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**AN ECONOMIC ASSESSMENT OF STRUCTURE, CONDUCT,  
AND PERFORMANCE OF RABBIT MARKET IN NAKURU,  
KIAMBU AND NYERI COUNTIES, KENYA**

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**A Thesis submitted to the Department of Agricultural Economics in partial fulfillment of  
the requirements for the award of a Master of Science Degree in Agricultural and Applied  
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## **DEDICATION**

This work is dedicated to my parents Mr. and Mrs. Mutsami, my siblings, Milton, Yvonne, Franklin and Electine, and, last but not least, my fiancée Sharon Vera and my son, Hera, for their love and persistent encouragement.

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## **ABSTRACT**

Rabbit (*Oryctolagus cuniculus*) is a preferred and sustainable source of proteins in the face of climate change, increase in population and changing meat consumption patterns in developing countries. This is because of its unique characteristics such as fast growth rate, high fecundity, feed conversion efficiency, early maturity, freedom from odour, noiselessness and its adaptability to a wide range of ecosystems. Rabbit meat is preferred because of its nutritional characteristics, for example low fat, calorie and cholesterol contents. Despite the high potential of rabbit enterprise in Kenya, the sector has not been fully exploited. Additionally, no study has been done to map out Kenya's rabbit value chain including the analysis of its market structure, conduct, and performance and the factors affecting profitability of rabbit farming. The current study aimed at bridging the afore-mentioned research gaps. The study was conducted in three counties namely, Kiambu, Nakuru, and Nyeri. A sample of 459 farmers and 80 traders from the three counties was interviewed. Focus group discussions (FGD) and Key Informant Interviews (KII) were conducted. The market Structure, Conduct and Performance (SCP) model was used to analyze marketing of rabbit in the three counties. A Two Stage Linear Square (2SLS) models was used to determine the factors influencing rabbit profitability. The study found that 88 percent of farmers practiced rabbit farming for commercial purposes. Value chain analysis revealed that rabbit skin was thrown away after slaughtering process in all the three counties. In Nakuru, the Gini-coefficients (GC) for producers and traders were 0.689 and 0.517 respectively. In Kiambu, the GC for producers and traders were 0.658 and 0.59 respectively. Lastly, the GC for producers and traders from Nyeri were 0.614 and 0.677 respectively. Market actors' behavior was characterized by bargaining, which was the main way of setting prices. About one third of farmers used mobile phones to connect with buyers. The rabbit farmers received unfair share of retail price with Nakuru having 43.46 percent,

Kiambu 50.70 percent and Nyeri 40.84 percent. In all the three counties, rabbit farming was profitable as depicted by positive marketing margins. Age of the household head, household size, years of education, number of rabbits kept, group membership, extension access, credit access, wealth index and income were the main factors influencing gross margins in the three study areas. Based on the findings, it is suggested that more effort and resources should be directed towards reducing information asymmetry among the rabbit value chain actors. This can be accomplished through the formation of farmer groups/associations for collective action during marketing. There is need for stakeholders such as both national and county governments, NGOs and farmers to invest in rabbit leather industry so as to realize high income. In addition, promotion of income diversification initiatives among rural farmers is necessary for improving their well-being and employment creation. This will enable smallholder farmers to earn high income which can be ploughed in other enterprises such as rabbit farming. Credit lending institutions such as commercial banks and micro-finance institutions should work towards providing affordable and accessible credit to rabbit farmers in order to improve their ability to cover costs associated with production and marketing of rabbits. Ensuring that interest rates are lowered to a level affordable by smallholder farmers and simplifying application and disbursement procedures of loans should be made a priority.

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## **ABBREVIATIONS AND ACRONYMS**

CBO	Community-Based Organization
CR	Concentration Ratio
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database
FGD	Focus Group Discussion
GC	Gini coefficient
GM	Gross Margin
GoK	Government of Kenya
HHI	Herfindahl-Hirschman Index
HLPE	High Level Panel of Experts
IAD	Institutional Analysis and Development
IFAD	International Fund for Agricultural Development
JICA	Japan International Cooperation Agency
ME	Marketing Efficiency
MoLD	Ministry of Livestock Development
NAFIS	National Farmers Information Service
NALEP	National Agriculture and Livestock Extension Program
NGO	Non-Governmental Organization
OLS	Ordinary Least Squares
SCP	Structure Conduct Performance
SDGs	Sustainable Development Goals
SSA	Sub-Saharan Africa

TGMM	Total Gross Marketing Margin
TR	Total Revenue
UN	United Nations
USAID	United States Agency for International Development

## CHAPTER 1: INTRODUCTION

### 1.1 Background

The global production and consumption of livestock products have rapidly increased in the past century owing to growth in income, population and urbanization (FAO 2016). According to FAO (2009), approximately 70 percent of the global 1.4 billion people depend on livestock for their wellbeing. The increase in demand for livestock products in developing countries has surpassed that of developed ones over the last decade (Smith *et al.*, 2013). Among the developing countries, Rae and Nayga (2010) observe that the supply of livestock products is highest in China and lowest in Sub-Saharan Africa (SSA). For instance, in 2007, China supplied 88.7 million tonnes of beef products while SSA supplied only 9.3 million tonnes (Thornton, 2010). This difference may be attributed to rapid technological innovation growth in Asian countries. Therefore, if properly harnessed, the sector has the potential of enabling SSA to achieve the first two Sustainable Development Goals (SDGs) that emphasize respectively poverty reduction and improvement of food and nutrition security globally by 2030 (UN, 2015). These goals can be realized by ensuring food availability, employment, good governance and increased investment in agriculture.

Although livestock are critical for risk mitigation, wealth creation, food and nutrition security (IFAD, 2009), their production in SSA is faced by myriad of challenges (e.g see Hungu *et al.*, 2013). The increase in human population has been identified as a major challenge to livestock farming in the majority of developing countries including Kenya (Mailafia *et al.*, 2010). In particular, the subdivision of land with successive generations in Kenya has resulted in continuous pressure on land leading to a decline in the production of food and cash crops (Miller *et al.*, 2011). In addition, climate change has been identified as a growing threat to livestock production in Kenya

(Rust and Rust, 2013). Notenbaert (2007) noted that increased variability of rainfall and temperatures result in deterioration of pastures and fodder quality and availability leading to reduction in the numbers of livestock in affected areas. Climate change has also resulted in increased occurrence of diseases and disease vectors which negatively affect animal health leading to low output from livestock (Rust and Rust, 2013).

According to Bett *et al.* (2012), the consumption of meat in Kenya has increased immensely from 361,115 metric tonnes (MT) in 1991 to 606,169 MT in 2007. In addition, per capita consumption of meat was 14.90 Kg in 1991 which increased to 16 Kg in 2007. The authors projected that the per capita consumption of meat would increase to 22kg by 2020. To meet the high demand for animal products, alternative sustainable sources of protein need to be considered (Akinmutimi, 2007). Among the available options, the rabbit (*Oryctolagus cuniculus*) has been identified as a suitable alternative (Mailafia *et al.*, 2010; Hassan *et al.*, 2012; Mailu *et al.*, 2013) owing to its fast growth rate, high fecundity, high feed conversion efficiency and early maturity. With good husbandry, rabbits can produce above 40 kits per annum compared to one calf for cattle and up to two kids in goats (Kitavi *et al.*, 2015). In addition, rabbits are considered free from odour, are noiseless and can adapt in many ecosystems unlike many of the larger ruminants (Dairo *et al.*, 2012).

Rabbit farming can be carried alongside other farming systems where they are fed on weeds, poultry waste, crop residues and even kitchen wastes (Antony and Madu, 2015). In addition, rabbit farming reduces the pressure on land caused by the use of food as feed where grain is used as feed for livestock such as pigs and poultry (Mbutu, 2013). It is also important to note that rabbit farming requires less initial investment thus it becomes affordable by the poorest people in the community

especially small and marginalized farmers. In addition, high returns can be earned within a short time of approximately six months from the enterprise thus considered profitable.

Rabbit meat is reported to be suitable for people in need of special diets, for example, patients with heart-related diseases, diets for the aged, diets with low sodium, diets meant for weight reduction. As observed by Mensah *et al.* (2014) most of the meat sold in developing countries such as Kenya have been found to have high levels of fat, high cholesterol and relatively low protein content. Compared to other types of meats such as beef, pork, and chicken, rabbit meat has the highest protein (20.8%) and lowest fat (4.5%), calorie (360.9 kg), and cholesterol contents (Van Heerden and Mentani, 2010) (Table 1.1). The levels of obesity associated with chronic diseases and cancer have increased in both developing and developed nations thus affecting food security and nutrition (Neumann *et al.*, 2010; Stevens *et al.*, 2012; Popkin *et al.*, 2012). Rapid growth in cases of overweight and obesity due to consumption of excessive red meat with high fats and calories creates a new food security challenge for governments, one that will not respond to food security policies that focus only on calorie intake (HLPE, 2014). Rabbit meat could be a solution to the management of obesity (Petracci and Cavani, 2012). In addition, income from rabbit sales can be used in supporting other farm enterprises (Moreki *et al.*, 2012). According to report by Covic and Hendriks (2016) on achieving a nutrition revolution for Africa, rabbit farming was proposed as one of the enterprises to be adopted by African farmers in addressing most forms of malnutrition.

**Table 1.1: Comparative nutritive value of rabbit meat**

Type of Meat	Protein (%)	Fat (%)	Calories per kg
Rabbit	20.8	4.5	360.9
Veal	19.1	12.0	381.4
Chicken	20.0	17.9	367.7
Turkey	20.1	20.0	540.3
Lamb	15.7	27.7	644.7
Beef	16.3	28.0	653.8
Duck	16.0	28.6	460.8
Pork	11.9	45.0	930.7

Source: Van Heeden and Mentani (2010)

Rabbit production is one of the fastest growing farming enterprises in Kenya (Ministry of Livestock Annual Report, 2005). Since the livestock census of 2009, the rabbit population in Kenya has been growing at an average of 13 percent from 483,000 in 2009 to 878,000 head in 2014 (FAOSTAT, 2014). Initially, rabbit farming was considered as a hobby for young boys (Borter and Mwanza, 2011). Different communities in Kenya have had different perceptions about rabbit rearing and consumption. For example, some communities believed that rabbits should not be eaten by adults (Ministry of Livestock Development (MoLD), 2012). Due to the realization of the importance of rabbits in nutrition and poverty alleviation, Kenyan government and non-governmental organizations (NGOs) have recently been involved in promoting rabbit farming and consumption. For example, since 2000, the Government of Kenya (GoK) has been promoting rabbit production through National Agriculture and Extension Program (NALEP) (MoLD, 2012).

Mailu *et al.* (2012) showed that Kiambu, Nyeri and Nakuru were some of the counties in Kenya where rabbit farming had increased substantially over the last decade. This increase in investment in rabbit enterprise may be attributed to GoK initiative in May 2011 that promoted rabbit production for the enhancement of food and nutrition security and poverty alleviation in line with Kenya's Vision 2030 (Mutisya, 2014). Some of these counties have shown interest in supporting rabbit enterprise. For example, one of the priority areas in Nakuru County Integrated Development Plan [CIP] (2013-2017) is the promotion and improvement of rabbit keeping (Republic of Kenya, 2013a). Specifically, the plan provides for the promotion of value addition and improvement of market access of rabbit and its products. This is done with the aim of raising income for poor households in the county. In Kiambu County, a rabbit slaughter house was built by the county government in Thika Town. The factory has been installed with value addition machines which enable processing of rabbit meat into sausages and meat loaves. This county government's initiative provides ready market for rabbits from farmers. According to Ipsos (2015), the World Bank through the Ministry of Agriculture helped in the construction of a rabbit breeding and processing plant in Othaya, Nyeri County. This was aimed at promoting commercial rabbit farming in the county.

Although government and NGOs have put in a lot of efforts to promote rabbit farming in Kenya, both farmers and traders still encounter unfavorable market conditions such as high transaction costs and information asymmetry which eventually negatively affects returns from sale of rabbits (Mbutu, 2013). Marketing is found to be a critical component in any sub-sector of agriculture because it ensures flow of farm produce from the farmer to the final consumer (Zorinah, 2015). For the vision of promoting rabbit sub-sector to exports standards to be achieved, there is need to have a clear understanding of its market locally. It is important to understand how various actors

in the rabbit market behave (conduct) and even factors determining entry into or out of the market. Performance of rabbit market can be very clear to various stakeholders and market actors by analyzing the actions of market participants along the value chain. For example, when few buyers of rabbits secretly negotiate and agree to offer farmers lower price, it will result to losses thus low performance. Rabbit value chain also needs to be very clear and well understood by all stakeholders involved in rabbit market in Kenya.

## **1.2 Statement of the research problem**

Although the GoK and Non-governmental Organisations (NGOs) have put in a lot of efforts to promote rabbit farming in Kenya, both farmers and traders still encounter unfavorable market conditions such as high transaction costs and information asymmetry which eventually negatively affects returns from sale of rabbits. Marketing is a critical component in any sub-sector of agriculture because it ensures flow of farm produce from the farmer to the final consumer. For the vision of promoting rabbit sub-sector to export standards to be achieved, there is need to have a clear understanding of its market locally.

Despite the high potential of rabbit farming in Kenya, the sector has not been fully exploited. This could be partly attributed to lack of policy-relevant information and data on Kenya's rabbit value chain. Although past studies have shown that many farmers in Kenya have adopted rabbit farming as a commercial enterprise (e.g., see Mbutu, 2013; Mutisya, 2014; Mailu *et al.*, 2013), there is no information on the structure, conduct and performance of the rabbit market in Kenya. No study has even attempted to document it. Most of the studies done on rabbits have mainly focused on production and biological aspects of the rabbit (Mailafia *et al.*, 2010; Hassan *et al.*, 2012; Mailu *et al.*, 2013; Ogola *et al.*, 2017). Mutisya (2014) and Mailu *et al.* (2013) recommended an in-depth analysis of the rabbit value chain to provide insights on the performance of rabbit market in Kenya.

The current study aimed at bridging this gap in knowledge by mapping the value chain as well as evaluating the SCP of the rabbit market in Kenya. In addition, the factors influencing marketing profitability were assessed.

### **1.3 Objectives of the study**

The overall objective of this study was to assess the SCP of rabbit market in Nyeri, Kiambu and Nakuru counties of Kenya.

The specific objectives of this study were to:

1. Map out the rabbit value chain in the three counties,
2. Assess the structure of rabbit market in the three counties,
3. Assess the conduct of rabbit market in the three counties,
4. Assess the performance of rabbit market in the three counties,
5. Assess factors affecting the profitability of rabbit enterprise from producers' perspective in the three counties.

### **1.4 Research questions**

The following research questions were addressed

1. Who are the main actors in the rabbit value chain in Nakuru, Kiambu and Nyeri Counties?
2. What is the level of value-added at each node of the rabbit value chain in the selected counties?
3. What is the level of concentration and entry and exit barriers in the rabbit value chain in selected counties?
4. What are the price setting behaviors and buying and selling practices of rabbit value chain actors in selected counties?

5. What are the factors influencing the profitability of rabbit enterprise in the selected counties?

### **1.5 Justification**

Understanding the rabbit value chain and the SCP of its market is essential to any interventions aimed at improving the livelihoods of smallholder farmers in Kenya. The findings of this study will assist farmers and other stakeholders in making evidence-based decisions in relation to the structure of the rabbit market and thus improve the general performance of rabbit market in the study areas. The information generated by this study will provide policy makers with evidence-based insights to allow for evidence-informed decision-making especially in designing policies addressing the constraints facing rabbit farmers, traders and other participants in the value chain in Kenya.

The mapping of the rabbit value chain identifies the main rabbit market agents as well as their activities, constraints and opportunities at every segment of the value chain. The information generated from value chain mapping will provide an understanding of the structure of the rabbit system operating in Kenya to stakeholders such as NGOs, development partners and both county and national governments. The information on profitability of rabbit enterprise will be important to farmers who would like to invest in rabbit farming. Farmers just like any other entrepreneur would prefer to engage in a profitable activity.

In general, the information generated by this study will guide the national and county governments and other stakeholders in their promotion of the rabbit enterprise as the country works towards achieving Vision 2030 and the recently launched Agenda Four Reforms. The study also contributes to Kenya's implementation of the Malabo Declaration of 2014 (Commitment to Ending Hunger in

Africa by 2025) by providing possible avenues to increase production and marketing of rabbit meat to improve national food security and nutrition especially among resource-poor farmers. The study also provides information on the constraints affecting the whole value chain thus providing knowledge which can be used to guide investment decisions by farmers and other interventions by government of Kenya, development partners and lobby groups. The study contributes to the existing body of scientific knowledge by addressing the research gap and therefore serves as useful source of baseline literature on rabbit value chain and marketing in Kenya.

### **1.6 Organization of this Thesis**

This thesis is structured into five chapters. Chapter one provides the background to the study highlighting the knowledge gap, objectives and justification of the study. Chapter two covers a review of literature on the state of rabbit farming in Kenya as well as various theories on SCP and the value chain concept. Chapter three presents the methodology adopted where the conceptual and empirical frameworks, study area, sampling, data collection procedures, data sources and data analysis procedures are described. In chapter four, study findings are presented in graphs and tables followed by discussions for each table and figure. Relevant conclusions and recommendations for policy interventions are highlighted in chapter five.

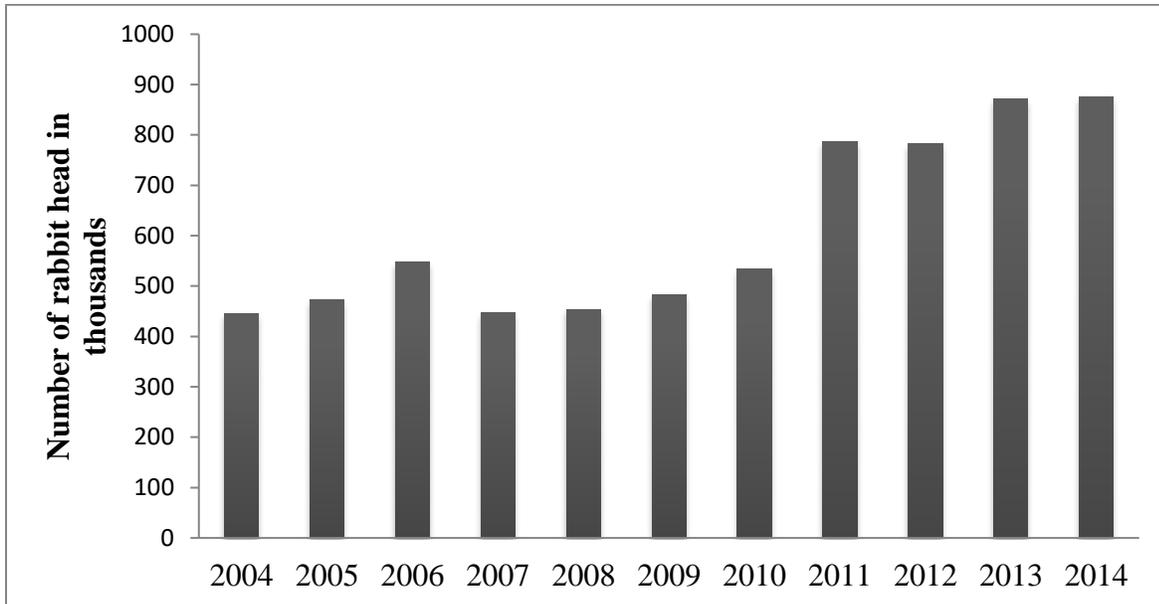
## CHAPTER 2: LITERATURE REVIEW

### 2.1 Overview of rabbit farming in Kenya

Rabbit farming is an ancient livestock farming activity all over the world. In Kenya, rabbit farming was associated with women and young boys who kept rabbits as a hobby (MoLD, 2004). In some areas of the country (such as Central and Western regions), rabbits were reared just for home consumption and to ensure food was sufficient in terms of protein. In recent years, rabbit farming has attracted a lot of interest which has resulted in the commercialization of the sector in various areas of the country. This may be attributed to nutritional and health value of the rabbit meat. The meat is categorized as “white meat” and is considered to have lower calories and higher protein content compared to that from other livestock such as cattle, goat and sheep (Mensah *et al.*, 2014). In addition, due to increasing population pressure on the available land, people are adopting farming enterprises that require small space but still remain profitable. Rabbit farming is one of options being adopted. Rabbit farming in Kenya has a potential of supporting programs aimed at poverty alleviation, improving on food security, creating more jobs for Kenyans and even acting as a foreign exchange earner.

