry practices in rabbit production. Hungu *et al.*, (2013) observed that access to technical information to support rabbit production is a major problem in Kenya. Gono, Dube, Sichewo and Muzondiwa (2013) identified lack of technical support as one of the constraints in rabbit production in Zimbabwe. The study findings imply that access to information on rabbit production technologies is insufficient and is likely to impact negatively on rabbit production in Subukia Sub-county.

Number of Trainings Received by a Farmer in Rabbit Production within the Last Three Months

Most farmers (70.9%) had not received any training in rabbit production within a span of three months, 20% had been trained once while only 9.1% had been trained twice as shown in Table 14.

Table 14

Number of Trainings in Rabbit Production (n=110)

Number of Trainings	Frequency	Percent
0	78	70.9
1	22	20.0
2	10	9.1
Total	110	100.0

Source: Survey Data, 2013

Gono *et al.*, (2013) found that only 31% of the farmers in Zimbabwe got technical advice on effective rabbit production systems. They further noted that the extension agents interviewed revealed that they had limited expertise in rabbit breeding and production. This implies that extension agents will shy off from training farmers or responding to farmers questions on rabbit production. A study by Moreki and Seabo (2012) recommended that extension agents should be trained in rabbit production to enhance their effectiveness in imparting knowledge and skills to the rabbit farmers.

Sources of Extension Services on Rabbit Production

The access to extension services by farmers was one of the independent variables, which was operationalized as the number of trainings received from the extension officers and the access to knowledge from the extension service through various means. The farmers were asked whether they had received knowledge on rabbit farming from the following sources: Newspapers/magazines/rabbit production manuals, TV/Radio, Agricultural Research Institutes, Agricultural Extension agents, Internet, field days, other farmers and agricultural shows. The responses from the farmers to the use of these sources are given in Table 15.

Table 15
Farmer's Sources of the Extension Services (n=110)

Source of extension services	Frequency	Percent
Other farmers	46	41.8
TV / Radio	44	40.0
Agricultural shows	39	35.5
Newspapers / magazines	28	25.5
Agricultural extension agents	17	15.5
Internet	9	8.2
Agricultural research stations	7	6.4
Field days	7	6.4

Source: Survey Data, 2013

Source of rabbit production technologies were; other farmers (41.8 %), Television/Radio (40 %), agricultural shows (35.5 %), newspapers / magazines (25.5 %), agricultural extension agents (15.5%), internet (8.2 %), agricultural research stations (6.4%), and field days (6.4 %) as shown in table 15. The findings indicate that farmers mainly depend on experienced

farmers for information on rabbit farming. Okwu & Umoru (2009) found that only 23% of farmers get agricultural information from extension agents in the Benue State, Nigeria

The index of farmers' access to extension services in Subukia Sub-County was developed from eight of the knowledge sources identified by the farmers (Table 16). The variables were recorded to form 0, 1 type of variable. The negative responses were assigned the value of 0 and the positive responses were assigned the value of 1. The variables were then added together to form the index of farmers access to extension service, the descriptive statistics and the frequency distribution of the index are given in Table 16.

The results concur with Hungu, *et al.*, (2013) who found that rabbit farmers seek for extension services from diverse sources including extension officers (32%) and other farmers (19%). An important finding in this study is that agricultural shows and mass media seem to be good sources of rabbit production technologies to the farmers in Subukia Sub-county.

Table 16

Farmer's Access to Extension Services in Subukia

Index score	Frequency	Percent
0	14	12.7
1	35	31.8
2	25	22.7
3	10	9.1
4	15	13.6
5	4	3.6
6	5	4.5
7	2	1.8
Total	110	100.0

The majority of the farmers (31.8 %) in Subukia had very low access (score of 1) to the extension services, while 12.7 % had no access (score of 0) to the extension services, 22.7 % had low access (score of 2). The farmers with the highest access (score of 7) to the extension services were few (1.8 %), followed by 4.5 % of the farmers with an access score of 6, and

3.6 % with a score of 5. Rabbit production could have been affected by farmers' low access to extension services. The findings indicate that there was inadequate extension as farmers reported that extension agents do not show much interest in training farmers on rabbit farming. This implies that with low access to agricultural extension, farm productivity and profitability might not be enhanced. Robertson (2012) reported that agricultural extension services have helped to improve agricultural production, profitability, and sustainability in developing countries.