Rabbit farming in Kenya has been improving over the last decade. Moreover, most producers participating in the industry have accrued good profits and at the same time formed farmer groups (Ministry of Livestock Annual Report, 2010). This is revealed by the increasing number of rabbits in the country. According to the Republic of Kenya (2015), the rabbit population increased from 534,000 in 2010 to 875,000 in 2014 (Figure 2.1). Rabbit meat production has also shown an upward trend. Meat production was estimated at 348 MT in 2014 valued at Kshs 139 million (US\$ 1.39 million) (Republic of Kenya, 2015). This was higher compared to 2010 when rabbit meat produced was estimated to be 233 MT valued at Kshs 93 million (US\$ 0.93 million). This

improvement in both the quantity and value of rabbit meat may be attributed to the publicity rabbit farming enterprise has received in the past (Ogola *et al.*, 2017).



**Figure 2.1: Number of Rabbits in Kenya**

**Source: FAOSTAT (2014)**

Several rabbit breeds are kept in Kenya. Mailu *et al.* (2013) found the most popular rabbit breeds in Kenya to be: New Zealand White, Californian White, Chinchilla, Dutch, Flemish Giant and French Ear Lopped. Other rabbit breeds kept in Kenya but not common included Angora, English Rabbit and Checkered Rabbit. The major factors that influenced the choice of rabbit breeds kept in Kenya were carcass weight and mothering ability. Based on these factors, Mailu *et al.* (2013) reckoned that the most preferred breeds by farmers in Kenya were New Zealand White and California White. The assessment of the SCP of the market for these rabbit species is the subject of this study.

## 2.2 The value chain concept

The term “value chain” refers to all events which are carried out to change a product from conception - which involves various levels of production including a combination of physical transformation and input of different producer services -, distribution, consumption to disposal after use (Kaplinsky and Morris, 2002). Value chain analysis (VCA) refers to the process of examining and understanding full range of activities required to make a product or service (Lugusa *et al.*, 2016). Fabe *et al.* (2009) documented three components of value chain analysis, that is, value chain mapping, accounting of flows and value chain modeling.

Value chain analysis is rapidly applied as a tool to establish linkages in agricultural commodities markets (Humphrey, 2005; USAID, 2006). Linkage to functional value chains comes with several benefits to farmers. According to McCormick and Schmitz (2001), enterprises with well-structured trading networks are always associated with increased trade thus high benefits for those involved.

Value chain analysis helps to identify lead firms in various industries. Farmers that are connected to a lead firm in a value chain are found to increase production rapidly. This is because the presence of lead firms encourages the transmission of best practices and helps in the provision of the required production advice such as good animal husbandry (Kaplinsky, 2000). While studying the value chain of Kenyan poultry industry, Okello *et al.* (2010) noted that farmers who were working with Kenchic (lead firm) on a contract basis were better off because they were accessing ready markets such as the Nakumatt supermarket and Kenchic appointed retailers and therefore earned higher prices compared to those who had no contracts. This suggests that linkage to major market actors such as lead firms and traders plays a key role in reducing information gap which is critical for the growth of any enterprise. McCormick and Schmitz (2001) further emphasize that the

moment a value chain is mapped it becomes very easy to examine various issues such as gender, the effect of the value chain on production and marketing and acquisition of knowledge on different combination of inputs.

Value chain mapping refers to the initial identification of actors and putting the traced product flows within the chain (including input supply, production, processing, and marketing activities) on a map. The objective is to give an illustrative representation of the identified chain actors and the related product flows. A mapped value chain includes the actors, their relationships, and economic activities at each stage with the related physical and monetary flows. Roduner (2004) noted that value chain mapping can result in a complex network of flows when studying some commodities.

## **2.3 Theoretical review**

### **2.3.1 Structure conduct performance (SCP) paradigm**

The "Structure-Conduct-Performance" (SCP) paradigm is a framework for determining the competition of different actors in a given market, studying the behavior of firms, and analyzing the achievement of a firm in producing benefits for its consumers (Thomas, 2012). SCP paradigm was formulated by Bain (1959). The framework was then modified by other researchers including Clodius and Muller (1961), Slatter (1968) and Bateman (1976). The aim of developing the framework was to help in analyzing allocation of industrial resources (Finlay, 2007). According to Ngigi (2008), the SCP framework focuses on the hypothesis of the cause-effect relationship among structure, conduct and performance aspects of an industry. In other words, the hypothesis means that the market structure (existing market environment) defines the conduct (behavior of

market actors in the environment) of market participants, which in turn results in market performance (Hai, 2003; Lee, 2008).

The SCP paradigm is based on two economic theories, i.e., price and industrial organization theories. Price theory provides various market structural variables namely, the degree of the seller and buyer concentration, the level of product differentiation, and the condition of entry (Lee, 2008). In other words, price theory helps in providing an explanation on the economic activities that create and/or transfer value in the marketing of commodities among various market participants (Weber, 2012). The theory of industrial organization aids in explaining the level of vertical integration, market maturity, government involvement in market activities, costs structure, diversification, and scale economies (Zorinah, 2015).

While developing the Institutional Analysis and Development (IAD) framework, Kirsten (2009) observed that the policy and governance environment plays a fundamental role in controlling production, exchange and distribution of commodities. Hence, the crucial role of any government is to provide rules that value chain actors must adhere to. In addition, the government has a role to enforce these rules to ensure a given market is fair to all actors (Williamson, 2000). It therefore means that market structure is the major component on which industrial organization is based. Therefore, many studies have adopted it to help in conceptualization.

The SCP paradigm is based on two competing hypotheses; the traditional-structure performance hypothesis and the efficient-structure hypothesis (Thomas, 2012). The traditional structure-performance hypothesis posits an inverse relationship between market concentration and degree of competition among different firms participating in the market (Edwards *et al.*, 2006). Shaik *et al.* (2012) noted that this hypothesis is based on joint profit maximization. Hence, in cases of an

oligopolistic market characterized with high seller concentration, firms are expected to accrue more profits when they merge. This is because market concentration allows firms to collude. Therefore, Thomas (2012) and Shaik *et al.* (2012) concluded that the traditional SCP hypothesis will only be supported if the positive relationship between market concentration (determined by concentration ratio) and performance (demonstrated by profit) is available.

The efficiency-structure hypothesis, on the other hand, postulates that a firm's performance and efficiency have a positive relationship (Edwards *et al.*, 2006; Laibuni and Omiti, 2014). According to Funke *et al.* (2012), market concentration arises from competition where firms incurring low cost increase gross margins by lowering output prices and increasing market share. It therefore means that the positive relationship between firm profits and market structure emerges from the gains made in market share by more efficient firms. The hypothesis therefore assumes that more efficient firms will accrue more profits just because they are efficient and not because of them having collusion with other firms in the market as stated by traditional structure-performance hypothesis (Thomas, 2012).

The definition of various components of SCP paradigm varies from one study to another depending on the commodity or sector, area under study and views of the researcher. The framework has three major components which include market structure, conduct and performance. Gichangi (2010) defines market structure as characteristics of the organization of a market which influence strategically the nature of competition and pricing within the market. Specifically, these characteristics include degree of seller and buyer concentration, conditions for market entry and exit. These industry characteristics are used to classify a market into perfectly competitive, monopoly, oligopoly, monopolistic or oligopolistic.

Market conduct refers to the competitive behavior that market participants use to market their commodities (Hai, 2003). More specifically, market conduct refers to market actors' strategies with respect to trading strategies such as buying, selling, transport, storage, information and financial strategy. Edwards (2006) lists the essential elements used to define market conduct as firm's pricing strategies, collusion, advertising, research and development. Mohamed *et al.* (2013) observed that these elements are as a result of market structure, that is, the success of a firm depends on the environment in which it operates in (structure). For example, advertising has an effect on the market structure since it can increase the entry barriers arising from product differentiation. In addition to structure, advertising has also an impact on market performance. Raible (2013) observed that advertising can be used as a persuasive tool which results in a higher demand for highly advertised commodities, and thus higher profits.

Collusion is the other behavior or conduct of firms and occurs in several ways. According to Raible (2013), horizontal collusion occurs where two firms in the same market cooperate with the purpose of acquiring market power so as to increase the gains through profits. The market power can be gained by raising market share or even devising strategies to increase barriers to entry. The other type of collusion is vertical. Shepherd and Wilcox (1979) noted that vertical collusion mainly occurs between given firms in a market and suppliers of a particular commodity. Market structure is usually affected by the type of collusion existing in a given market. For example, Barthwal (2004) observed that the existence of horizontal collusion which increases market concentration which decreases competition.

High investment in research and development (R&D) is another strategy used by firms to increase their competitiveness in a market. According to Furguson and Furguson (1994), R&D can occur in different ways in a given market including development of new commodities, changing product

quality to conform to consumer preferences, establishment of new markets and adopting cost-effective processing methods.

The third component of the SCP model is market performance. In the view of Bain (1968), market performance deals with the economic results that flow from the system in terms of its pricing efficiency and flexibility to adapt to changing situation etc. It represents the economic results of structure and conduct. The main elements of market performance are production efficiency, advanced technology, product quality and profit rate.

### **2.3.2 Methods of operationalizing SCP**

From Section 2.3.1 market structure is measured by the degree of buyer and seller concentration and barriers to entry and exit. Lee (2008) categorizes various elements of market structure into two: intrinsic and derived structural variables. According to Zorinah (2015), intrinsic structural variables are defined by the characteristics of products and existence of innovations and technologies concerning production and marketing. On the other hand, derived structural variables are defined by market agents and governments and include barriers to entry and exit, buyer and seller concentration, product differentiation and availability of information.

Empirically, most studies use concentration index as a proxy for market structure (e.g., see Hrazdil and Zhang, 2012; Pulaj and Kume, 2013). Market concentration is important because it determines the level of competition in the market and is defined by the existing number of firms and their shares in the market. According to Compte *et al.* (2002), research on market concentration as a proxy for market structure provides important insights for competition policy. Nellis and Parker (1992) additionally note that a worthwhile strategy of competition can be determined only after the type of the competition is assessed in the existing market.

Different methods can be used to determine market concentration. These include the  $n$ -firm Concentration Ratio ( $CR_n$ ), the Herfindahl-Hirschman Index (HHI), the Gini coefficient and Lorenz curve (Pulaj and Kume, 2013). The main elements considered in different methods are the number of firms and the size (or share) of the firm in a given market. Wesman (2005) points that the  $n$ -firm concentration ratio refers to the market share of either four (4-firm concentration ratio) or eight (8-firm concentration ratio) largest firms in a given market. Market share in this case is presented as a percentage of shares. Tiku *et al.* (2009) observes that  $n$ -firm concentration ratio helps to determine whether a market is dominated by few large firms or many small ones. Market concentration ratio has a range of 0-100 percent such that if a 100 percent is obtained, all the shares in the market are controlled by the  $n$ -largest firms (Bikker and Haaf, 2000). However, Pulaj and Kume (2013) noted that concentration ratio has a limitation in that there is no standard method of determining whether to focus on 4 or 8 firms. It therefore means the choice of 4 or 8 is arbitrary and varies with researchers.

Developed independently by Herfindahl (1950) and Hirschman (1964), Herfindahl-Hirschman index (HHI) is also used to determine the structure of a given market. It is computed by the summing up squared market shares of all the firms in the market giving a range of 0 to 10,000 (Pulaj and Kume, 2013). HHI values of less than 1,000 indicate low market concentration while values close to 10,000 show high concentration or a monopolistic tendency. Increases in the HHI indicate a reduction in competition and a rise of market power (de Vany *et al.*, 2003).

The Gini coefficient (GC) is used to measure market concentration especially in regard to inequality in resource distribution (Tiku *et al.*, 2009). It is computed by subtracting the product of proportion of sellers and proportion of sales from one. GC ranges from 0 to 1, where 0 implies perfect equality in distribution (suggesting a perfect market) while 1 indicates perfect inequality

(or presence of an imperfect market). The closer the GC is to zero, the greater the degree of equality and the lower the level of market concentration and hence more competition (Nwalem *et al.*, 2016).

The Lorenz curve represents income distribution by depicting the portion of income controlled by a given group of market actors (Onyango, 2013). A wide gap between the Lorenz curve and the line of perfect equality depicts high inequality in the distribution of market share thus high market concentration. This means that few firms control the market (Nellis and Parker, 1992).

The use of concentration ratio in SCP analysis has generated controversy among researchers (Zorinah, 2015). The ratio is argued to be deficient in that it only shows the market power of a few largest firms in the market (Tiku *et al.*, 2009). This means that the influence of other firms in the industry is overlooked. To avoid misleading results of using concentration ratio alone, the current study adopted a combination of methods to measure market concentration. These include concentration ratio, HHI, the Gini coefficient and the Lorenz curve.

Market conduct consists of elements such as firm's pricing strategies, advertising, collusion, and research and development (Teka, 2009). The definition of market conduct implies analysis of human behavioural patterns that are not readily identifiable, obtainable, or quantifiable. Thus, in the absence of a theoretical framework for market analysis, there is a tendency to treat conduct variables in a descriptive manner (Thompson, 2011).

Market performance is the product of market structure and conduct. Several elements are used to measure market performance. These include gross margin (proxy for profitability), marketing margin and efficiency (Haruna *et al.*, 2012) of which marketing margin is the most common. According to Demissie *et al.* (2015), marketing margin refers to the difference between the price paid by a consumer and the selling price of a producer of a given product or the difference between

retail and farm prices. Ghorbani (2008) observes that it is the portion of the price of a commodity that a producer does not get. A wide marketing margin indicates high prices for consumers and low prices for producers (Kariuki, 2011). It suggests some level of farmer exploitation by brokers or middlemen. In contrast, Gyimah (2001) argued that high market prices paid by consumers may not be wholly high as a result of profiteering behavior of brokers or retailers. Zorinah (2015) noted that there are several factors affecting marketing margin including changes in retail demand, farm supply and marketing input prices. Wohlgenant (2001) added that the degree of processing along the value chain, length of the value chain, the time a commodity takes to be sold, technical change and existing market power also affect marketing margin of a given commodity.

The firm gross margin is another measure of market performance. It is mainly used for measuring profitability of a given enterprise (Eronmwon *et al.*, 2014). It is calculated by determining the difference between the total revenue received and the variable costs associated with the trade commodity (Enibe *et al.*, 2008). Generally, the higher the gross profit margin the better. A high gross profit margin means that the value chain actor did well in managing his/her cost of sales (Ndung'u *et al.*, 2013; Bukar *et al.*, 2015). It also shows that the enterprise has more to cover for operating, financing, and other costs. The gross margin may be improved by increasing sales price or decreasing cost of sales. However, such measures may have negative effects such as decrease in sales volume due to increased prices, or lower product quality as a result of cutting costs.

Lastly, market performance is measured from the firm's efficiency or productivity. According to Abdou (2004), marketing efficiency is the difference between purchasing and selling prices of marketers compared to real marketing costs. Marketing costs are all expenses incurred in organizing and carrying out marketing process of a commodity (Babatunde and Oyatoye, 2005). All stages in a marketing chain (assembling, transport, storage, grading, processing, wholesaling

and retailing) involve expenses (Takele, 2010). The marketing efficiency estimates the financial marketing feasibility of executing any additional services. A positive signed estimate would justify application of such services and a negative estimate will indicate otherwise (Abdou, 2004; Haruna *et al.*, 2012; Zorina, 2015).

In agri-food commodity markets the marketing efficiency of a given commodity can be increased by availing market information to farmers, increasing the scale of operation (firm size), hiring knowledgeable and experienced personnel, and collectivization of market actors (e.g introducing actor groups or cooperatives) to increase bargaining power (Xaba and Masaku, 2012). The current study used the three measures of market performance (gross margin, marketing margin and marketing efficiency) to test the hypothesis of low rabbit market performance in the study areas.

## **2.2 Determinants of market performance**

To further understand how profitability from rabbit enterprise is affected by various factors, a regression was run. In any production process, making profit is usually the main objective. Therefore, it is important to study some of the factors affecting rabbit profitability from producer's perspective.

The gross margins used as a proxy for market performance can be influenced by several factors. Such factors can be categorized as actor-specific, farm-specific, market-specific and institutional factors. Actor-specific factors include age, education and experience of the actor, and his or her resource endowment including capital. Household size can influence marketing performance either positively or negatively. According to Dawit (2010), a large household size encourages consumption of commodities which are supposed to be marketed thus resulting in low market performance. However, Dor and Umar (2015) found contrary results in which the size of the

household had a positive influence on beef marketing in Nigeria. The authors explained that large households provide cheap labour, which eventually reduces marketing and production costs therefore increase in agricultural gross margins.

The empirical evidence on the effect of actor's education level on market performance is mixed. On one hand, education has a positive effect on market performance. For example, Zhou *et al.* (2008) observed that education enables market participants to acquire and process new knowledge and information which allows them to make sound and well-informed decisions towards promoting their enterprises. For example, Tedesse (2011) observed that market actors with formal education tended to be among early adopters of new agricultural technologies and innovations in Ethiopia. On the other hand, Lapar *et al.* (2002) found a negative relationship between numbers of years of formal education on market performance in that actors with more formal education were risk averse and thus opted for other livelihood options.

Farmer's age has also been found to have mixed effect on the gross margins. Omiti *et al.* (2006) observed that older farmers in Kenya had lower efficiency as compared to younger ones since they were often reluctant to adopt new innovations due to their risk adversity. This means that younger farmers are more agile and ready to take up new management practices and ideas that could improve the delivery of the marketed commodity. On the other hand, it has been found that increased knowledge and skills in agribusiness management such as production, operation, and management, increase with age (Guancheng *et al.*, 2015; Buleca *et al.*, 2016).

Experience in farming is a measure of the number of years a respondent has operated a given farm enterprise. Majority of studies indicate that farming experience positively influences an actor's sales output (Amos, 2007; Akinola and Adeyemo, 2008; Akinola and Adeyemo, 2013). This means

that the more the experience, the better use of available resource and hence the higher the output which translates to higher gross margins, *ceteris paribus*.