4.3.4 Access to Markets for Rabbits

The access to markets was one of the independent variables of this study. The variable access to markets was operationalized as the number of marketing outlets that were available to the farmers. The farmers were asked to state whether they had access to the following markets that were available in the area: other farmers, butchers, hotels, supermarkets, and the overall farmer's perception on the availability of the market for rabbits and their products. The responses from the farmers on the availability of these markets outlets are given in Table 17.

Table 17

Availability of Markets for the Rabbits (n=110)

Perception on Market Availability	Frequency	Percent
No Market at all	71	64.5
Sometimes there is market	39	35.4
Total	110	100.0

Source: Survey Data, 2013

Majority of the farmers (64.5%) felt there was no market for rabbits at all while 35.4% felt that they sometimes got markets for rabbits. Farmers reported that there was no well established marketing channel for rabbits. Rabbits were mainly sold to other farmers as breeding stock and at varied prices dictated by the buyers. The findings agree with Ozor and Madukwe (2005) that marketing constraints that included low prices of rabbit meat and its products and minimum sources of ready markets for rabbits and its products affect rabbit production.

Table 18

Distribution of Respondents by Market Outlets (n=110)

Market outlets	Frequency	Percent
Other farmers	31	28.2
Butchery	5	4.6
Supermarkets	3	2.7
Home consumption	71	64.5

Source: Survey Data, 2013

This item was meant to get information on where farmers sell rabbits for those who had earlier reported that sometimes they get market. Majority of the farmers (28.2%) sold rabbits to other farmers, 4.6% to local butcheries and 2.7% to supermarkets while home consumption stood at 64.5% as shown in Table 18.

The index of farmers' access to market outlets in Subukia Sub-County was developed from the responses of the farmers in regards to the availability of the outlets to the rabbits (Table 19). The variables were recorded to form 0, 1 type of variables, where the positive responses were assigned a value of 1 and the negative responses a value of 0. The variables were then added together to form the index of farmers access to markets, the descriptive statistics and the frequency distribution of the index are given in Table 19.

Table 19

Index of Farmer's Access to Market Outlets

Index score	Frequency	Percent
0	66	60.0
1	4	3.6
2	31	28.2
3	9	8.2

Majority of the farmers (60%) with index score of 0 had no access to market for rabbits while those with a substantial access to the markets with an index score of 3 were a paltry 8.2%. Olagunju and Sanusi (2010) had identified marketing as one of the greatest challenges that

hindered rabbit production in Nigeria. Ozor and Madikwe (2005) concurred that challenges in rabbit marketing results from few markets outlets for rabbits. Oseni et al (2008) also observed that marketing channels of rabbits in Northwestern Nigeria are not well organized. In a similar study, Oluwatusin (2014) found 80% of the rabbit farmers in Nigeria faced the marketing constraints. Onifade, Abu, Obiyan and Abanikannda (1999) noted that though markets for rabbit exist in Nigeria, there is no organized marketing of rabbits in Nigeria. This implies that farmers are not likely to enhance rabbit production when the markets are disjointed.

4.3.5 Respondents' Access to Breeding Stock

The access to breeding stock by the respondents was one of the independent variables, which was operationalized as the number of sources used by the farmers in acquiring their breeding animals. An index of access to breeding animals was developed based on the following sources: research institution, agricultural training centre, NGOs, and registered breeder. The variables were recorded to form 0, 1 type of variable. The negative responses were assigned the value of 0 and the positive responses were assigned the value of 1. The variables were then added together to form the index of farmers access to breeding stock, the descriptive statistics and the frequency distribution of the index are given in Table 20.

Table 20

Respondents' Access to Breeding Stock

Index score	Frequency	Percent
1	96	87.3
2	14	12.7
Total	110	100.0

Most farmers (87.3%) had a score index of one while only 12.7% had a score of 2. This implied that the access to breeding stock was quite low. Oseni *et al.*, (2008) found that access to foundation stocks for rabbit farmers in Nigeria stood at 18 percent.