Firm-specific characteristics include distance of firm to market and the size or scale of operation. Mathenge *et al.* (2010) found that distance to market was negatively related to market performance (proxied by gross margins) of agricultural commodities in Kenya. This is because distance is directly related to transactions costs in form of transportation, marketing and access of market information. For example, Halloway *et al.* (2002) observed that increase in distance to the market caused Ethiopian dairy milk to spoil and increased marketing costs thus lowering market performance of the enterprise. In northern Kenya, Onyango (2013) found that actors involved in small ruminant production and marketing accrued small profit margins because of long distances to livestock markets. Therefore, based on the existing literature, distance to the market is negatively related to market performance.

Farm size has been found to be one of the factors that positively influence market performance (in terms of gross margins) of agricultural business enterprises (Olaoye and Rotimi, 2010). Some studies (e.g., Ndung'u *et al.*, 2013; Twinamasiko, 2014) report increase in profitability with increase in farm size. Large farm size enables an actor to produce a lot hence benefits from economies of scale. On the other hand, Gebregziabher (2010) and Bett *et al.*, 2012 found a negative relationship between land size and gross margins from poultry production in Ethiopia. This is because farmers with large farms paid little attention to production and marketing of poultry farming in Ethiopia. Therefore, the effect of land size on gross margins has mixed effects. The direction of the influence of land size depends on the land size requirement of a given agricultural enterprise.

The institutional factors likely to influence market performance include access to credit, access to information, government regulations and membership in groups. Access to affordable credit plays an important role in increasing gross margin aspect of market performance (Martey *et al.*, 2012). Omer *et al.* (2016) noted that access and utilization of credit by actors along the value chain increases their purchasing power, which allows value addition. Twinamasiko (2014) observed that availability of credit services enabled market participants to increase the size of their enterprises in Malawi, which enabled them to benefit from economies of scale. However, previous studies have confirmed that credit not properly managed could affect negatively the operations of marketers (Agbo and Usoroh, 2015; Ukwuaba, 2017). Unless properly monitored credit obtained by actors may get diverted to social issues rather than economic purposes for which the loans were approved in the first instance. If this happens repayment may be difficult with negative impacts on the profitability of the enterprise. Generally, based on the existing literature, credit access (especially when well managed) has a positive effect on market performance.

Collective marketing is critical for information and input access as well as in peer learning (Alene *et al.*, 2008). Similarly, participation in collective marketing groups increases motivation of farmers and other value chain actors to produce more (Gani and Adeoti, 2011). In Uganda, Nowakunda *et al.* (2010) found that group membership increased the bargaining power of banana farmers, which eventually improved market performance. Ayieko, Bett and Kabuage (2014) also found that there was a positive and significant relationship between being a member of a trader group and the marketing net return. They further stated that the increase was due to the access to marketing information, easy market access and benefits associated with being a member of these groups. The results agreed with those of Farayola, Akintaro, Yahya and Oni (2014) that found that being a member of a cooperative increased the marketing net return of cocoa marketers in Oyo

State in Nigeria. Generally, based on existing literature, collective action positively influences profitability of any agricultural enterprise.

Transaction costs represent major expenses involved in adding value or creating form, time, place and possession utilities to the marketing of agricultural produce and products. Studies have shown a negative relationship between transaction costs and market performance. For example, Osondu *et al.* (2014) found a negative relationship between transaction costs and market performance in their study of the determinant of market net returns of cabbage vegetables in Aba, Nigeria. Ayieko, Bett and Kabuage (2014) in Kenya, also observed that the marketing cost of indigenous chicken had a negative and significant effect on the marketing net returns at 1%. They further observed that an increase in the marketing cost led to a reduction in the marketing net returns by 16% holding all other factors constant. This result agrees with that of Dastagiri *et al.* (2013) who showed that marketing costs had a negative effect on the marketing net return of vegetables in India.

Government policy/regulation has mixed effects on profitability thus market performance of agricultural enterprises. Public policies/regulations designed to provide public goods can increase the profitability of private investments but can also have crowding-out effect on other value chain actors such as those providing inputs and other services (Mogues *et al.*, 2012). Benin *et al.* (2011) determined the returns to public spending on a large-scale extension service program in Uganda. It was evident that the policy had a positive relationship with returns from agricultural production. Lack of proper regulations has in the past led to low profits. For example, Adakaren (2014) found that lack of a proper regulation on standardization system of grading and measurement caused watermelon producers in Nigeria to experience low gross margins. Most of the measures are susceptible to manipulation to change volume so as to take the advantage of producers. Therefore, quantities vary within markets, across markets and from time in the market place. The use of

weighing scales is limited which explains why prices are determined by haggling between sellers and buyers. Some producers end up getting low prices for their produce resulting to low or negative profits.

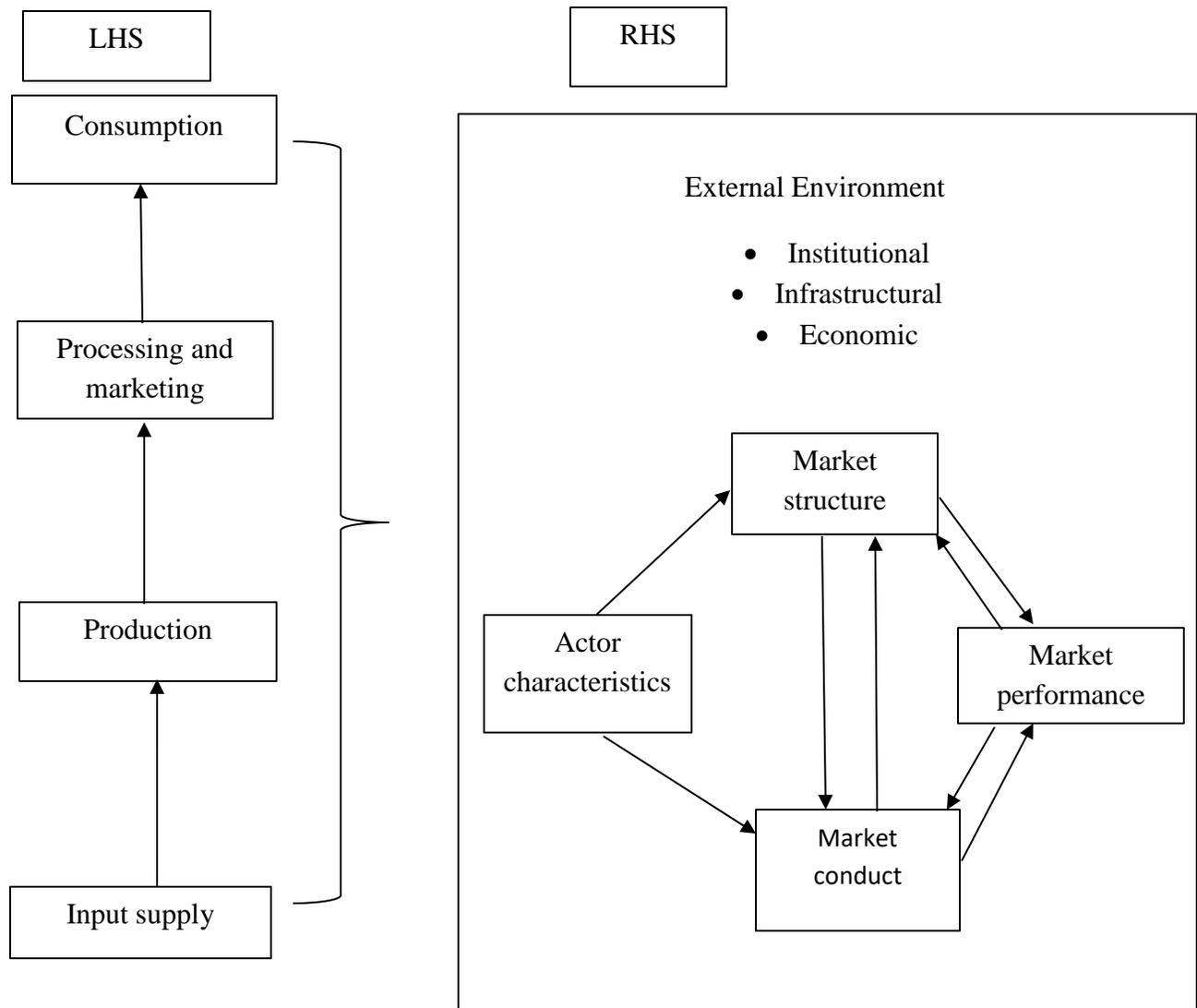
Although many studies have been undertaken on livestock marketing in Kenya (e.g., see Juma *et al.*, 2007; Aklilu, 2008; Oyuga, 2008; Hungu, 2013; Onyango, 2013; Kitavi *et al.*, 2015), there is virtually no information on the factors influencing the market performance of producers in the rabbit value chain in the country. This might be due to unavailability of relevant data on the subject. The current study therefore sought to fill the gap by providing insights on factors influencing rabbit market performance.

## CHAPTER 3: METHODOLOGY

### 3.1 Conceptual framework

In an increasingly complex economy like Kenya, where the exchange of information and goods is accelerating, trade of agricultural commodities is growing with multiple stakeholders (Baldwin, 2013). In this business environment, as explained by institutional economics (Ménard, 2012), competition for the end-customer takes place more among networks of firms and other actors than among individual firms. The analysis of competing firms, thus, has to go beyond the limits of each firm to incorporate the analysis of the entire chain(s) in which the firms participate (Christopher, 2010). In that regard, value chain analysis provides a way to identify the flow of commodities from production to final stage which is consumption and how such activities are related to SCP of a market. (Altenburg, 2007). Figure 2.1 presents such a relationship with the left-hand side (LHS) showing the different stages of the value chain while the right-hand side (RHS) indicates the interlinks of the elements of SCP framework.

As indicated in Figure 2.1, the different elements of SCP are linked to the stages of value chain. Activities along the value affect the performance of any market or business enterprise. For example, the price and volume of inputs used during production affects the gross margins (indicator of market performance). Additionally, cost of value addition at any stage of the value chain is a typical indicator of marketing efficiency. Therefore, participants along the chain try to minimize on costs so as to increase their market performance. The SCP framework explores differences in behavior (conduct) along the main processes within the firm, starting from its product/market selections back to raw materials sourcing, plus internal auxiliary activities when relevant. The number (concentration) of participants at each stage of the value chain can be used to determine the structure of the SCP framework.



**Figure 3.1: A schematic representation of the value chain and elements market structure, conduct and performance paradigm**

Source: Author

The RHS of Figure 2.1 presents the existing relationships among the three elements of the SCP. There are causal relationships from the structure, which determine the conduct, which together determine the performance (Negusse, 2009). Market structure influences conduct of actors in a given market. For example, high market concentration encourages firms to collude (Edwards,

2006). Market structure can also be influenced by market conduct. Market behavior of firms determines the competition level in the market. For example, when firms collude, competition which existed among them lowers lower because they control the market as one entity. Market structure and conduct together determine market performance (Figure 2.1). The market behavior of firms will determine whether or not they compete and whether they are acting innovatively to improve market efficiency. For example, informal association between even a small numbers of firms (collusion) can cause price distortions which can negatively influence the performance of some of actors along the value chain.

As presented in Figure 2.1, the operation of SCP framework is embedded in the external environment of any business. Some of the elements constituting external environment include institutions (standards, rules and regulations and contracts), infrastructure (roads, electricity, market structures) and the economic factors (such as inflation). For example, performance of any business will depend on availability of standards such as those required for grading and pricing. Availability of well-developed road networks, storage facilities and market infrastructure reduce transaction costs which in turn increases gross margins of enterprises.

### **3.2 Empirical framework**

In order to operationalize the SCP model described above, different analytical methods were employed to achieve the objectives of the study. These analytical methods are described by objective in the sections that follow.

#### **Objective 1: Mapping the rabbit value chain in Kiambu, Nyeri and Nakuru counties of Kenya**

The study adopted FAO methodology of functional and institutional analysis to map out the rabbit value chain in the three counties of Kenya (FAO, 2005a). The mapping started by creating an initial map of the value chain which gave a general idea of all participants in the continuum (institutional analysis) and how the various actors behave and relate with each other (functional analysis) (Fabe *et al.*, 2009). Functional analysis provided an explanation of main functions in the continuum including production, processing, and transport, and other support activities such as supply of inputs, extension and credit services (Rudenko, 2008). After the map was drawn, the flow of live rabbit and its products from one stage to the other were quantified in monetary terms thus elaborating the value chain with potential further analysis. The above procedure enabled the assessment of relative importance of different points in the value chain (FAO, 2006). The assessment of the constraints facing various actors in each segment of the chain were investigated from focus group discussions (FGDs), key informant interviews (KIIs) and the administration of a semi-structured questionnaire. In addition, opportunities available for rabbit producers and traders were investigated.

## **Objective 2: Assessing the structure of rabbit market**

To assess the structure of the rabbit market, the study used market concentration which is a critical proxy for market competition (Hrazdil and Zhang, 2012). The following measures were applied:

### **(i) Lorenz curve**

Lorenz curve was used to assess the magnitude of rabbit traders in a given market through a representation following Reuben and Mshelia (2011). Rabbit traders were counted cumulatively from the smallest sized firm to the largest in percentage along the horizontal axis and market shares were cumulated from the smallest sized firm along the vertical axis (Onyango, 2013). The resultant curve was then compared with a diagonal line or the line of equal distribution. The area between the Lorenz curve and the diagonal line is called area of concentration (Tiku *et al.*, 2009). In case of an unequal distribution of firms, the Lorenz Curve was supposed to move away from the diagonal line (Ferguson & Ferguson, 1994). The proportion of this area to the total area under the diagonal line gave the Gini coefficient.

### **(ii) Gini coefficient (GC)**

The Gini coefficient was used to determine the level of inequality in market shares among rabbit market actors. It was calculated as follows (Juma *et al.*, 2004):

$$GC = 1 - \sum XY \dots\dots\dots (3.1)$$

where GC is the value of the Gini coefficient, X is the proportion of rabbit sellers, and Y is the cumulative proportion of sales. GC values vary from zero to one (Bukar *et al.*, 2015). Values tending to approach zero indicate perfect equality of market participants while those approaching one indicate perfect inequality among actors (Zorinah, 2015).

**(iii) Herfindahl Hirschman Index (HHI)**

Herfindahl Hirschman index (HHI) was used to assess whether a large proportion of market share is held by few or many players. The Herfindahl Hirschman Index was calculated as follows:

$$HHI = \sum_{i=1}^N \left(\frac{X_i}{T}\right)^2 = \sum_{i=1}^N (S_{i=1})^2 \dots\dots\dots (3.2)$$

where  $S_i$  is the  $i$ th share of a firm in the market,  $T$  is the total market size and  $X_i$  is quantity produced by the  $i$ th firm. HHI range from close to zero to 10,000 (Ayieko, 2014). According to United States Department of Justice and Federal Trade Commission (USDOJFTC, 2010), a  $HHI \leq 100$  shows that the market is highly competitive, a  $HHI < 1500$  indicates that a market is not concentrated, a HHI between 1500 and 2500 indicates that the market is moderately concentrated, while a HHI greater than 2500 indicates that the market is highly concentrated.

**Objective 3: Assessing the conduct of rabbit market**

Market conduct refers to the behavior that firms engage in while participating in markets in which they sell or buy (Nzima, 2013). In the current study, market conduct was determined by focusing on variables such as the pricing strategies of firms, collusion, presence of licenses and advertising and promotion activities. Collusion was assessed by enquiring whether value chain participants formed groups so as to influence rabbit prices. The pricing strategies evaluated in the study were own-price setting, negotiations at either the firm gate or in the market, and price setting by suppliers.

#### **Objective 4: Assessing the performance of rabbit market**

To assess the performance of the rabbit market in Kiambu, Nyeri and Nakuru counties, the study used the following measures for different rabbit market actors; the gross margin, marketing margin and marketing efficiency.

##### **(i) Gross margin analysis**

Gross margin is one of the measures used to determine profitability of a firm. It is calculated by determining the difference between the total revenue received and the variable costs associated with the firm (Bosena *et al.*, 2011). In this study, gross margin was used to assess the returns gained by different rabbit market participants. It was calculated as follows;

$$GM_i = TR_i - TV_i \dots\dots\dots (3.3)$$

where  $GM_i$ ,  $TR_i$  and  $TV_i$  refer to gross margin, total revenue and total variable costs for  $i$ th firm respectively. A high gross margin means that the value chain actor did well in managing his/her cost of sales. It also shows that the enterprise has more to cover for operating, financing, and other costs.

##### **(ii) Analysis of marketing margin**

Marketing margin refers to the difference between the price the consumers pay and the price the producers receive (Demissie *et al.*, 2015). Marketing margin can also be said to be the difference between retail and farm gate prices (Gichangi, 2010). According to Teka (2009) the marketing margin is calculated in relation with price paid by consumer and is then presented in form of a percentage. A wide margin indicates high prices to consumers and low prices to producers thus

possibility of uncompetitive market. The total gross marketing margin (TGMM) was calculated as follows:

$$TGMM_i = \frac{PC_i - PP_i}{PC_i} \times 100 \dots\dots\dots (3.4)$$

where  $TGMM_i$  is the total gross marketing margin for  $i$ th actor,  $PC_i$  is the selling price rabbit trader to consumers for  $i$ th trader and  $PP_i$  is the buying price by rabbit trader from  $i$ th firm. A wide marketing margin indicate that consumers pay high prices while producers receive low prices from traders which is a sign of low market performance.

**(iii) Marketing efficiency**

The marketing efficiency estimates the financial marketing feasibility of executing any additional services (Haruna *et al.*, 2012).

$$Marketing\ efficiency = 100 - \left( \frac{Marketing\ cost}{Marketing\ margin} \times 100 \right) \dots\dots\dots (3.5)$$

A positive sign estimates would justify application of such services, making it efficient, and a negative estimate will indicate otherwise.

**Objective 5: Assessing factors influencing performance of rabbit market from producers’ perspective**

It is imperative to assess the drivers of rabbit producer’s market performance so as to provide insights to rabbit stakeholders on factors to consider during provision of interventions aimed at improving the sector. Ordinary Least Squares (OLS) and two-stage least squares (2SLS) regressions are the most common methods used to assess the different factors influencing market performance (Kainga, 2013); Isibor and Ugwumba, 2014). OLS regression is employed when the



where  $GM_i$  represents the rabbit gross margin of the  $i$ th household while  $\beta_i$  are unknown parameters to be estimated and  $\varepsilon_i$  represents the error term.