Table 21

Respondents' Source of Rabbit Breeding Stock (n=110)

Source of Breeding Stock	Frequency	Percent
Agricultural Training Centre	17	15.5
Other farmers	118	88.7
NGOs	12	10.1

Source: Survey Data, 2013

This multiple response question was not mutually exclusive. Farmers were required to indicate their sources of rabbit breeding stock out of the choices given. Majority of the farmers (88.7%) obtain rabbit breeding stock from other farmers, 6% source from NGOs and 5.3% source from ATCs. Gono *et al.*, (2013) found 76.2% of the farmers got their breeding stock from other local farmers and neighbours. This implies that most farmers obtained breeding stock from other farmers who could supply low quality breeding rabbits. Hungu, *et al.*, (2013) reported that 64% of farmers bought their replacement stock from other farmers. The finding is in consonance with previous study by Ozor and Madukwe (2005) who found shortage of pure breeding stock as a major drawback in rabbit production. When farmers lack reliable and stable sources of parent stock, they tend to obtain the breeding stock from other farmers where quality may not be assured. This affects the overall productivity of the rabbits. Oseni, *et al.*, (2008) found that lack of reliable and stable sources of breeding stocks for backyard rabbit units hampered successful rabbit farming.

4.4 Tests of Hypotheses

Four hypotheses were tested in this study, and the findings were as follows;

Table 22

Results of Hypothesis Tests for Influence of Selected Factors on Rabbit Production (n=110)

Factors influencing rabbit production	Level of rabbit production	Frequency (%)	Chi-square	P-value
Index of access to credit	low level of production	60	38.924	0.000
	medium level of production	23		
	high level of production	20		
	very high level of production	7		
Index of access to extension services	low level of production	60	46.447	0.000
	medium level of production	23		
	high level of production	20		
Index of access to markets	low level of production	60	37.550	0.000
	medium level of production	23		
	high level of production	20		
	very high level of production	7		
Access to breeding animals	low level of production	60	36.203	0.000
	medium level of production	23		
	high level of production	20		
	very high level of production	7		

Source: Survey data, 2013

4.4.1 Test of Hypothesis One

Hypothesis One stated that: ‘There is no statistically significant influence of access to credit on rabbit production among smallholder farmers in Subukia Sub-County’. The Chi-square test was used to test the hypothesis. The aim was to determine the influence of access to credit on rabbit production in Subukia Sub-County. The tests as indicated in Table 23 below shows χ^2 value of 38.924 and the probability of the computed Chi-square value (P value) as 0.000. Since the probability of the computed Chi-square value is less than 0.05 the level of significance set $\alpha=0.05$, the null hypothesis was therefore rejected and concluded that access to credit had statistically significant influence on rabbit production among smallholder farmers.

Table 23

Access to Credit and Rabbit Production

rabbit production	Index of access to credit				Total
	0	1	2	3	
low level of production	4	51	0	5	60
moderate level of production	0	22	0	1	23
high level of production	0	15	0	5	20
very high level of production	0	4	2	1	7
Total	4	92	2	12	110

Chi square=38.924, df= 9, p-value=0 .000, p<.05

This means that access to credit enhances the production of rabbits in Subukia Sub-county. (Curtis, 2013) reported that access to credit is often unavailable or unaffordable for smallholders and the majority rely on friends, relatives or small savings and loans clubs, often supported by NGOs. He further noted that timely and affordable credit enables smallholder farmers to buy essential inputs and technologies. Oseni (2012) reported that successful implementation of smallholder rabbit production can be facilitated through the provision of micro-credit and soft loans by banks and micro-credit institutions.

4.3.2 Testing for Hypothesis Two

Hypothesis Two stated that: ‘There was no statistically significant influence of access to extension services on rabbit production among smallholder farmers in Subukia Sub-County’. The Chi-square test was used to test the hypothesis. The aim was to determine the influence of access to extension services on rabbit production in Subukia Sub-County. The tests as indicated in Table 24 show χ^2 value of 46.477 and the probability of the computed Chi-square value (P value) as 0.000. Since the probability of the computed Chi-square value is less than 0.05 the level of significance set $\alpha=0.05$, the null hypothesis was rejected and concluded that access to extension services had statistically significant influence on rabbit production.

Table 24

Access to Extension Services and Rabbit Production

Rabbit production	Access to extension services						Total
	Low		Moderate		High		
	1	2	3	4	5	6	
Low level of production	13	22	10	6	9	0	60
Moderate level of production	12	8	0	0	0	3	23
High level of production	6	7	2	1	2	2	20
Very high level of production	0	2	1	3	1	0	7
Total	31	39	13	10	10	7	110

Chi square=46.447, df=18, p-value=.000, p<.05

Oseni (2008) reported that training of backyard rabbit farmers on basic husbandry techniques contributes to the sustainability of such production systems. Haq (2011) also noted that the knowledge derived from extension services may be used by farmers to increase their production.