Asset index can be derived using monetary prices, unit values or weights obtained from software's such as the Principal Component analysis (PCA) or Multivariate correspondence analysis (MCA). Unit values often equate or weigh equally all the assets regardless of their differences in cost of acquisition or capital. Monetary prices are used where the prices of the assets are known. However, price use is biased owing to factors such as when the asset was acquired, depreciation, and appreciation of assets hence not giving a true reflection of a household's wealth or asset index. Therefore, this study follows Filmer and Pritchett's' (2001) recommendation of using PCA that aggregates several asset ownership variables into a single dimension (Moser and Felton, 2007). The Principal Component Analysis (PCA) method was applied in the calculation of the household asset index according to asset ownership. The PCA method helps to create a factor score, which is used for calculating an asset index for each household asset. Using Filmer and Pritchett's (2001) formula, the household asset index was computed as follows:

$$A_k = f_k \frac{a_{ik} - a_k}{s_k} \dots\dots\dots 3.12$$

where  $A_i$  is value of asset index for the  $i$ th household,  $f_k$  is the factor score coefficient for the  $k$ th asset obtained from PCA,  $a_{ik}$  is the value of the  $k$ th asset for the  $i$ th household,  $a_k$  is the mean of the  $k$ th asset over all households,  $s_k$  is the standard deviation of the  $k$ th asset over all households.

**Table 3.1: Description and hypothesized signs of explanatory variables in the profitability equation**

<b>Variable</b>	<b>Description</b>	<b>Expected signs</b>
lnGM	Natural log of rabbit enterprise gross margin	
HH_AGE	Age of household head in years	+
EDUC	Number of years in formal education	+/-
lnINCOME	Natural log of monthly household income in Kshs.	+
CREDIT	Access to credit (1=Yes; 0 otherwise)	+
WEALTHINDEX	Wealth index	+
EXTEN	Access to extension services (1=Yes; 0 otherwise)	+
TOTAL_RABBIT	Total number of rabbits	+
HHSIZE	Number of members in each household	+
GENDER	Gender (1=Male; 0 female)	+/-
GRPMEMBER	Group membership (1=Yes; 0 otherwise)	+

Source: Author's conceptualization, 2017

The **Age** of the household head was hypothesized to have a positive influence on the gross margin of the rabbit enterprise. This may be attributed to more experience old people have in farming as compared to the youth (Gbetibouo, 2009). In addition, older farmers have more resources at their disposal to enable them invest more in rabbit farming and marketing (Abdoulaye *et al.*, 2014).

Farmers' **education** measured in years of schooling was hypothesized to have a positive influence on gross margin. This is because farmers and other value chain agents with more years of schooling have a higher ability to accept new ideas and innovations hence are in a position to produce quality rabbits and supply them in high value markets thus earn high income (Gani and Adeoti, 2011).

**Income** was hypothesized to have a positive influence on the rabbit producers' gross margin. This means that the higher the income, the higher the ability of farmers participating in commercial rabbit enterprise which results in high revenue. High income allows for adoption of improved farming technologies (Moranga, 2016).

**Gender** can affect the profitability of the rabbit enterprise either positively or negatively. Asfaw & Ademassie (2004) noted that males have more access to farming and marketing information as compared to females thus able to adopt new technologies easily. On the other hand, women have higher ability of implementing farming activities because most of them remain at home and are engaged in farming (Nhemachena and Hassan, 2007). Therefore, gender can both positively and negatively influence gross margins from rabbit production.

**Credit** was hypothesized to positively influence rabbit producers' gross margin. This is because it enables farmers to purchase inputs when required. In addition, Otieno *et al.* (2010) found that credit access by the household head was vital for the improvement of small holder agriculture in Kenya.

Shiferaw *et al.* (2006) observed that membership in developmental groups allows uptake of new innovations through mobilization of resources and information sharing. Thus, group membership was expected to have a positive influence on the gross margin accrued by rabbit farmers.

**Wealth index** was used to represent wealth status of households. It was expected to positively influence the profitability of rabbit enterprise. This is because ownership of assets increases efficiency and capacity of production which eventually result in an increased productivity (Lawal *et al.*, 2011).

### **3.3 Study area**

#### **3.3.1 Rationale for choosing the study areas**

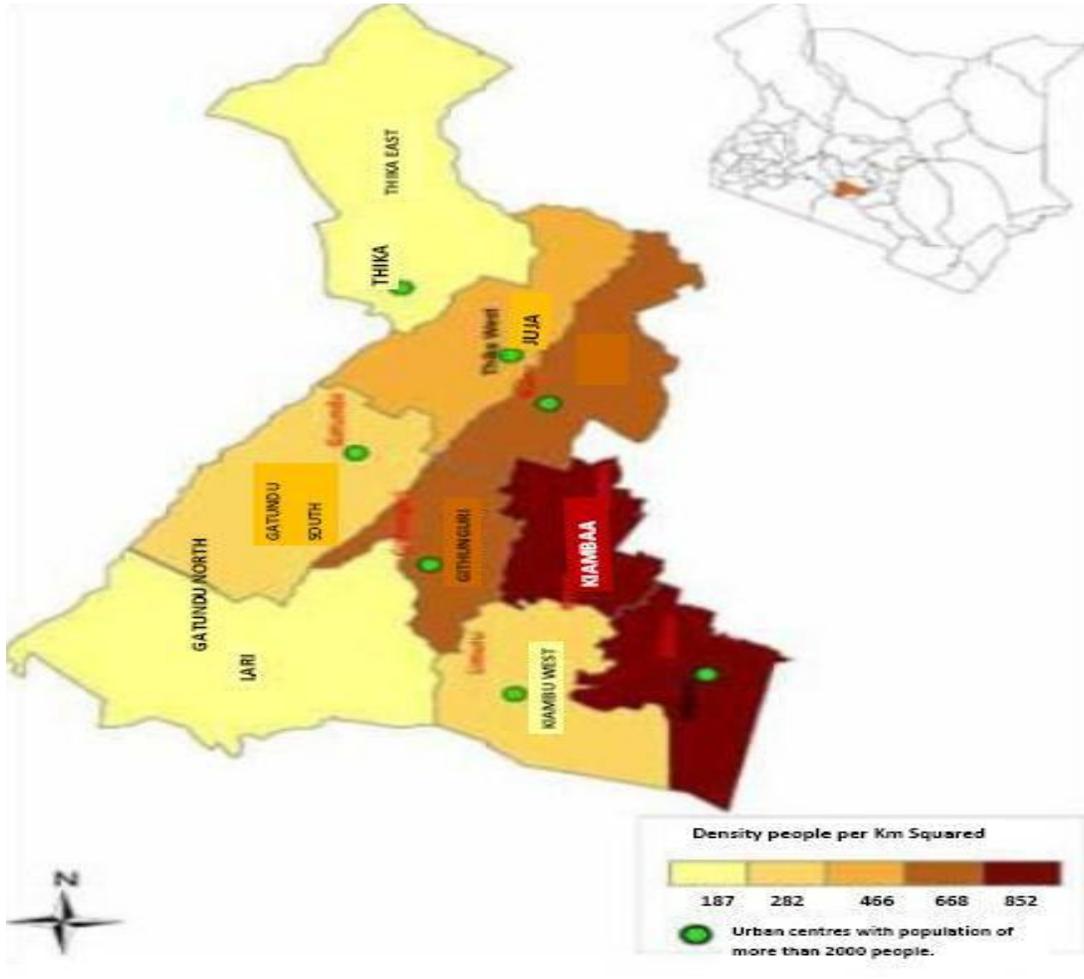
The study was conducted in three counties of central Kenya namely Kiambu, Nakuru, and Nyeri. These study areas were chosen because they had the largest number of farmers keeping rabbits (see Wanyoike *et al.*, 2013). Rabbit farming started being promoted by the National Agriculture and Extension Program (NALEP) in 2000 (Borter and Mwanza, 2010).

#### **3.3.2 Rabbit production in Kiambu County**

According to NAFIS (2011), rabbit farming started being commercialized in Kiambu County in 2004. This has led to Kiambu County government including rabbit farming in their County Integrated Development Plan (CIDP) of 2013-2017 as one of priority areas for investment (Republic of Kenya, 2015a). Accordingly, 100 rabbit farmers were trained every year through farm demonstrations, field days, farm visits and farmer consultations. Rabbit farmers are now benefiting from the rabbit factory established in Thika town. The construction of the factory and purchase of processing equipment were funded by the county government of Kiambu. The factory provides ready market for rabbits from farmers.

Kiambu County is one of the four counties in central Kenya and has 12 sub-counties, i.e Limuru, Kikuyu, Kabete, Lari, Gatundu South, Gatundu North, Githunguri, Kiambu, Kiambaa, Ruiru, Juja

and Thika Town (Figure 3). The sub-counties are then divided into 60 wards. In 2015, Kiambu)



**Figure 3.2: Map of Kiambu County, Kenya**

**Source: Republic of Kenya (2015a)**

Kiambu County is characterized by three different groups of soils namely high level upland soils, plateau soils, and volcanic footbridges soils. The fertility of the soils favors livestock farming and cultivation of different cash and food crops such as tea, coffee, horticultural products, pyrethrum, vegetables, maize, beans, peas, and potatoes. A bimodal type of rainfall is received in the county with long rains being experienced between months of March and May and short rains between months of October and November.

### 3.3.3 Rabbit production in Nakuru County

Nakuru County is found in the Rift Valley and has four sub-counties namely Nakuru, Molo, Subukia and Naivasha (Figure 4) and a total population of 1,603,000 in 2015 living 2,889km<sup>2</sup> (Republic of Kenya, 2015b). It borders Kiambu, Baringo, Kericho, Laikipia and Nyandarua counties (Figure 4). The temperatures range between 10 degrees Celsius and 20 degrees Celsius. The rains are of the bimodal type whereby the long rains are received in the month of April, May, and August while the short rains are received between the month of October and December. The mean annual rainfall is estimated to be 850mm per year which allows farmers in the county to practice both crop and livestock enterprises.

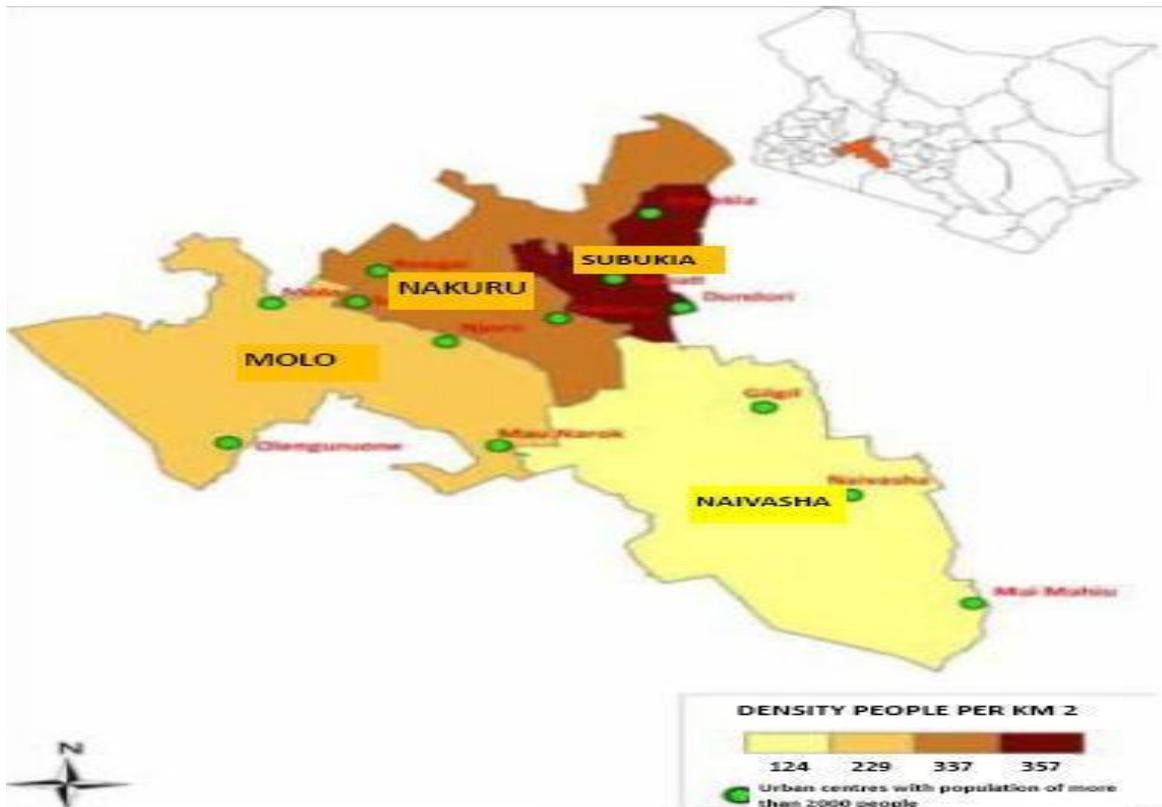


Figure 3.3: A map of Nakuru County, Kenya

Source: Republic of Kenya (2015b)

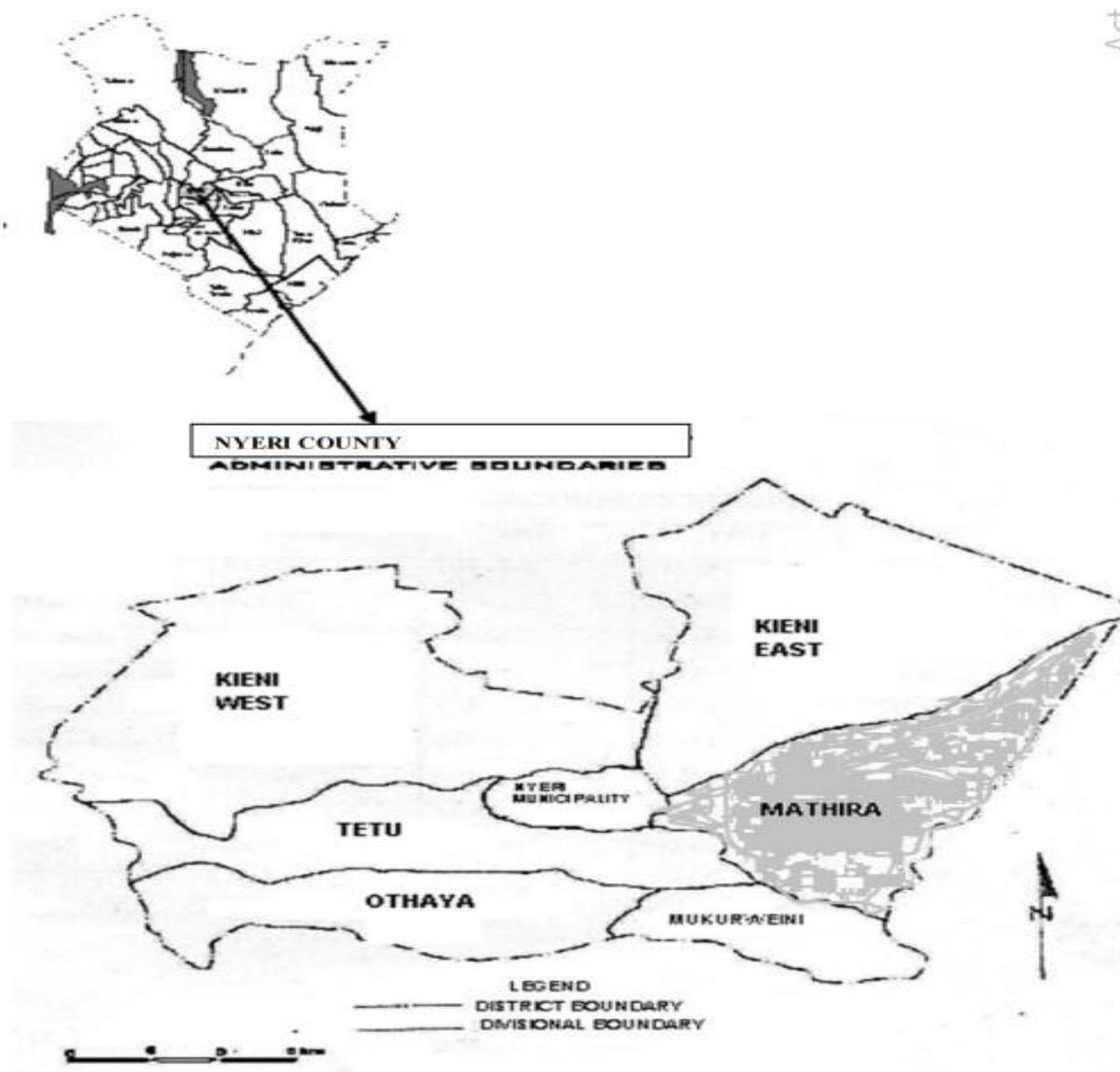
Nakuru is one of the counties with the highest number of farmers practicing rabbit farming in Kenya. As at 2014 the county had 1,830 households involved in rabbit rearing both on large and small scale (Mutisya, 2014). In addition, the county has prioritized rabbit farming as an important sector (Republic of Kenya, 2015b).

### **3.3.4 Rabbit production in Nyeri County**

Nyeri County is found in former Central Province of Kenya. It had a total population of 661,156 in 2015 and an area 3,356km<sup>2</sup> (Republic of Kenya, 2015 c) The county borders Kirinyaga to the east, Nyandarua County to the west, Muranga County to the south, Laikipia County to the north and Meru County to the north east (Figure 5). It is subdivided into 6 constituencies namely Nyeri Town, Othaya, Tetu, Kieni, Mathira and Mukurwe-ini (Figure 5).

Agriculture is the main economic activity in Nyeri County. The county is known for its high production of tea and coffee mainly for export. Livestock farming and horticulture are also practiced on large scale. The county receives bimodal rainfall with an average of 500 mm to 1500 mm during the short and long rains periods respectively. It is therefore favorable for a wide range of agricultural activities including rabbit rearing (Ngecu *et al.*, 2004).

According to (JICA, 2015), rabbit rearing has become an important economic activity in Nyeri County. Rabbit farmers in the area are supported by various stakeholders such as the County Government, development partners (such as World Bank and JICA) and universities (such as Jomo Kenyatta University of Agriculture and Technology [JKUAT]) through training. For example, Nyeri County in collaboration with the World Bank and JICA are in the process of establishing rabbit factory in Othaya Constituency.



**Map of Study Area**

**Figure 3.4: A map of Nyeri County, Kenya**

Source: KNBS (2013)

### **3.4 Research design**

The study used a deductive type of research design. This is because methods for analyzing SCP and value have been used in the past by several researchers (see Odero, 2012; Ayieko, 2014;

Zorina, 2015). A cross-sectional survey design was adopted for this study. Observations from different respondents were made at a single point in time. Information was collected by administering questionnaires to respondents (Orodho, 2003). Both qualitative and quantitative data were used to assess the SCP of the rabbit market in Kiambu, Nyeri and Nakuru counties.

### **3.5 Data type and sources**

#### **(a) Focus group discussions**

The study used focus group discussions (FGD) where a group of rabbit enterprise participants were selected to comment and discuss various issues concerning various activities along the rabbit value chain in Kenya. In this study, one FGD was done in each of the three counties. Each group consisted of 12 participants comprising of farmers, traders and local livestock staff members. A sample of questions were used as a guide in focus group discussions and probing questions were applied to get an in-depth understanding and knowledge on structure conduct and performance of rabbit industry in the three counties. The information from the FGDs was used to validate the questionnaire.

#### **(b) Key informant interviews**

Key informant interviews were conducted so as to collect information on rabbit marketing from a wide range of people for example, community leaders, representatives from Ministry of Agriculture, Livestock and Fisheries' in the sub-County, farmer/trader associations and managers from Kenya Rabbit Breeders Association. The interviews enabled getting first-hand information about rabbit enterprise in areas of study thus helped in validating of the questionnaire.

## **(c) Rabbit producer questionnaire surveys**

### **(i) Sample size determination**

The current study used mini census to determine sample size of 229 and 230 of rabbit and non-rabbit keepers respectively. The method was adopted because the population of rabbit keepers in the three counties was small. Israel (1992) notes that a census eliminates sampling error and provides data on all the individuals in the population.

### **(ii) Sampling Procedure**

The study employed a multistage sampling procedure. This sampling procedure has the advantage of facilitating sequential sampling across two or more hierarchical levels (Cochran, 1977). In addition, the technique has been found out to be cost effective and facilitates the collection of data from geographically dispersed groups when face-to-face contact is required (Sedgwick, 2015). Three counties (Kiambu, Nakuru and Nyeri) were purposively selected because they had the highest number of farmers involved in rabbit keeping (Serem *et al*, 2013 citing MoLD, 2010). The next step involved listing all the sub- counties in each of the three counties. One sub-county was selected from each county on the basis of having the highest rabbit population. One ward with highest number of rabbits was selected from the selected sub-counties in each county. Stratified sampling method was applied where respondents were split into two groups that is, rabbit and non-rabbit farmers. Each stratum was sampled as an independent sub-population. A list of all farmers who practiced rabbit farming was drawn with the help of community elders. A second list of farmers that did not keep rabbits was also obtained with the help of local leaders and administrators (namely, village headmen and area agricultural extension officers, respectively). The lists formed sampling frame for the study. The respondents were then sampled from the two lists using

probability proportionate to size sampling method. A total of 459 farmers were sampled in the three counties.

A pre-tested semi-structured questionnaire was administered through face-to-face interviews. Among rabbit keepers, only the heads of the households were interviewed because they are the ones who were involved in making decisions concerning the enterprise. A total of 459 questionnaires were used to capture information from both rabbit and non-rabbit farmers in all the three counties. The information included socioeconomic characteristics such as gender of household head, education level, marital status, the number of years of experience in rabbit enterprise, occupation, inputs sources, and availability of services such as extension, credit and veterinary and main source of income. The questionnaire was also used to capture data on production such as the breeds and number of rabbits being reared, the type of feed and the costs involved in production. Marketing information included selling price, market, buyers of rabbits, transaction costs involved in marketing, access to market information, membership and benefits from groups.

#### **(e) Trader interviews**

In order to get marketing information, 80 traders were identified through referrals from rabbit producers for face-to-face interviews owing to lack of a valid sampling frame of traders/brokers. For the interviewer to trace the traders/brokers involved in the enterprise, farmers were requested to recall those whom they sold rabbits to, or refer the interviewer to them for the administration of trader questionnaire. The sampling of brokers and retailers was quite challenging because majority of them were not residing in areas of study. I had to book appointments with them for the interviews.

The traders/broker questionnaire had information on both socioeconomic and marketing features of traders/brokers. Socioeconomic information included gender, education level, marital status, number of years of experience in rabbit marketing, main occupation, and main source of income. Marketing information had both buying and selling prices, buyers and sellers of rabbits, value addition, costs incurred such as taxes, licenses, market information accessibility, price setting, availability of credit and membership to groups/associations.

### **3.6 Data analysis**

#### **3.6.1 Data capture and analysis**

The data from FGD were analyzed qualitatively. This is where answers for each question of the FGDs were rearranged so that all the answers for each question were put together. Main ideas from the answers for each question were then noted. The same procedure was applied in analyzing data from KIIs. The insights from both the FGD and KII were then used to develop questionnaire for the main survey and mapping of the rabbit value chain.

The questionnaire data were captured in Statistical Package for Social Sciences (SPSS) VERSION 22. STATA version 14 was used to compute descriptive statistics such as means, standard deviation, and frequencies and estimate 2SLS model. Data for SCP were computed using STATA software. The results were presented in tabular and graphical formats.

The information for value chain mapping was captured by FAO VCA-Tool version 3.1 which is Software for Value Chain Analysis (FAO, 2013). The software helped to build a quantitative database of each of the value chain stages, thus allowing individual analysis of each rabbit chain actor.

### **3.6.2 Diagnostic tests**

To determine the robustness of the model, several tests were carried out. The diagnostic tests include:

#### **(i) Multicollinearity**

To test for multicollinearity, pairwise correlation of the independent variables was carried out. Variance Inflation Factors (VIF) was also adopted because some authors such as Gujarati (2007) observed that pair wise correlations cannot be solely dependent on to produce an infallible guide to multicollinearity. According to Greene (2002), variables with VIF greater than 5 depict high multicollinearity. However, Gujarati (2004) points out a rule of thumb that any variable with VIF value more than 10 is highly collinear. In the current study, independent variables that were selected to be included in the model produced VIF values ranging between 0.061 and 1.784 which is a clear indication that multicollinearity did not exist (Appendix III).

#### **(ii) Heteroscedasticity**

The Breusch-Pagan was used to determine if the variance across the error terms was constant. As a rule of thumb, if the test is statistically significant, the null hypothesis is accepted. This therefore means there is no constant variance and hence the presence of heteroscedasticity. The results from the test indicate the absence of heteroscedasticity (see Appendix III).

## CHAPTER FOUR: RESULTS AND DISCUSSION

### 4.1 Socio-economic characteristics of rabbit and non-rabbit farmers in Nakuru, Kiambu and Nyeri

Table 3 presents details of the socioeconomic attributes of rabbit and non-rabbit farmers in Nakuru, Kiambu and Nyeri Counties. The average age in years for rabbit farmers was about 50, 51 and 58 in Nakuru, Kiambu and Nyeri Counties. However, non-rabbit keepers were found to have a lower mean age of 49, 45 and 50 for household heads in Nakuru, Kiambu and Nyeri. This difference shows that rabbit enterprise is for the elderly. This finding is in agreement with Ogolla *et al.* (2017) who reported that majority (more than 70%) of rabbit farmers in Kenya were aged 50 years and above. Further, as observed by IFOAM (2013), the preference of rabbit production by older people may be due to their preference for health benefits associated with consuming white meat. In addition, it is a less demanding enterprise in terms of energy expenditure and capital outlay for senior citizens.

Rabbit farmers in Nakuru had the highest number of years of education with an average of 9.88. followed by Kiambu and Nyeri at 9.3 and 8.81 respectively. This indicated that literacy levels among rabbit farmers are higher than the national average of 6 years (KNBS and ICF Macro, 2010). Non-rabbit keepers in the three counties had more years of education compared to rabbit keepers. The finding is also in line with a survey by KDHS (2014) where it was found that 88 percent of women and 92 percent of men are literate. The difference in education may imply that

**Table 4.1: Socioeconomic characteristics of both rabbit and non-rabbit farmers**

Variable	Nakuru		Kiambu		Nyeri	
	Rabbit farmers	Non-rabbit farmers	Rabbit farmers	Non-rabbit farmers	Rabbit farmers	Non-rabbit farmers
<b>Age</b>	49.91 (10.51)	48.89 (42.80)	51.18 (19.54)	44.54 (0.28)	58.31 (0.32)	49.71 (13.52)
<b>Education</b>	9.88 (8.10)	10.82 (3.26)	9.3 (2.87)	10.21 (6.12)	8.81 (2.24)	9.78 (3.92)
<b>Household size</b>	4.44 (1.68)	3.59 (0.91)	3.48 (1.68)	3.43 (4.58)	4.18 (1.07)	3.25 (1.73)
<b>Land size</b>	2.01 (1.80)	1.71 (2.40)	1.56 (1.21)	1.42 (0.96)	2.48 (2.75)	1.94 (1.67)
<b>Asset index</b>	17.41 (13.35)	17.86 (12.67)	15.59 (7.25)	18.51 (9.61)	16.57 (18.10)	17.52 (15.54)
<b>Distance to market</b>	2.69 (2.37)	3.56 (1.62)	2.49 (1.74)	4.09 (1.05)	2.81 (1.63)	2.89 (3.15)
<b>Gender</b>	0.79 (0.41)	0.77 (0.39)	0.68 (0.13)	0.83 (0.33)	0.61 (0.41)	0.75 (0.18)
<b>Farming main activity</b>	0.74 (0.89)	0.66 (0.84)	0.68 (0.50)	0.62 (0.51)	0.94 (0.31)	0.64 (0.20)
<b>Group membership</b>	0.64 (0.25)	0.39 (0.17)	0.52 (0.17)	0.43 (0.50)	0.88 (0.64)	0.46 (0.36)
<b>Credit access</b>	0.29 (0.34)	0.28 (0.34)	0.32 (0.67)	0.33 (0.62)	0.44 (0.29)	0.39 (0.15)
<b>Extension access</b>	0.36 (0.15)	0.19 (0.08)	0.26 (0.22)	0.30 (0.14)	0.13 (0.11)	0.18 (0.06)

Source: Author's survey, 2017

majority of non-rabbit keepers were formally employed thus earned higher incomes hence did not require to engage in other activities to sustain themselves. Due to lower education, it was prudent for rabbit keepers to engage in other income generating enterprises such as keeping of rabbits to provide for their basic needs such as food and clothing.

The average household sizes for rabbit keepers for Nakuru, Kiambu and Nyeri were 4.44, 3.48 and 4.18 persons respectively. This finding is similar to Kenya's national average household size of 3.9 persons (KNBS and ICF Macro, 2014). Compared to rabbit owners, non-rabbit farmers had lower household sizes with an average of 3.59, 3.43 and 3.25 for Nakuru, Kiambu and Nyeri respectively. These findings suggest that rabbit farmers had many dependants thus the need for income diversification so as to cater for the needs of large household sizes. The result agrees with Moiruri (2015) who pointed out that farmers with larger household sizes have to find out other ways and means to take care of their household members.

The study areas were characterized with small pieces of land which is a common trend for smallholder famers in Kenya. Rabbit farmers in Nakuru, Kiambu and Nyeri had an average of 2.01, 1.56 and 2.48 acres respectively. However, it was clear from the respective counties that non-rabbit keepers had smaller pieces of land as compared to rabbit keepers. This result shows that rabbit farmers had enough land to grow fodder for their rabbits.

Household asset index among rabbit keepers was highest in Nakuru with an average of 17.41. Nyeri had an average of 16.57 while Kiambu had an average of 15.59. That for non-rabbit keepers was 17.86, 18.51 and Nyeri 17.52 for Nakuru, Kiambu and Nyeri Counties respectively. Non-rabbit farmers therefore have a higher asset index than their counterparts who practice rabbit farming. Therefore, non-rabbit farmers appear to be better off than rabbit farmers. The lower

household asset index among rabbit keepers reflect their poverty levels thus the need to engage in diversified economic activities such as rabbit farming so as to widen their sources of basic needs such as income and food.

On average, rabbit farmers in Nyeri covered the longest distance to market at 2.81km compared to 2.61 and 2.49 km in Nakuru and Nyeri Counties respectively. Interestingly, non-rabbit farmers in all counties covered longer distances to markets at an average of 3.56, 4.09 and 2.89 in Nakuru, Kiambu and Nyeri respectively. These findings imply that rabbit farmers had an upper hand in accessing bulky inputs such as feeds and market for the produce thus their adoption of the enterprise. Longer distances covered by non-rabbit keepers might have been a disincentive for them to start keeping rabbits.

More than a half of the rabbit farmers in the three study areas were men with Nakuru having the highest proportion of 79% followed by Kiambu 68% and then Nyeri 61%. The difference in gender could be explained by the fact that rabbit farming is one of the economically lucrative farming enterprise thus tend to attract more men than women (World Bank, 2009). In addition, gender disparity may be as a result of cultural believe that rabbit farming is meant for men and boys (Borter and Mwanza, 2011). In Kiambu and Nyeri Counties, more women were involved in rabbit farming compared to those in Nakuru. This may be attributed to training programs especially those targeting women in the two areas initiated by the respective county governments and other stakeholders as reported by farmers during FGDs.

More than half of both rabbit and non-rabbit farmers depended on agriculture as the main source of income. This may be attributed to good climatic conditions found in the study areas which favor agricultural production. The proportion of rabbit farmers who dependent on farming as main

activity was 74, 68 and 98 percent for Nakuru, Kiambu and Nyeri counties respectively. On the other hand, that of non-rabbit farmers was 66, 62 and 64 percent for Nakuru, Kiambu and Nyeri counties respectively. Therefore, it is clear that higher proportion of rabbit farmers depended on farming as the main activity as compared to non-rabbit farmers. This may be explained by the larger tracts of land owned by rabbit farmers thus had enough space to start keeping rabbits and also acted as a source of fodder.

More than half of rabbit farmers were members of developmental groups with Nakuru having 64 percent, Kiambu 52 percent and Nyeri 88 percent (Table 3). Contrary to these findings, less than 50 percent of non-rabbit keepers had membership in formal groups. The need for training on better rabbit husbandry practices might be the reason for higher number of rabbit farmers joining developmental groups. Davis *et al.* (2012) observed that farmer groups are increasingly being used by agricultural extension providers such as county governments to train a wider audience through Farmer Field School (FFS), a strategy which has increased adoption of new farming enterprises such as rabbit farming.

#### **4.1.2 Important socioeconomic characteristics of rabbit and non-rabbit farmers in Nakuru, Kiambu and Nyeri**

Table 6 presents the results of t-test undertaken on means of socio-economic characteristics of rabbit and non-rabbit farmers. For example, rabbit and non-rabbit farmers in both Kiambu and Nyeri counties were significantly older than non-rabbit farmers. However, non-rabbit farmers had significantly more educated household heads than rabbit keepers in all the three counties. In addition, rabbit farmers had significantly larger household sizes than non-rabbit farmers.

**Table 4.2: Important socioeconomic characteristics of rabbit and non-rabbit farmers in Nakuru, Kiambu and Nyeri counties**

Variable	Nakuru			Kiambu			Nyeri		
	Mean F	Mean NF	t-test	Mean F	Mean NF	t-test	Mean F	Mean NF	t-test
Age	49.91	48.89	-0.49	51.18	44.54	-2.31***	58.31	49.71	-1.85*
Education	9.88	10.82	1.79*	9.3	10.21	2.97***	8.81	9.78	4.10***
Household size	4.44	3.59	-3.54***	3.48	3.43	-0.13	4.18	3.25	-2.79***
Land size	2.01	1.71	-0.68	1.56	1.42	-0.55	2.48	1.94	-1.07
Asset index	17.41	17.86	0.55	15.59	18.51	2.57*	16.57	17.42	1.40
Market distance	2.69	3.56	2.61***	2.49	4.09	4.10***	2.81	2.89	0.57
Gender	0.79	0.77	-0.38*	0.68	0.83	-2.81**	0.61	0.75	-2.26**
Farming	0.74	0.66	-1.28	0.68	0.62	-0.54	0.94	0.64	-4.84***
Group membership	0.64	0.38	-3.67***	0.52	0.44	2.85**	0.88	0.46	1.70*
Extension access	0.36	0.19	-2.56*	0.26	0.30	0.45	0.13	0.18	2.24
Credit access	0.29	0.28	-0.11	0.32	0.33	0.19	0.44	0.39	2.19**

NB: the asterisk denotes significance level; \* at 10%, \*\* at 5% and \*\*\* at 1%; F denotes farmer and NF non-farmer

Source: Author's Survey, 2017

In all the three counties, non-rabbit farmers were relatively wealthier compared to their rabbit farming counterparts depicted by a significantly higher mean household index.

Non-rabbit keepers were travelled significantly longer distances to market than rabbit farmers in Nakuru and Kiambu counties. The fact that there was no statistical significant difference in distance to market between rabbit and non-rabbit keepers in Nyeri suggest these households were from almost the same neighbourhood.

There were significantly more male-headed non-rabbit farming households in Kiambu and Nyeri counties. In addition, while the proportion of households that depended on farming as main activity was higher among rabbit farmers relative to non-rabbit farmers, difference was statistically significant only in Nyeri county ( $t=-4.84$ ;  $p=0.001$ ). The proportion of rabbit farmers who were members of groups was statistically higher than their non-rabbit farming counterparts in all the three counties (see Table 6). Only Nakuru and Kiambu showed a statistical difference in proportion of households who accessed extension services between rabbit and non-rabbit keepers.

## 4.2 Value chain analysis of rabbit industry in Nakuru, Kiambu and Nyeri Counties of Kenya

Figures 6, 7 and 8 provide a detailed flow of rabbit and its products along the supply/value chain. The typical number of intermediaries ranged between one and four, indicating that some rabbit value chains are fragmented and therefore incur high transaction costs (Shiferaw *et al.*, 2007; 2008).

### 4.2.1 Rabbit production

The most common type of rabbit production in all the three study areas was small scale with 68 percent of farmers keeping less than 10 rabbits (Table 5). This finding is in line with Hungu *et al.* (2013) and Serem *et al.* (2013) who found that majority of rabbit farmers in the Kenya practised small-scale rabbit farming.