4.3.3 Test for Hypothesis Three

Hypothesis Three stated that: ‘There is no statistically significance influence of access to market on rabbit production among smallholder farmers in Subukia Sub-County.’ The Chi-square test was used to test the hypothesis. The aim was to determine the influence of access to market on rabbit production in Subukia Sub-County. The tests as indicated in Table 25 show χ^2 value of 37.550 and the probability of the computed Chi-square value (P value) as 0.000. Since the probability of the computed Chi-square value is less than 0.05 the level of significance set $\alpha=0.05$, the null hypothesis was therefore rejected and concluded that there was statistically significant influence of access to market on rabbit production among smallholder farmers in Subukia Sub-County.

Table 25
Access to Market Outlets and Rabbit Production

	Index of access to markets			
Rabbit production	0	1	2	Total
low level of production	46	14	0	60
moderate level of production	10	10	3	23
high level of production	10	8	2	20
very high level of production	0	3	4	7
Total	66	35	9	110

Chi square=37.550 df= 6, p-value=0.000

This was in agreement with Borter and Mwanza (2011) who reported that many farmers in Kenya keep rabbits based on inadequate information about its profitability and market dynamics. They further reported that rabbit export market is hampered by non compliance to specific production and processing standards. Osor and madukwe (2005) noted that in south west Nigeria, rabbit meat is lowly priced in order to attract buyers or is rejected due to social reasons or lack of familiarity.

The null hypothesis is therefore rejected, and the alternate hypothesis accepted that there is statistically significant influence of the access to market outlets on the production of rabbits by farmers in Subukia Sub-County. This means that as the access to market outlets increased, the production of rabbits in the study area increased in an attempt to meet the demand.

4.3.4 Test for Hypothesis Four

Hypothesis Four stated that: ‘There was no statistically significant influence of access to breeding stock on rabbit production among smallholder farmers in Subukia Sub-County.’ The Chi-square was used to test the hypothesis. The aim was to determine the influence of access to breeding stock on rabbit production in Subukia Sub-County. The tests as indicated in Table 26 shows χ^2 value of 36.203 and the probability of the computed Chi-square value (P value) as 0.000. Since the probability of the computed Chi-square value is less than 0.05 the level of significance set $\alpha=0.05$, the null hypothesis was therefore rejected and concluded that access to breeding stock had a statistically significant influence on rabbit production.

Table 26

Access to Breeding Stock and Rabbit Production

Rabbit production	Access to breeding stock		
	1	2	Total
Low level of production	55	5	60
Moderate level of production	22	1	23
High level of production	18	2	20
Very high level of production	1	6	7
Total	96	14	110

Chi square =36.203, df=3, p value= 0.000, p<.05

That was in agreement with Oseni (2012) who reported that the provision of suitable breeding stocks is a key requirement to the sustainability of rabbit production. Oseni *et al.*, (2008) further reported that inaccessibility to foundation and replacement stocks was one the drawbacks in rabbit production in developing countries. Hungu *et al.*, (2013) noted that lack of quality breeding animals have denied the rabbit farmers access to a wide range of genetic materials which are fundamental to the improvement of production of rabbits.

4.5 Implications of the Research Findings

The gender parity in rabbit production noted in this study implies that rabbit production can be enhanced and be taken as a family enterprise. Rabbit farmers cut across all ages. Since majority (78%) of the farmers fall in the age bracket of 30-50 years, this implied that if extension is packaged to entice this category of farmers, rabbit production as a source of livelihoods could be enhanced. Literate farmers are able to make use of diverse sources of knowledge on rabbit production. However, enhanced education was not commensurate with participation in rabbit production. This could mean that farmers with college and university education may get other sources of income rather than rabbit production. Most (76.4%) farmers were married. This implied that they needed to provide food and income to their families while they also shared labour within the households.

The study area was dominated by small and ultra-small rabbit production units. This implies that farmers might not take advantage of economies of scale in their production and would thus not realize substantial benefit from this enterprise unless the factors that affect production were adequately addressed. Ngong ATC in Kajiado County is the only registered

rabbit breeding centre in Kenya. It is a public agricultural training center that has persistently been breeding and selling rabbits in Kenya. Its location in Kajiado County; a distance of over 200km makes it expensive for farmers to access purebred rabbit breeding stock. Farmers therefore purchase stock that is not well bred from other rabbit farmers in their immediate neighborhoods to cut down on costs of travel.