**Table 4.3: Number of rabbits kept in the three counties**

No. of rabbits	County			Pooled
	Nakuru	Kiambu	Nyeri	
0-2	25.6	29.9	36.3	29.8
3-10	32.8	40.7	30.1	38.2
11-50	24.4	21.2	16.6	19.3
>50	17.2	8.2	17.0	12.7

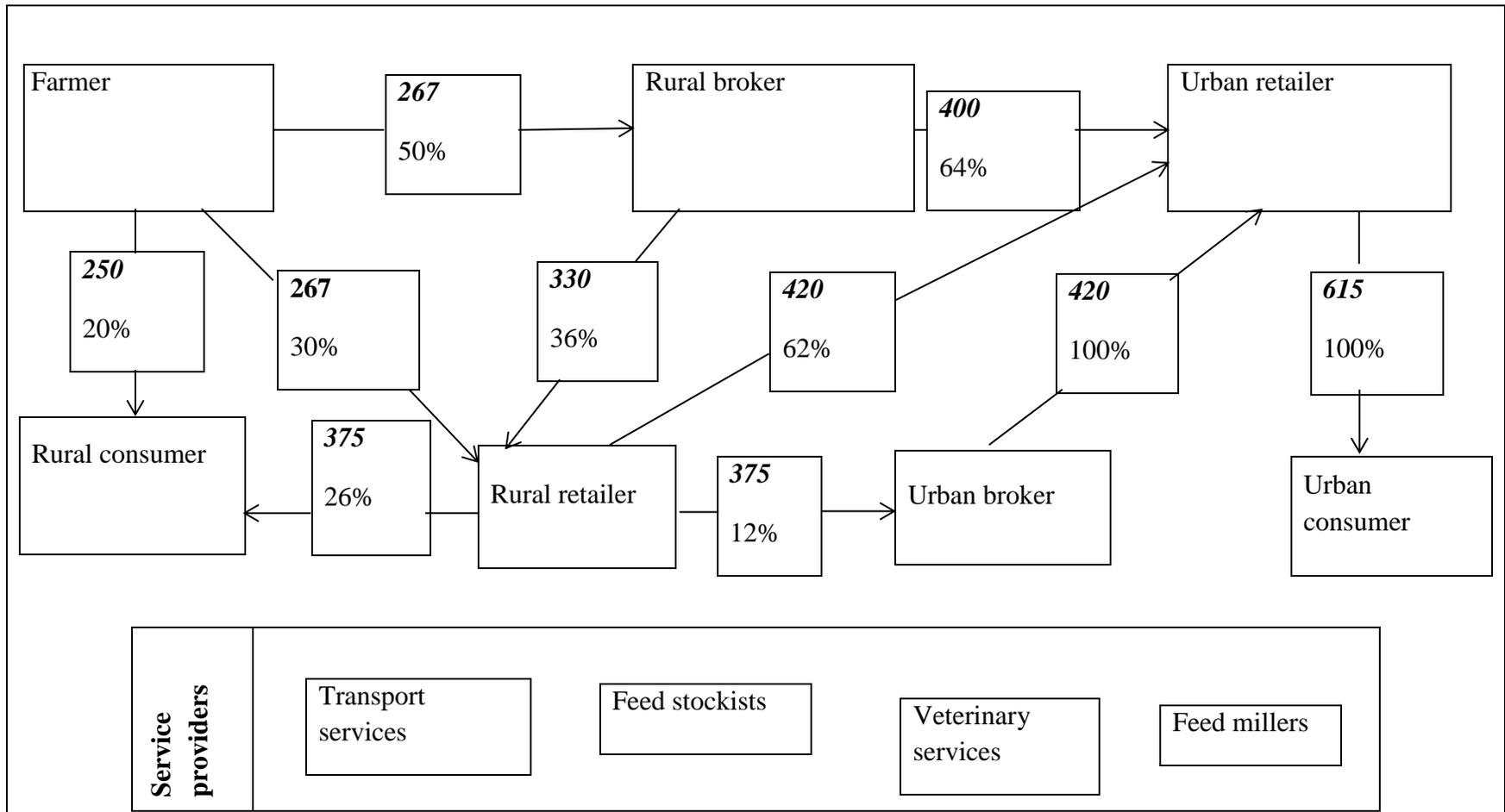
Source: Author's survey, 2017

About 60 percent of farmers in the three counties obtained their parent stock from neighbors. In Nyeri County, only 5 percent of the respondents purchased their parent stock from Wambugu multiplication station (the only rabbit multiplication center in the county). The low proportion of farmers acquiring their stock from the station was attributed to high prices of the improved rabbit breeds. In Nakuru County, the County Government rabbit breeders especially for the New Zealand variety for sale to other farmers in the area. Farmers purchased local breeds at an average price of Ksh. 400 while improved breeds sold at Ksh. 1,250 (Table 6). Improved rabbit breeds in Kiambu County were reported to be purchased from Ngong Veterinary Farm and farmers.

**Table 4.4: Rabbit breeds and their average market prices in the three study counties**

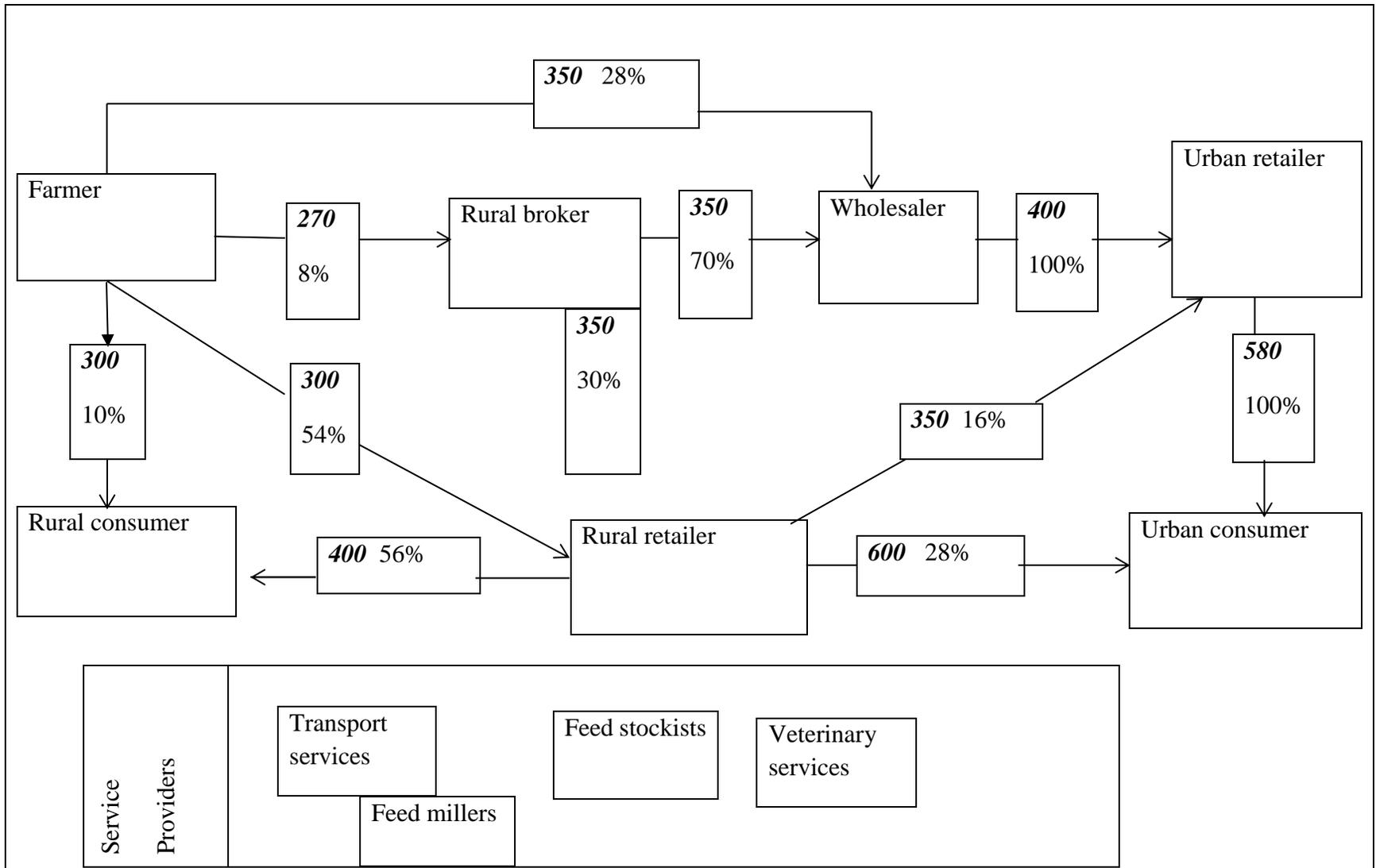
<b>Average price/head in Kshs.</b>				
<b>Breed/Race</b>	<b>Nakuru</b>	<b>Kiambu</b>	<b>Nyeri</b>	<b>Pooled</b>
Local	425	351	389	401
Pure breed	1500	950	1325	1250

Source: Author's survey, 2017



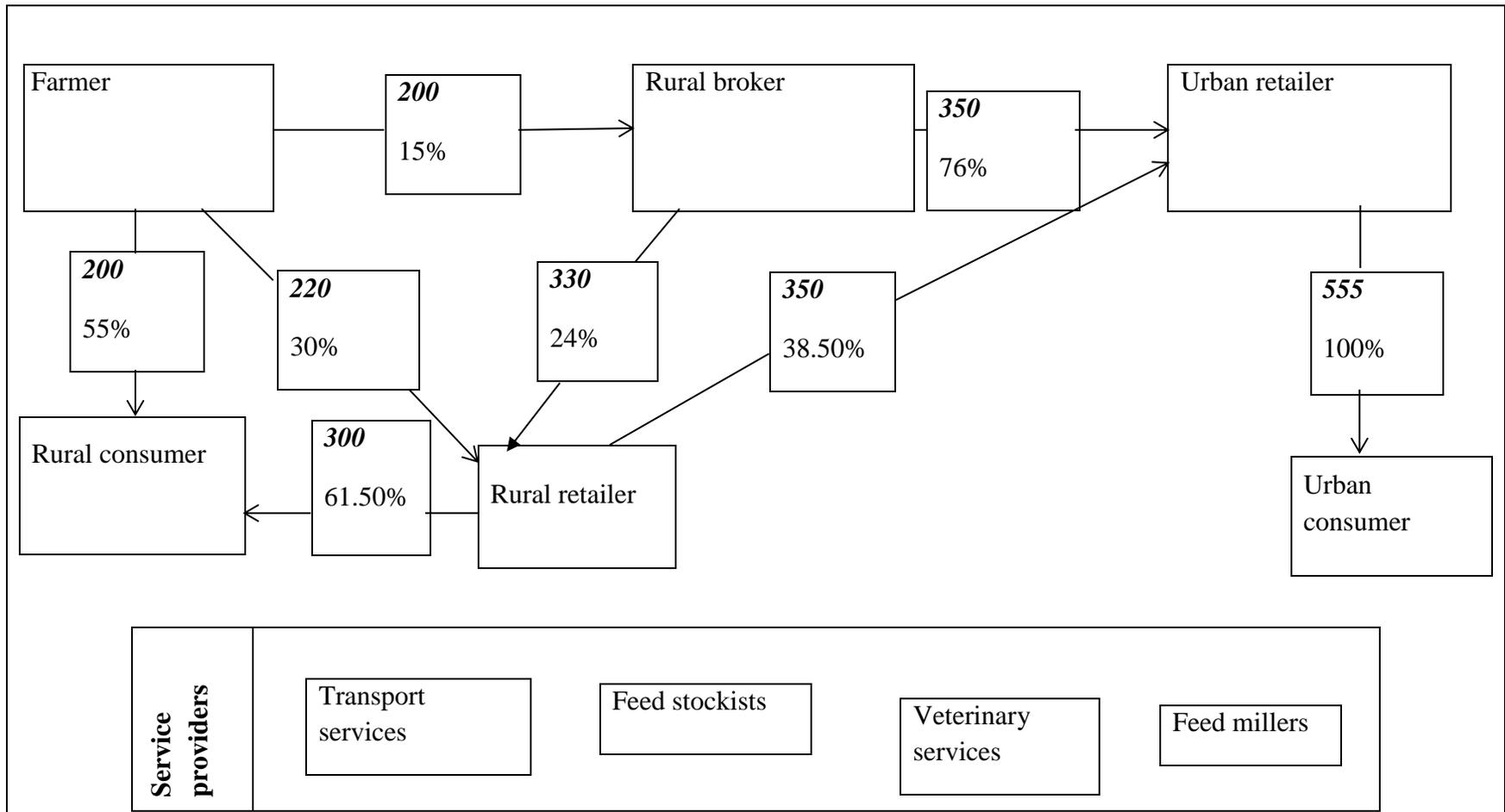
**Figure 4.1: The Rabbit Value Chain in Nakuru, Kenya**

Source: Author's survey, 2017 NB: Numbers italics and bold are prices in Ksh per kg of rabbit traded while those not in italics are proportions of number of rabbits traded at each stage of the value chain



**Figure 4.2: The rabbit value chain in Kiambu County, Kenya**

Source; Author's survey, 2017 NB: Numbers in italics and bold are prices in Kenyan shillings per kilogram of rabbit traded and those not italics are proportions of number of rabbits traded at each stage



**Figure 4.3: The rabbit value chain in Nyeri County, Kenya**

Source: Author's survey, 2017

NB: Numbers highlighted in italics and bold are prices in Kenyan shillings per kilogram of rabbit traded and those not in italics are proportions of number of rabbits traded at each stage

From the household survey and focus group discussions, it was evident that rabbit keeping was carried out by almost all members of the household. This was different from the past where activities related to rabbit keeping were associated with young boys (Serem *et al.*, 2013). This implies that the enterprise is gaining importance among all people especially adults as a source of income and food. All rabbit farmers interviewed in the three counties indicated that they consume rabbits because of their nutritional benefits.

Majority (85%) of the farmers in the three study areas fed their rabbits on locally available materials such as wild grasses (weeds, legumes), indigenous plants and herbs, cultivated forage (hay), farm crop residue (such as potato vines), agricultural by-products and kitchen waste. These materials were reported to be easily accessible by farmers from their own farms. Some farmers in all the study areas reported to be mixing locally available feeds with those bought from feed shops. This was done to reduce the cost of solely depending on manufactured feeds which were viewed as expensive by majority of the farmers surveyed. One kilogram of rabbit pellets feed from the shops was sold at an average of Ksh. 50, 53.28 and 59.61 for Kiambu, Nakuru and Nyeri counties respectively. The difference in prices may be attributed to proximity animal feed millers.

The main reason for rearing rabbits was for commercial purposes (Table 4.7). This finding agrees with that of Mailu *et al.* (2014) who found that about 53 percent of farmers kept rabbits on a commercial basis. However, due to poor market linkages, about one third of the farmers interviewed ended up consuming their rabbits.

**Table 4.5: Reasons for rearing rabbits in the three study counties**

Reason	County			Pooled
	Nakuru	Kiambu	Nyeri	
For sale	88.6	92.1	79.4	89.2
Home consumption	5.4	3.2	10.6	4.8
Manure	3.9	2.9	5.3	4.1
Pet	2.1	1.8	4.7	1.9

Source: Author's survey, 2017

The study showed that farmers in Nakuru sold a mature rabbit at an average of Ksh. 250, 267 and 267 per kg to consumers, retailers and brokers respectively (Figure 6). As illustrated by Figure 6, 7 and 8 a half of the rabbits produced in Nakuru were sold through brokers who were connected to other market traders. In Kiambu, farmers sold their rabbits at an average of Ksh. 300, 270, 300 and 350 per kg to consumers, brokers, retailers and wholesalers respectively (Figure 7). Buying prices from producers were different in Nyeri where rabbits were sold at an average of Ksh. 200, 200 and 220 to consumers, brokers and retailers respectively (Figure 8). Farmers from Kiambu County received higher prices due to establishment of a processor in the area by their county government. The plant is managed by the Rabbit Association of Kenya (RABAK) which offers higher prices to farmers. This has created stiff competition between retailers who buy rabbits from farmers and RABAK which has compelled other traders in the area to increase their prices. More than three quarters of farmers in the respective counties reported to be selling their rabbits at farm gate. This may be attributed to lack of enough information on market of rabbit and its products in the study areas. Some farmers slaughtered rabbits upon request by consumers which sometimes

led to increase in prices to cater for costs incurred during slaughtering and other processing activities.

Farmers reported during the FGD that they mainly use the manure from the rabbits to apply in the fields where they have planted crops especially kales and onions. Some of the manure is sold to neighbors at an average price of Ksh. 55 per kg. In addition, rabbit urine was sold to farmers to supplement inorganic fertilizers.

#### **4.2.2 Wholesaling**

An examination of Figures 6, 7 and 8 reveal that only Kiambu County sells rabbits to wholesalers. The wholesalers in the area offered better prices than retailers and brokers. Farmers were paid an average of Ksh. 350 per kg of live rabbit. Payments to farmers were made on the same day through mobile money transaction services called *M-pesa*. Wholesalers carried value addition on rabbits by processing them into meat and sausages which were then sold to retail outlets in nearby towns such as Thika and Nairobi. Each kilogram of meat was sold at an average price of Ksh. 400. Other by-products such as skin were not processed due to lack of tannery in the area. Skin was either fed to dogs or disposed.

#### **4.2.3 Retailing**

Retailing is another important component of the rabbit value chain in the three study areas. It is through them that the majority of the rabbits get to the final actors i.e consumers. Majority (72%) of the retailers were found in the markets which are scattered around the major towns and purchased the rabbits either directly from producers or from wholesalers at wholesale prices. The most common main retailers in the three counties were *Naivas* and *Tuskys* supermarkets and restaurants (food outlets). The costs that were incurred by retailers included transportation, market

fees, county government levies and storage. Two groups of retailers were evident; urban and rural retailers. Rural retailers sold to rural consumers at an average price of Ksh. 375, 400 and 300 in Nakuru, Kiambu and Nyeri respectively (Figures 4.6, 4.7 and 4.8). Rural retailers sold their rabbits to brokers who then bulked them for sale to urban retailer for slaughter and packaging. The urban retailers then sold rabbit meat to urban consumers. 82 percent of urban retailers were restaurants accounted for more than 60 percent of urban retailers in all the study areas. This is where more value was added to rabbit meat by cooking or roasting.

#### **4.2.4. Consumers**

Urban consumers paid higher unit prices as compared to their rural counterparts. For example, in Nakuru County, urban consumers paid an average of Ksh. 615 per kg of rabbit meat (Figure 4.6). In Kiambu and Nyeri counties, urban consumers bought the same meat at Kshs. 580 and 555 respectively.

#### **4.2.5 Service providers in the rabbit value chain**

##### **(a) Transporters**

Transporters play an important role in the movement of rabbits from various production points to final consumers. The transport of rabbits is made by producers, brokers, and retailers from producers or intermediate markets to the end market in different ways in each of the study areas. Walking was found to be the main mode of transport (Table 4.8). This finding corroborates with that of Bett *et al.* (2012) who found that walking was the major form of transport for those who were handling improved chicken in Kenya. Some of the rabbit actors used motorbikes as a form of transport. For instance, transporters who used motorbikes popularly called *bodaboda* (Table 4.8) were hired by most of the actors along the value chain. Some actors had their owned motorcycles which they used for transportation. Pick-up trucks were used for transportation of

rabbits in all the study areas. It was also noted that there were no specialized rabbit transporters in all the three counties.

**Table 4.6: Transport of rabbits and products**

<b>Mode of transport</b>	<b>Nakuru (%)</b>	<b>Kiambu (%)</b>	<b>Nyeri (%)</b>
Walking	58.7	55.4	63.8
Motorbike	29.2	33.6	34.9
Vehicle	12.1	11.0	1.3

Source: Author's survey, 2017

#### **(b) Government institutions**

In all the three study areas, the respective county governments have started investing in rabbit farming. This is through training and construction of processing plants. In addition, the World Bank assisted the Government of Kenya to set up the Kenya Agricultural Productivity Programme (KAPP) which has been very instrumental in helping rabbit farmers access the right production practices especially in Nakuru and Nyeri counties

There are two government regulations that control transportation of rabbits from one place to another. Specifically, transporters of processed rabbits were required to have a certificate of transport (COT) which was supposed to be issued by the veterinary officer to the owner of the slaughtered rabbits. In addition, all transporters of live rabbits were required by law to obtain a transport/movement permit. In Nyeri and Nakuru counties, such government regulations were largely unenforced and hence not implemented by most actors in such areas. In Kiambu, a

movement permit and COT were issued upon payment of a fee of Ksh. 50 and Ksh. 100 per consignment, respectively. From the interviews with the transporters, it was evident that the fees are a burden to them which end up increasing their costs.

#### **(c) Rabbit feed suppliers**

Majority of feed suppliers sell feed in small quantities to make it accessible and affordable to smallholder rabbit farmers. The feed manufacturers/millers e.g *Jubilee Feeds*, *Logorn Feeds International* and *Pwani Feeds* in Kiambu County and *Wonder Feeds Limited* in Nakuru deliver feed to the agro-vet stores from which farmers buy directly. The main types of manufactured rabbit feeds are bran, maize germ and concentrates which were used to feed rabbits.

#### **(d) Extension services**

In the last six months, only 36, 26 and 13 percent of rabbit farmers in Nakuru, Kiambu and Nyeri respectively reported to have been visited by extension officers. Most of the extension officers were from NGOs (such as CARITAS International for the case of Nyeri County) and ministry of agriculture and livestock from the county government. The extension services were offered for free so as to encourage more farmers into the rabbit enterprise. The rest reported that they had never contacted or been visited by extension officer. They therefore used their own knowledge in rabbit production while others got advice from neighbors, friends and relatives. This implies that rabbit veterinary services in the study had not picked up well.

#### **(e) Slaughterhouses**

Only Kiambu County had a rabbit slaughterhouse. Located in Makongeni area of Thika Sub-County, the slaughterhouse was constructed by the Kiambu County Government managed by

RABAK. In Nyeri County, a rabbit slaughter-house was under construction during the study period while Nakuru County had none. 64 percent of rabbit farmers sold live rabbits. Another 36 percent slaughtered their rabbits at home where waste was in most cases dumped in open pits. The transport costs to the slaughterhouses are incurred by the rabbit suppliers themselves. In Kiambu County, payments to farmers for rabbit delivery to the slaughter house is Kshs. 450 per kg of meat (dead weight) or Kshs. 225 per kg of live weight. Payments are done the same day via *m-pesa* mobile service.

#### **4.2.6 Challenges and opportunities faced by rabbit farmers in the three counties**

Table 9 presents the main challenges faced by rabbit producers in Nakuru, Kiambu and Nyeri counties. As shown, 58, 74 and 81 percent of respondents in Nakuru, Kiambu and Nyeri counties respectively cited diseases and parasites as the main production challenge. This finding agrees with that of Serem *et al.* (2013) who found that 71 percent of farmers in Kenya complained of diseases as a major challenge of rabbit production. It could be attributed to lack of trained rabbit service providers such as veterinary and extension officers.

**Table 4.7: Proportion of rabbit producers who reported rabbit production challenges in the three counties**

<b>Challenges</b>	<b>Nakuru County</b>	<b>Kiambu County</b>	<b>Nyeri County</b>	<b>pooled</b>
Diseases and parasites	58.42	74.36	81.25	71.15
Expensive feed	50.50	20.41	75.0	58.3
Lack of drugs	43.56	53.85	43.75	44.0
Access to extension	24.75	46.16	40.12	32.76
Theft	24.66	15.42	17.26	16.9
Lack of quality breeding stock	59.80	64.23	70.16	66.6
Lack of market	79.21	54.21	62.14	57.04
Low prices	65.35	47.64	26.84	44.8
Access to market information	57.4	31.98	21.02	25.19

Source: Author's survey, 2017

Existence of expensive feeds was a serious challenge in Nyeri County with about 75 percent of farmers encountering it. Kiambu County had the lowest proportion of farmers facing the challenge. This may be due to proximity of Kiambu farmers to feed manufacturing companies such as Chania feeds.

Further, 44 percent of farmers in Nakuru and Nyeri counties reported that lack of specific drugs for rabbits was one of the major challenges they face (Table 6). They pointed out that the situation had led to increased rabbit mortality. Lack of extension services was a major issue in Kiambu County (46%) and Nyeri County (40%). A lower proportion (25%) of producers faced the same challenge in Nakuru County. This may be due to the high commitment that the Nakuru County

Government has put in place to help rabbit producers to improve on their productivity. Less than 30 percent of farmers reported theft as one of the challenges. In addition, lack of high quality and affordable breeding stock was one of the major challenges experienced. These finding tallies with that of Oseni *et al.* (2008) who observed that the majority of rabbit farmers in Nigeria lacked access to quality genetic stocks. Farmers also complained of being offered low prices. Low market prices may be attributed to the mushrooming of rabbit brokers in the study areas who ended up gaining high profits at the expense of the rabbit farmers. These challenges tally with those of Serem *et al.* (2013) who noted that challenges such as rabbit diseases, inadequate husbandry practices, lack of improved breeding stock deter rabbit farmers from exploiting their full potential.

Information regarding specific opportunities available in the view of farmers is presented in Table 4.7. The results showed that an estimated 69 percent, 74 percent and 66 percent of rabbit farmers from Nakuru, Kiambu and Nyeri stated high demand of rabbit meat and other products to be an important opportunity. The finding corroborates that of Borter and Mwanza (2011) who found out that rabbit meat had high demand due to its nutritional superiority.

**Table 4.8: Proportion of rabbit producers who reported opportunities in the three study areas**

<b>Opportunity</b>	<b>Nakuru</b>	<b>Kiambu</b>	<b>Nyeri</b>	<b>pooled</b>
High demand	69.21	73.60	55.92	64.52
Value addition	48.11	82.14	32.68	47.43
Support by county governments	59.37	71.86	65.53	61.9
Establishment of slaughterhouses	80.20	76.24	77.88	78.66

Source: Author's Survey, 2017

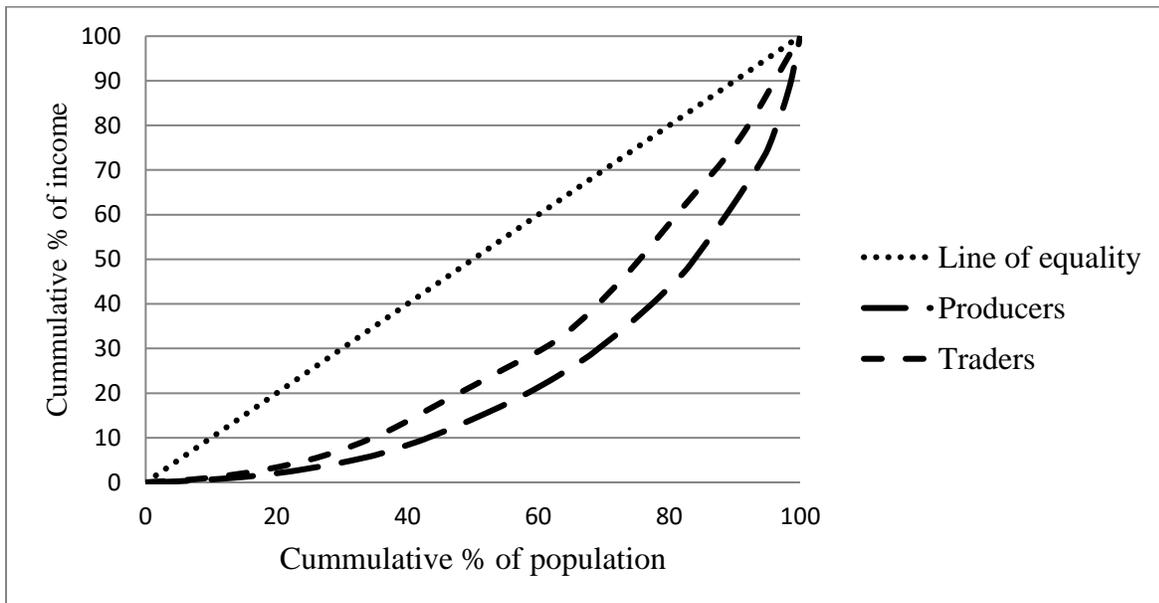
Other opportunities observed were support by county governments, availability of slaughter houses and ability to carry out rabbit meat value addition by farmers themselves. Improving rabbit farming and marketing was one of the investment plans in all the three counties studied.

### 4.3 Structure, conduct and performance of the rabbit market in the three study areas

#### 4.3.1 Market structure

##### a) Market concentration among rabbit producers and traders

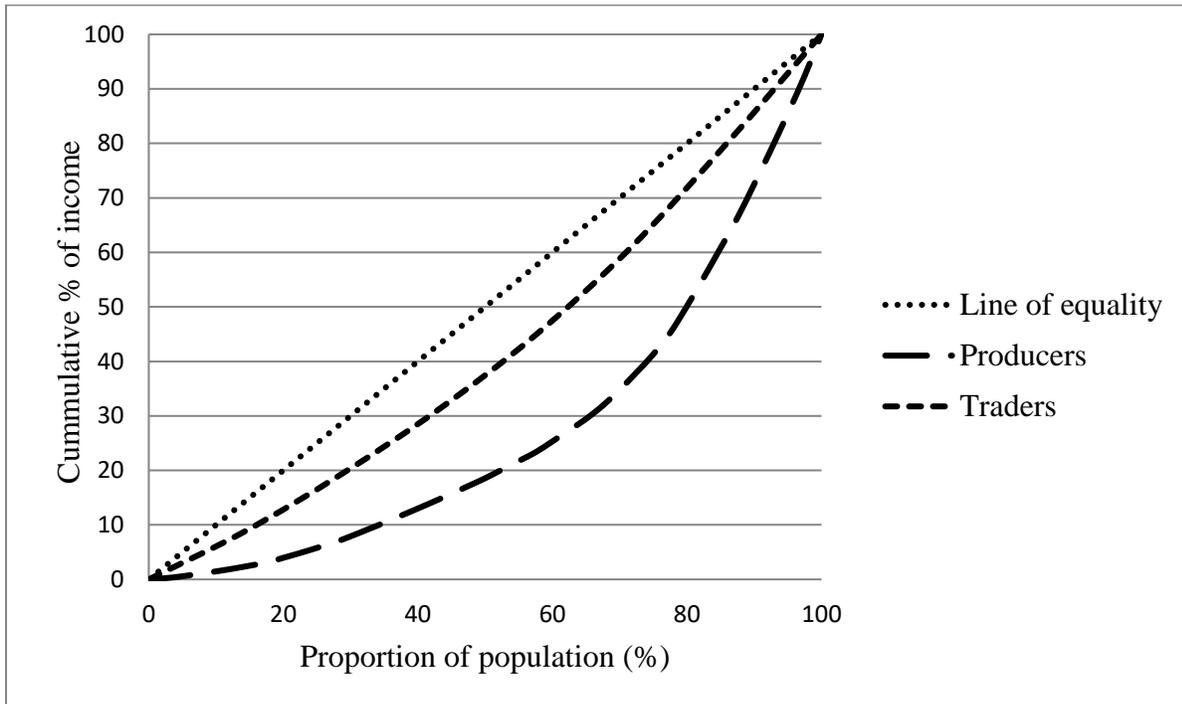
Figures 4.9 shows that rabbit traders' income is more equally distributed than producers' in Nakuru County. This may be due to higher competition among traders as compared to producers. This finding is strongly supported by Onyango (2013) who observed a large gap of inequality between Isiolo livestock market producers and traders in Kenya.



**Figure 4.4: Lorenz curve for traders and producers in Nakuru County**

Source: Author's survey, 2017

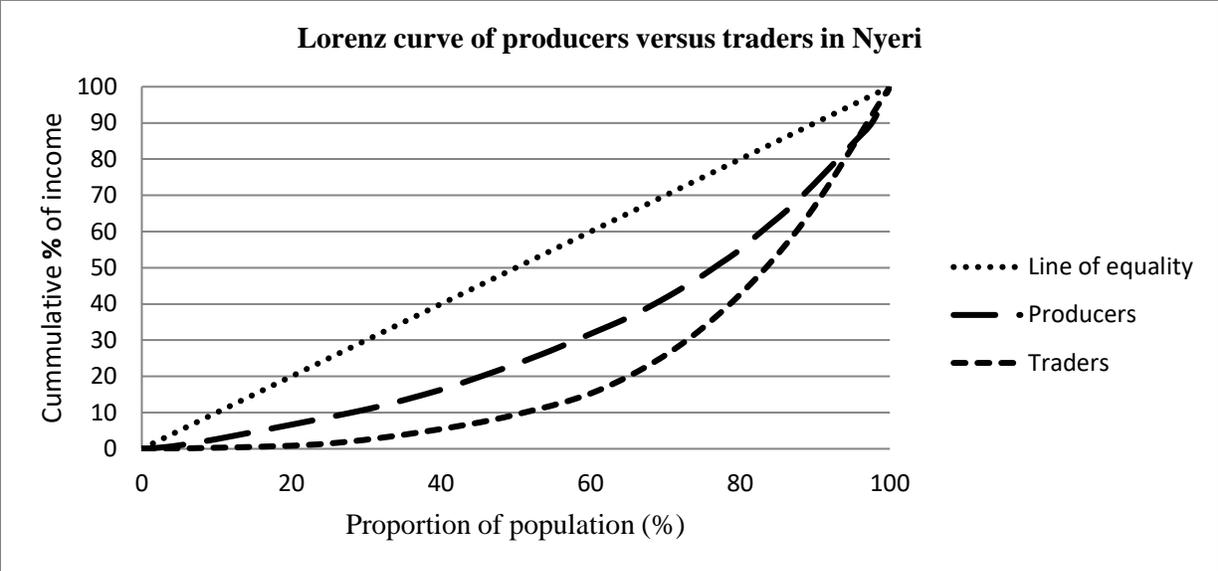
In Kiambu County the Lorenz curve reveals a deeper inequality among rabbit producers relative to that of among rabbit traders. The finding reveals that there was lower competition among producers as compared to traders.



**Figure 4.5: Lorenz curve for traders and producers in Kiambu County**

Source: Author’s survey, 2017

Nyeri County presents an interesting result. That is, rabbit farmers are more egalitarian than rabbit traders. This may be attributed to a higher collective action as compared to the other two counties among rabbit farmers where they share production and marketing information (Table 4.4). Accordingly, rabbit traders in Nyeri County seem to enjoy substantial monopoly power relative to those in Nakuru and Kiambu counties. This could be attributed to lower number of traders engaged in the rabbit industry as compared to other study areas.



**Figure 4.6: Lorenz curve for traders and retailers in Nyeri County**

Source: Author’s survey, 2017

Table 4.11 presents the Gini coefficients for the rabbit producers and traders in the three study sites. The Gini coefficients corroborate the Lorenz curves that rabbit producers in Nakuru and Kiambu counties are more concentrated than traders while the converse is true in Nyeri County. These observations suggest that rabbit production in Nakuru and Kiambu counties has oligopolistic structures where only few actors controlled a large share of the market relative to rabbit trade. Similar results were found by Ajala and Adesehinwa (2008) who observed a Gini coefficient of 0.66 indicating lack of high competition in pig market in Nigeria. In Nyeri County, rabbit traders enjoy a virtual monopoly while those in Nakuru are the most competitive

**Table 4.9: Gini coefficients for rabbit producers and traders in Nakuru, Kiambu and Nyeri counties**

Value chain actor	Gini-coefficient			
	Nakuru	Kiambu	Nyeri	Pooled
Producers	0.689	0.658	0.614	0.635
Traders	0.517	0.59	0.677	0.561

Source: Author's survey, 2017

The Herfindahl Hirschman Index (HHI) was also used to determine whether the rabbit market was held by few or many players. The HHI for rabbit traders and producers are presented in Table 12.

**Table 4.10: Herfindahl Hirschman Index (HHI) for rabbit players in Nakuru, Kiambu and Nyeri Counties**

Market player	Nakuru	Kiambu	Nyeri	Pooled
Producer	6372	5215	4806	5132
Traders	4122	4796	5977	4489

Source: Author's Survey, 2017

Calculations performed on rabbit producers for Nakuru, Kiambu and Nyeri, gave HHI indices of 6372, 5215 and 4806 respectively. Comparing the market from the producer's perspective, Nakuru County was the most concentrated followed by Kiambu and then Nyeri. However, the rabbit market for traders had the most concentration in Nyeri followed by Kiambu and then Nakuru. It therefore follows that, although none of the three counties did not show pure monopoly power (at

10,000), the rabbit market was highly concentrated for both traders and producers. This finding means that there was little rabbit market competition in all the three counties. The finding corroborates well with that of Olufemi and Adeolu (2011) who used HHI and found out a high broiler chicken market concentration in Southwestern Nigeria.

#### **b) Product differentiation**

As shown in Table 4.13, producers in the three counties kept different breeds of rabbits. Most (61.35%) of farmers in the three study sites kept New Zealand White breed. The finding implies that New Zealand White was the most preferred breed which may be attributed its bigger size and ability to grow fast compared to other breeds. Other breeds kept included Chinchilla, Carlifornian, Flemish giant, French ear lopped, Dutch, Cross breed, ILRI grey, Angora and Kenyan white (Table 4.13).

**Table 4.11: Proportion of respondents who reported the breeds of rabbits they rear in the three study sites**

Breed	County			
	Nakuru	Kiambu	Nyeri	Pooled
New Zealand White	59.60	58.97	68.75	54.51
Carlifornian White	41.41	54.23	68.0	54.51
Crosses	18.18	46.15	25.0	34.85
Chinchilla	28.28	38.46	37.50	32.15
Flemish giant	17.17	25.64	25.0	23.29
Dutch	16.16	15.38	18.75	17.11
French-earloped	13.13	23.08	12.5	14.94
Angora	6.06	23.08	12.5	12.12

Source: Author's survey, 2017

Product differentiation occurred mostly at retailing and wholesaling stages where live rabbits were slaughtered. Processing resulted in products such fresh meat, roasted meat and and sausages which earned the involved individuals higher income than their counterparts who sold live rabbits. Processing activities confer a competitive edge to retailers and wholesalers.

### **(c) Barriers to entry and exit**

While rabbit farmers cited capital outlay to be the main barrier to entry into rabbit rearing, the average initial capital reported was relatively small and affordable at Kshs. 3, 160, 2,720 and 2,510 in Nakuru, Kiambu and Nyeri respectively. As such, it is difficult to actually term it an entry

barrier. Among the traders, the initial capital outlay was substantial and could serve as an entry barrier. On average, rabbit traders in Nakuru, Kiambu and Nyeri counties had to set aside Kshs. 10, 580, 13, 200 and 8, 750 respectively to fully engage in rabbit business. Gichangi (2010) observed that unavailability of startup capital acted as an entry barrier among farmers and traders in Kenya.

About 64, 66 and 76 percent of traders in Nakuru, Kiambu and Nyeri counties indicated that they lacked storage facilities such as refrigerators. While this may not constitute a substantive entry barrier, it increased operational costs due to hiring coolers. This observation tallies to that of Nzima *et al.* (2014) who noted that access to better storage facilities was a barrier to entry into groundnuts trading in Malawi.

#### **4.3.2 Market conduct**

Market conduct was determined from the behavior of rabbit traders and farmers including their pricing strategies, advertising and sales promotion, and degree of collusion.

##### **a) Pricing strategies**

There were no trader-based organizations or marketing groups in Nakuru markets to affect the bargaining power. This means that the prices offered by rabbit traders varied from one trader to the next. However, 45 percent of Kiambu farmers sold their rabbits to RABAK at a fixed price of Ksh. 350 per kg thus had a higher bargaining power (Figure 4.7). Most (55.12%) of traders in all the markets depended on bargaining as a way of setting rabbit prices. The proportion of traders who used bargaining to discover rabbit prices was 56.0, 51.2 and Nyeri 64.7 percent in Nakuru, Kiambu and Nyeri counties respectively (Table 4.14). In Ethiopia, Tedesse (2011) found 51 and 54 percent of traders and farmers respectively used bargaining to discover fruit prices.

**Table 4.12: Determination of rabbit prices**

	<b>Nakuru (%)</b>	<b>Kiambu (%)</b>	<b>Nyeri (%)</b>	<b>Pooled</b>
Set by buyer/seller	31.0	39.4	25.3	32.94
Negotiation	56.0	51.2	64.7	55.12
Market prices	13.0	9.4	10.0	9.91

Source: Author's survey, 2017

Only 10 percent of retailers purchased rabbits from either farmers or wholesalers on a consignment basis. This therefore means that farmers or wholesalers were paid after the rabbits had been sold. The agent sells the rabbits on behalf of the sender according to instructions.