Farmers had challenges of accessing credit for rabbit production which limited their capacity to upscale their enterprise. Other constraints were access to market, and limited extension services. Since these two factors significantly influenced rabbit production, it implied that farmers could only produce rabbits at subsistence level.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter gives a summary, conclusions and recommendations of the study. It ends with recommendations for further research.

5.2. Summary of the Study

The largest world producers of rabbits are China, Italy, Spain, and France. They produce three quarters of the world production. In Africa, the leading rabbit producing countries are Morocco and Nigeria which are reported to produce 20000 to 99000 tons of meat per year. Rabbit farming is also undertaken in the USA, Africa, and the Republic of Korea. Kenya is still in the initial stages of developing a vibrant rabbit sub-sector. Rabbit production contributes to the first Millennium Development Goal of eradicating extreme poverty and hunger by enhancing household food security.

Farmers have in the past made efforts towards food self-sufficiency by raising various livestock breeds such as cattle, sheep, goats, pigs and poultry. Despite these efforts, Kenya remains food insecure. The Kenya Government has encouraged farmers to use rabbits as a source of food particularly because they do not directly compete with humans for food. Farmers in Subukia Sub-County, farmers started keeping rabbits because of their fast growth rate and high fecundity. Rabbits require low startup capital investment and feed on crop residues. Although rabbit production is easier to start than other livestock projects, the percentage of farmers who rear rabbits and the rabbit numbers in Subukia-Sub County are generally low. The factors responsible for this low level of production were not well understood hence the need for this study. The purpose of the study was to determine the influence of farmers' demographic factors, access to credit, extension services, breeding stock, and markets on rabbit production.

This research was undertaken among rabbit producing farmers in Subukia Sub-County to establish the influence of selected factors on rabbit production. The assessment was based on how the following five factors: demographic factors, access to credit, access to extension services, access to market outlets, and access to breeding stock influenced the production of rabbits. The study used a cross-sectional survey research design. The respondents were

identified through purposive and snowball sampling procedures. A sample of 110 rabbit keeping farmers aged 18 to 68 years in Subukia Sub-County was interviewed.

Approximately 51.8% of the respondents were males. Among the respondents, 38.2% had primary school education, 32.7% had secondary school education, 15.5% had no formal education, 8.2% had college certificate, 4.5% had diploma and 0.9 had university education. The married respondents were 76.4%, 10.9% were single, 8.2% widowed, 2.9% divorced and 0.9% were separated.

Respondents' education and marital status their influenced rabbit production while gender and age had no influence rabbit production in Subukia Sub-County. The extent of rabbit production as a household enterprise in the Sub-County was low partly due to inadequate breeding stock and less than 6 rabbits for 75% of the respondents. At least 18.2% had 6 to 15 rabbits, 3.6% had 16 to 50 rabbits while 2.7% had more than 51 rabbits. There was low income received from the rabbit enterprise compared to the total farm income generating activities undertaken by the farmers. The income from total farm ventures was significantly higher ($p = .000$) than the income from rabbit production. Thus, the monthly contribution of rabbit production to household income was minimal partly due to the low level of production (two rabbits per farmer).

Most of the farmers (92.7%) had not borrowed agricultural credit for rabbit production. Most (95.8%) of the respondents used their personal savings to finance rabbit production. Among the challenges faced by the respondents in accessing agricultural credit was lack of collateral for 25.5% of the respondents, lack of guarantors for 22.7%, high interest rate for 15.5% and inability to write a business plan for 11.8% of the respondents. Majority of the respondents (70.9%) had not been trained on rabbit production while only 29.1% had been trained in a span of three months. Among the trained respondents, 20% had been trained once while 9.1% had been trained twice. Other farmers (41.8%) ranked top as the main source of rabbit production technologies among the respondents. This was followed by TV/radio (40%), agricultural shows (35.5%), Newspapers/magazines (25.5%) and agricultural extension agents (15.5%). Majority of the respondents (31.8%) had very low access to extension (score of 1) while 12.7% had no access (score of 0).

About 64.5% of the respondents felt that there was no market for rabbits at all while 35.4% felt that they sometimes got markets for rabbits. Among the market outlets, 28.2% of the farmers sold rabbits to other farmers as breeding stock, 4.6% to local butcheries and 2.7% to supermarkets while home consumption stood at 64.5%. Majority of the farmers (60%) had no access to market for rabbits while only 8.2% accessed markets. Majority of the farmers (88.7%) obtained rabbit breeding stock from other farmers, 6% from NGOs and 5.3% from Ngong ATC, Kajiado County. Four hypotheses were tested by use of Chi-square. The evidence from the research data indicated that rabbit production was significantly ($p \leq 0.05$) influenced by access to credit, access to extension services, access to market outlets, and access to breeding stock.

5.3. Conclusions

Based on the findings of the study, the following conclusions were made:

- i. The scale of rabbit production was low as each farmer had an average of 2 rabbits.
- ii. Most respondents (96.4%) relied on personal savings to finance rabbit production due mostly to stringent requirements in accessing credit. Many financial institutions were not willing to risk lending credit to rabbit farmers.
- iii. Respondents lacked adequate extension services on rabbit production.
- iv. Most respondents (88.7%) obtained breeding stock from neighbouring rabbit farmers. Ngong ATC, a government owned breeding centre in Kajiado County, was the only reputable rabbit breeding station where few respondents (5.3%) obtained their breeding stock.
- v. Respondents had challenges in marketing rabbits and rabbit products.

5.4. Recommendations

Based on the conclusions of the study, the researcher made the following recommendations:

- i. The Government of Kenya (GoK) should partner with the private sector to enhance provision of soft loans to smallholder rabbit farmers.
- ii. The Ministry of Agriculture, Livestock and Fisheries (MoALF) should formulate a policy framework to guide the training of farmers and extension agents on rabbit production as an emerging and poverty alleviating livestock species.
- iii. Nakuru County Government should establish a rabbit breeding centre from which farmers can easily access affordable, quality breeding stock.

- iv. MoALF should mobilise rabbit farmers to form a regional marketing association/cooperative in order to enhance their market access.

5.5 Recommendations for Further Research

Two areas of study need to be undertaken in Subukia Sub-County in the future. They include:

- i. A study that will look at more factors affecting the production of rabbits such as availability of feeds, labour, types of breeds kept, farmers adoption on production technologies.
- ii. A study to capture the perceptions and attitudes of the rabbit farmers towards the production of rabbit compared to other farm enterprises.

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APPENDIX A
FARMERS' QUESTIONNAIRE ON SELECTED FACTORS INFLUENCING
RABBIT PRODUCTION AMONG SMALLHOLDER FARMERS

Introduction

I am a student pursuing a Master of Science degree in Agricultural Extension at Egerton University, Njoro Campus. I am conducting a research study on selected factors influencing rabbit production among smallholder farmers in Subukia Sub-County. The study findings will be used to inform the Ministry of Agriculture, Livestock and Fisheries, and other stakeholders on factors that influence rabbit production and in turn take appropriate intervention measures to improve levels of production among smallholder farmers. You have been chosen to provide information that will help to improve rabbit production in this Sub-County. Your responses will be treated with the highest level of confidentiality.

Guidelines:

- i. Please complete all the sections provided.*
- ii. Tick (✓) the most appropriate answer from the alternative given.*

Section A: Demographic Information of the Respondent

1. Gender Male

Female

2. My age group (Tick one)

18-24 years

25-29 years

30-34 years

35-39 years

40-44 years

45-49 years

50-54 years

55-59 years

60-64 years

Above 65 years

3. My education level (Tick one)

No-Formal Education

Primary

Secondary

College

Diploma

University

Other (specify):

4. Marital status (Tick one).

Single

Married

Widowed

Divorced

Separated

Others (specify):

Section B: The Extent of Rabbit Production

5. My farm size in acres:

6. Fill *Table 1*.

Table 1

Type of livestock	Number
Rabbits	
Cattle	
Goats	
Sheep	
Poultry	
Other(s)	

7. Average income from the rabbit enterprise per month: Kshs

8. Average household farm income per month: Kshs.....

9. Reasons for starting the rabbit enterprise (Tick all that apply)

Home consumption

Sale of breeding rabbits to other farmers?

Sale of meat to hotels /other consumers

Sale of by-products (eg manure)

Others (specify).....

10. Breed(s) of rabbits on the farm (Tick all that apply)

New Zealand White

California White

Chinchilla

Flemish Giant

Kenya White

French Earlop

Others (specify).....

11. Please indicate your level of agreement with each of the following statements on the concept of rabbit production by circling the option that best describes your response.

Key

SD Strongly Disagree

D Disagree

U Uncertain

A Agree

SA Strongly Agree

For example –Rabbit meat is highly nutritious. SD D U A SA

Answer – Rabbit meat is highly nutritious. SD D **U** A SA

NB/ The answer signify that you are uncertain on whether rabbit meat is highly nutritious.

- | | | | | | |
|---|----|---|---|---|----|
| a) I always get relevant advice on rabbit production from extension agents whenever I need it | SD | D | U | A | SA |
| b) I have attended a training on rabbit production in the last one year | SD | D | U | A | SA |
| c) I always get a place to sell my rabbits whenever I want | SD | D | U | A | SA |
| d) I rarely satisfy the current market needs for rabbits | SD | D | U | A | SA |
| e) I always get agricultural credit for rabbit farming whenever I need | SD | D | U | A | SA |
| f) I always get amount of agricultural credit I apply for | SD | D | U | A | SA |
| g) Selling rabbits is profitable | SD | D | U | A | SA |
| h) I always get purebred rabbits whenever I want them | SD | D | U | A | SA |
| i) I always get a type of rabbit breed I want | SD | D | U | A | SA |

Section C: Influence of Access to Credit on Rabbit Production

12. (a) Have you ever borrowed credit to finance the rabbit enterprise? (Tick (√) one)

Yes

No

(b). If No, please give reason(s)

.....

.....

.....

13. Indicate how you finance your rabbit enterprise on *Table 2*. (Tick (√) Yes or No)

Table 2

Sources of finance	Yes	No
Personal savings		
Borrowing from friends		
Borrowing from Financial institutions		
Borrowing from relatives		
Borrowing from private moneylenders		

14. List three challenges you face in borrowing agricultural credit on rabbit production?

.....

.....

.....

.....

.....

Section D: Influence of Access to Extension Services on Rabbit Production

15. Have you been trained on rabbit keeping?(Tick one)

Yes

No

16. Do you know any extension agent promoting rabbit farming in this area? (Tick one)
- Yes
- No
17. Indicate the number of times you have been trained by extension agents on rabbit production in the last 3 months.....
18. Please select your source (s) of information on rabbit farming. (Tick (√) all that apply).
- Newspapers/magazines/rabbit production manuals
- TV/Radio
- Agricultural Research Institutes
- Agricultural Extension agents
- Internet
- Others (specify)
-

Section E: Influence of Access to Market on Rabbit Production

19. Put a tick on the following statements as they apply on the availability of markets for the rabbits.
- No market at all
- Sometimes I get a market
- I always get a market for my rabbits
20. Please, indicate where you sell your rabbits.....
- Other farmers
- Rabbit butchery
- Schools/Research Institutions
- Hotels
- Others (specify):
21. List three challenges that you face in the process of marketing your rabbits
-
-
- (a) Are you a member of any rabbit farming organization/association? (Tick one)
- Yes
- No

(b). If Yes, what are the benefits?

.....
.....

(c) If No, explain.

.....
.....

Section F: Influence of Access to Breeding Stock on Rabbit Production

1. Please complete all the statements provided.

2. Tick (✓) or circle the most appropriate answer from the alternative given.

22. Where did you get the initial breeding stock? (Put a tick on the most appropriate response)

Research Institution

Agricultural Training Centre (ATC)

Other farmers

Non Governmental Organization (NGO)

Others (specify):

(b) Have you ever obtained rabbits from a registered rabbit breeder? (Tick one)

Yes

No

(c) If Yes, name the source.....

(d) If No, explain

.....
.....

23. List three challenges you face in obtaining rabbit breeding stock.

.....
.....
.....

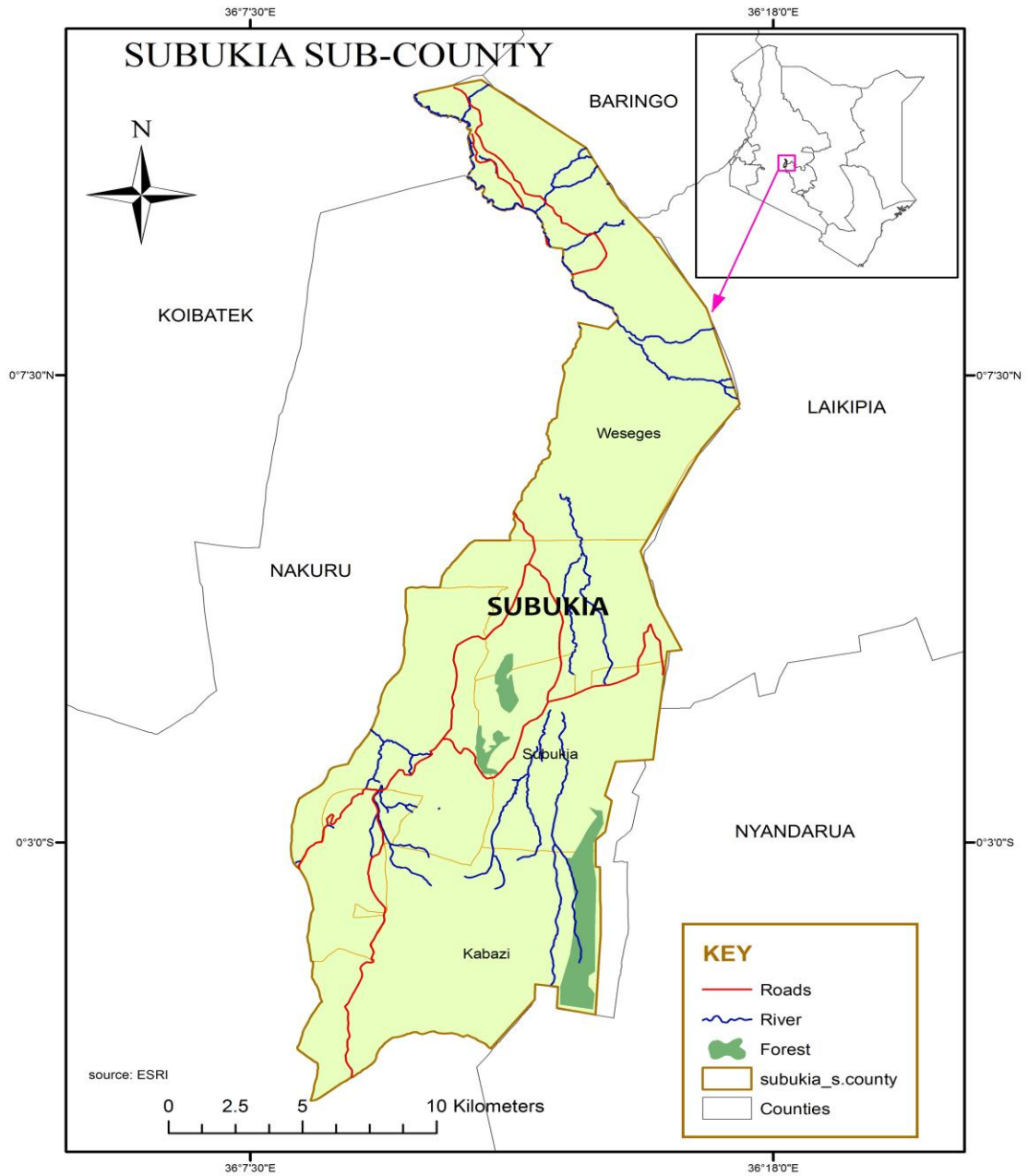
24. Suggest ways in which rabbit production can be improved in Subukia Sub-County.

.....
.....

Thanks for your cooperation

APPENDIX B

MAP OF THE STUDY AREA



Source: Nakuru District Strategic Plan (2005 – 2010)

APPENDIX C
RESEARCH AUTHORIZATION LETTER

REPUBLIC OF KENYA



NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Telephone: 254-020-2213471, 2241349, 254-020-2673550
Mobile: 0713 788 787, 0735 404 245
Fax: 254-020-2213215
When replying please quote
secretary@ncst.go.ke

P.O. Box 30623-00100
NAIROBI-KENYA
Website: www.ncst.go.ke

Our Ref: **NCST/RCD/10/013/50**

Date: **3rd September, 2013**

Simon Gichohi Wambugu
Egerton University
P.O.Box 536
Egerton.

RE: RESEARCH AUTHORIZATION

Following your application dated *14th August, 2013* for authority to carry out research on *"Influence of selected factors on rabbit production among smallholder farmers in Subukia District of Nakuru County, Kenya,"* I am pleased to inform you that you have been authorized to undertake research in **Subukia District** for a period ending **31st December, 2013**.

You are advised to report to **the District Commissioner, the District Education Officer and the District Agricultural Officer, Subukia District** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.

DR. M. K. RUGUTT, PhD, HSC.
DEPUTY COMMISSION SECRETARY
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Copy to:

The District Commissioner
The District Education Officer
The District Agricultural Officer
Subukia District.

"The National Council for Science and Technology is Committed to the Promotion of Science and Technology for National Development".