Because of communities' remoteness and poor communications with marketplaces, rabbit farmers' uncertainty about market prices is usually high. Rabbit traders may take advantage of farmers' ignorance of the market price and extract a rent from them by offering very low prices for their products (Courtois and Subervie, 2014). The fact that the farmer does not have the necessary price information to engage in optimal negotiation makes rabbit traders to gain more at the expense of farmer. The profits from the enterprise are low thus negatively affecting farmers' market performance.

#### **b) Advertising and sales promotion**

None of the rabbit producers advertised their products. However, 38, 48 and 32 percent of producers in Nakuru, Kiambu and Nyeri counties respectively indicated that they had contacts of regular buyers whom they would alert by telephone when they had ready rabbits for sale. About

one third of retailers especially restaurants advertised through posters and social media such as *facebook* and *whatsapp*. All sales were made in cash using a direct payment system.

### **c) Degree of collusion**

In this study, no collusion was observed among the actors. This may be due to the fact that most market actors did not belong to development groups and trade associations which usually allow for group buying and selling. Similar results were reported by Yesufu and Anyanwale (2011) who found no evidence of existence of collusion among broiler farmers and traders in South Western Nigeria.

### **4.3.3 Market performance**

#### **a) Producer share of the retail price**

Table 4.15 presents the mean rabbit agent prices and producer shares of the retail price in the three study counties. Producers in Kiambu had the highest share of retail price (50.70%) followed by Nakuru (43.46%) and then Nyeri (40.84). Given that only 16 percent of all respondents sold rabbit carcasses, the lack of value addition is glaring. FAO (2007) observed that smallholder farmers are earning less than their fair market share because of lack of value addition. In addressing this problem, SNV (2012) recommended better livestock policies and restructuring of livestock markets to increase livestock farmers' bargaining power a voice in the market and enable them to have effective contribution toward market prices. Such initiatives can be supplemented by farmers themselves forming/joining farmer groups/associations to increase their bargaining power.

**Table 4.13: Mean agent earnings and producer share of the retail price in the three study counties**

<b>Agent's price</b>	<b>Nakuru</b>	<b>Kiambu</b>	<b>Nyeri</b>	<b>Pooled</b>
Producer price (Kshs/kg)	267.45 (90.57)	293.50 (24.32)	226.0 (102.14)	254.24 (84.2)
Retail price (Kshs/kg)	615.28 (121.34)	578.86 (62.43)	554.60 (50.31)	567.84 (62.17)
Producer share (%)	43.46	50.70	40.84	41.53

NB: Standard deviations in parentheses

Source: Author's survey, 2017

## **b) Gross margin**

### **i) Producer's gross margin**

As shown in Table 4.16, the rabbit enterprise in all the three counties had positive gross margins suggesting that it is a profitable enterprise. The profitability is higher in Kiambu and Nakuru counties and least in Nyeri County. The higher producer gross margin in Kiambu County could be attributed to organized rabbit marketing associated with RABAK and also its proximity to the capital city of Nairobi. These results show that rabbit market performance in Kiambu is higher as compared to Nakuru and Nyeri counties.

**Table 4.14: Mean rabbit producer gross margin in Nakuru, Kiambu and Nyeri counties**

<b>Item</b>	<b>Nakuru</b>	<b>Kiambu</b>	<b>Nyeri</b>	<b>Pooled</b>
<b>(shillings/kg)</b>				
Revenue	267.40 (116.03)	293.0 (24.32)	226.0 (102.14)	252.15 (98.8)
Cost	121.16 (84.18)	131.15 (48.11)	144.20 (61.43)	129.37 (141.26)
Gross margin	146.29 (56.61)	162.35 (97.44)	81.80 (70.64)	122.78 (108.2)

NB: Standard deviations in parentheses

Source: Author's survey, 2017

#### **ii) Trader's gross margin**

Like in the case of producer gross margins, rabbit retailer gross margins were all positive in the three counties (Table 4.17). It suggests that rabbit trading is a profitable venture. A similar pattern is observed for the retailer gross margins in the three counties i.e., Kiambu County has the highest followed by Nakur and then Nyeri counties.

**Table 4.15: Trader gross margin in Nakuru, Kiambu and Nyeri counties**

<b>Item</b>	<b>Nakuru</b>	<b>Kiambu</b>	<b>Nyeri</b>	<b>Pooled</b>
<b>(shillings/kg)</b>				
Revenue	615.28 (121.34)	578.86 (62.43)	554.60 (50.31)	558.39 (91.38)
Cost	391.81 (172.60)	331.15 (128.60)	362.58 (126.14)	344.10 (111.57)
Gross margin	223.47 (75.84)	247.71 (109.34)	192.02 (59.20)	214.29 (88.20)

NB: Standard deviations in parentheses Source: Author's survey, 2017

Juxtaposing Table 4.16 and 4.17 reveals that rabbit retailers in all the three counties obtained more profits compared to producers with Kiambu County being the most lucrative. The percentage difference between producer and retailer gross margins were 52.76, 52.58 and 137.8 percent for Nakuru, Kiambu and Nyeri respectively. The higher retailer over producer gross margins could be attributed to the fact that most retailers (Nakuru 71 percent, Kiambu 84 percent and Nyeri 58 percent) carry out value addition of rabbits which led to higher revenue. Adera *et al.* (2016) found that dairy retailers in Ethiopia accrued more profits from milk sales than farmers because they were in positions to do value addition on raw milk.

### **c) Marketing margin**

Table 4.20 presents marketing margins for retailers in the three study counties. It is clear from the Table 18 that Nyeri County had the widest spread between farm-gate and retail prices. Kiambu County had the narrowest spread which may be attributed to the fixed rabbit buying price offered by RABAK. Therefore, farmers have information on marketing prices which is even RABAK's

website. It therefore means the performance of rabbit marketing is higher in Kiambu County as compared to Nakuru and Nyeri counties.

**Table 4.16: Marketing margins in Nakuru, Kiambu and Nyeri counties**

Item	County			
	Nakuru	Kiambu	Nyeri	Pooled
Marketing margin (%)	56.54	49.30	59.16	54.22

Source: Author's survey, 2017

#### **d) Marketing efficiency**

Table 4.21 presents marketing efficiencies of rabbit traders in the three study areas. A positive sign value indicates the application of additional marketing services and a negative value indicates otherwise. Since the results from the analysis show values of 10.95, 16.03 and 18.31 for traders in Nakuru, Kiambu and Nyeri respectively, it justifies the application of additional services at the marketing stage of the rabbit value chain. This finding is in line with that of Goutam Das, Jain and Dhaka (2014) where marketing efficiency for dairy milk traders in India was found to be positive.

**Table 4.17: Marketing efficiency in Nakuru, Kiambu and Nyeri counties**

Item	County			
	Nakuru	Kiambu	Nyeri	Pooled
Marketing cost (Kshs.)	391.81	331.5	362.58	344.1
Marketing margin (Kshs.)	440.2	394.8	443.38	408.7
Marketing efficiency (%)	10.95	16.03	18.31	15.81

Source: Author's survey 2017

#### **4.3.4 Factors influencing the profitability of the rabbit enterprise in Nakuru, Kiambu and Nyeri counties**

Table 4.21 presents model results of factors influencing rabbit farmer's gross margin in the three study areas.

**Table 4.18: Factors Influencing Producers' Gross Margins in Nakuru, Kiambu and Nyeri counties**

Variable	County					
	Nakuru		Kiambu		Nyeri	
	Coef.	s.e	Coef.	s.e	Coef.	s.e
Age	-0.051	0.032**	1.067	0.056**	-1.762	0.386***
Household size	-0.99	0.011***	-0.428	0.174**	-0.992	0.831
Education	-0.074	0.049*	-0.146	0.18	-0.09	0.042**
Gender	-0.449	0.863	-0.197	0.173	-1.68	1.22
Number of rabbits	0.812	0.319**	3.157	0.655***	5.348	0.045***
Group membership	0.791	0.715	0.279	0.181	0.793	0.383**
Extension access	0.091	0.034**	0.107	0.227	0.720	0.261
Credit access	0.141	0.0452***	0.144	0.057**	0.127	0.170
Wealth index	0.659	0.342*	0.189	0.003	0.428	0.174
Income	0.442	0.026***	5.348	0.045**	0.081	0.009***
Constant	6.92	0.337***	1.067	0.056**	-1.762	0.386***
Prob>F	0.000		0.001		0.000	
R-Squared	0.4866		0.5521		0.4238	

Source: Author's survey 2017

Notes: The dependent variable is rabbit producer's gross margins

\*, \*\*, \*\*\* indicate significance at the 10, 5 and 1 percent level, respectively

The age of the household head was negatively and positively significant in Nakuru and Nyeri respectively. This means that the age of household head negatively and positively influenced gross

margins in the two study areas at 5 percent and 10 percent respectively. Younger farmers in Nakuru gained more profits from rabbit farming and the reverse happened in Nyeri. The observation in Nakuru implies that younger farmers adopted new husbandry technologies such as use of improved rabbit breeds which matured very fast and attracted higher returns. However, in Nyeri, as observed by Ndung'u *et al.* (2012), older farmers gained more profits from the enterprise as compared to younger ones. This may be explained by more effort put in by older farmers who are expected to provide for their households.

The size of the household had a negative influence on gross margins from rabbit sales in Nakuru and Kiambu counties. This implies that farmers who had fewer number of household members gained more profits than those with higher number. This may be explained by more resources put in to provide for the daily needs of large household than to family enterprises such as rabbit farming hence low returns achieved. The result contrasts with that of Horna *et al.* (2005) who observed that households with large number of persons is capable of providing enough labour which in return improves output thus high revenue will be accrued.

Years of schooling were found to be negatively significant in Nakuru and Nyeri counties. Education may be a gateway to white-collar jobs thus limit serious participation in rabbit farming. The finding contrasts that of Affognon *et al.* (2015) who observed that educated household heads were able to understand the benefits of participating and have more access to information than those with a lower education level.

The number of rabbits representing output was a positive and significant factor in influencing farmers' gross margins significance levels in Nakuru, Kiambu and Nyeri counties. Due to economies of scale, farmers with large number of rabbits gained higher profits than those with

smaller numbers. These findings concur with those of Chalwe (2011) who observed that the higher the produce the higher the farmer's incentive to sell more and generate more income thus more profits are accrued.

Group membership was positive and significant in influencing gross margins from rabbit sales in Nyeri County only. Groups increase farmer's capacity to help one another in solving their problems and learning and adopting new technologies. The positive influence of group membership on gross margins was relevant in Nyeri County because of the strategies the Nyeri County Government has put in place to help farmers form groups so that they can reach them very easily. This observation is consistent with Shiferaw *et al.* (2006) who argued that membership to an active group enhances the uptake of technological innovations through mobilization of resources and information sharing among members thus improved productivity which allows for higher profits.

Access to credit positively influenced gross margins from rabbit farming in Nakuru and Kiambu counties. Access to credit enables farmers to purchase agricultural inputs which increase production hence gross margins. Randela *et al.* (2008) found a positive and significant relationship between access to credit and gross margins among smallholder farmers in South Africa.

Household income from other sources positively influenced rabbit gross margins. The income from other sources is likely to provide flows of cash income that can be used to buy rabbit inputs and adopt improved technologies which are expected to result in high gross margins. Nasir and Hundie (2014) found a positive and significant influence of off-farm employment on agricultural production and productivity among smallholder farmers in Gurage zone of Southern Ethiopia.

## **CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS**

### **5.1 Summary**

Despite its potential in improving the livelihoods of smallholder farmers, rabbit farming has not been fully exploited in Kenya. In addition, past studies have shown that most farmers in Kenya have adopted rabbit farming as a commercial enterprise. However, there are limited empirical insights on the structure, conduct and performance of the rabbit market. This study bridges the mentioned gaps by focusing on the structure conduct and performance of the rabbit market along the value chain and investigate the factors influencing gross margins of the rabbit enterprise in Nakuru, Kiambu and Nyeri counties.

Data were collected from a sample of 459 farmers and 80 traders in the three counties using semi-structured questionnaire. Descriptive statistics were computed to characterize the rabbit farming system while the SCP model to assess structure, conduct and performance of the rabbit market. A two-stage least squares regression (2SLS) was employed to assess factors influencing gross margins earned by rabbit farmers.

The results show that the rabbit value chain in the study areas were moderately well developed. Kiambu County had most developed value chain due to presence of a wholesaler. Nyeri and Nakuru counties lacked wholesalers. The salient feature in the three counties is lack of value addition on rabbit meat by-products such skin. Farmers and other processors threw away the skin or even fed it to the dogs. The main challenges in each of the three value chains were asymmetry of information, lack of vertical coordination and imbalanced bargaining power among value chain actors.

Assessment of market structure depicted that rabbit trader's income was more equally distributed than producer's in Nakuru County. In Kiambu County, a deeper inequality among rabbit producers relative to that of rabbit traders was revealed. Nyeri County presented an interesting result where rabbit farmers were more egalitarian than traders. The main rabbit breed kept by most farmers was New Zealand White breed. The assessment of market conduct showed that bargaining was the main way of setting rabbit price. None of the producers advertised their products. Traders advertised through posters and social media such as *whatsapp* and *facebook*. Market performance assessment showed that farmers were earning less than their fair market share which was attributed to lack of value addition among farmers. Gross margins were positive for both producers and traders. However, traders earned more gross margins than producers.

The results of the 2SLS model show that some factors were significant in influencing the gross margins earned by rabbit farmers in some counties and not others. The variables that were found to negatively influence producer's gross margin included age, household size and education in years. Those that positively influenced gross margins include age, number of rabbits kept, group membership, wealth index and income.

## **5.2 Conclusions**

Rabbit farming in the three study counties is for the elderly. In addition, rabbit farming is increasingly becoming commercialized with well-developed value chains especially in Kiambu and Nakuru counties. There is no value addition done on rabbit skin.

The rabbit market in the three counties is oligopolistic with little competition. This is shown by Gini coefficients which are all above 0.5. There is no fairness in distribution of earnings from the rabbit enterprise. The most relevant barrier to entry among rabbit actors is lack of storage facilities

such as refrigerators. Bargaining is the main way of discovering prices in the three study areas. There was no evidence of collusion among the actors. Majority of farmers used telephone calls to connect with buyers. In this study, no collusion was observed among the actors. The rabbit producers received an unfair share of retail price.

The study also found out that producers received unfair share of retail price. This means traders involved in rabbit marketing received higher profits compared to producers. Generally, rabbit marketing is profitable as shown by positive marketing margins.

The age of the household head both positively and negatively influences profits from rabbit enterprise. Household with fewer number of members seem to accrue more profits from rabbit farming than their counterparts with big household sizes. Due to economies of scale, farmers with large number of rabbits are able to gain higher profits than those with smaller numbers. Both membership in groups and access to credit positively influences rabbit profitability.

### **5.3 Recommendations for policy action**

Based on the findings from this study, the following recommendations are made:

1. The value chain analysis revealed that the actors are throwing away skin which is a valuable resource that could fetch a lot of cash in the leather industry. Therefore, there is need for the relevant stakeholders such as county governments and farmers themselves to invest in rabbit leather industry.
2. Rabbit rearing was found to be profitable and positively influenced by group membership. Therefore, it is recommended that in order to enhance this profitability, farmers should form or join existing groups. Groups in every county should be supported by county government through capacity development.

3. The market share of rabbit producers was found to be lower than that of traders. Therefore, relevant stakeholders such as NGOs, both national and county government, and development partners should direct more efforts towards reducing information asymmetry among producers so that they can make informed decisions when bargaining during price setting with traders. Infrastructure such as slaughter houses should be improved in each county. This will enable farmers add value to their rabbits hence earn high revenue.
4. The age of the household head both positively and negatively influenced rabbit farming. Therefore, strategies in improving rabbit industry should target both youths and old people. The policy makers should consult all groups of people when designing, planning and implementing policies related to the rabbit industry.
5. Household income from other sources positively influenced rabbit gross margins. Therefore, promotion of income diversification initiatives by county government among rural farmers is necessary for improving their well-being and employment creation. This will enable smallholder farmers to earn high income which can be ploughed in other farming enterprises such as rabbit farming.
6. Access to credit positively influenced gross margins from rabbit farming. Credit lending institutions such as commercial banks and micro-finance institutions should therefore work towards providing affordable and accessible credit to rabbit farmers in order to improve their ability to cover costs associated with production and marketing of rabbits.

#### **5.4 Suggestion for further study**

The current study focused on the production and marketing of rabbits. Future studies could focus on analyzing consumers' awareness, perceptions and willingness to pay for value added rabbit meat.

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## Appendices

### Appendix I: Survey Questionnaires

#### (i) Farmers' Questionnaire

1.1 County

[1] Kiambu [2] Nakuru [3] Nyeri

1.2 Sub-county \_\_\_\_\_

1.3 Location \_\_\_\_\_

1.4 Sub-location \_\_\_\_\_

1.5 Name of the respondent \_\_\_\_\_

1.6 Sex [1] Male [2] Female

1.7 Phone number \_\_\_\_\_

1.8 Age of in years \_\_\_\_\_

1.9 Formal education level of the respondent

Years of formal schooling completed (primary and above)	Highest level of formal education completed [1] none [2] primary [3] secondary [4] certificate [5] diploma [6] undergraduate degree [7] master degree [8] PhD

1.10 Marital status [1] Married [2] Single [3] separated [4] Divorced/divorcee [5]

widow/widower

1.11 Is farming your primary economic activity? (1= Yes 0= No)

1.12 What other activity do you rely on as source of income?

(1 = Salaried employee 2 = Business man/woman 3 = Casual laborer 4 = Boda boda/

motorcycle operator 5 = Fishing 7= Other (Specify) .....

1.13 Household size \_\_\_\_\_

1.14 Average household monthly net income and expenditure

Income category (Kenyan shillings)	Tick category	Indicate average amount (Kshs)
Below 1,000		
1,001- 5,000		
5,001-10,000		
10,001-15,000		
15,001-20,000		
20,001-25,000		
25,001-30,000		
30,001-35,000		
Above 35,000		

1.14.1 Estimate your monthly expenditure for the following

Food Ksh _____	Medicare Ksh _____	Purchase of assets Ksh. _____
Clothing Ksh _____	Entertainment Ksh _____	Savings kshs. _____
School fees _____	Donations Ksh. _____	Others (Specify)

1.15 Assets

	How many do you own?	How much did spend to purchase?	If sold now, how much could you earn?
--	----------------------	---------------------------------	---------------------------------------

1.15.1 Chairs			
1.15.2 Mattress			
1.15.3 Couch			
1.15.4 <i>Sufuria</i>			
1.15.5 Kerosene lamp			
1.15.6 Car battery			
1.15.7 Generator			
1.15.8 Solar system			
1.15.9 Mobile solar lamp			
1.15.10 Radio			
1.15.11 TV			
1.15.12 Sewing machine			
1.15.13 Smart phone			
1.15.14 Mill (for flour)			
1.15.15 Hoe/axe			
1.15.16 Bicycle			
1.15.17 Motorbike			
1.15.18 Car			
1.15.19 Cart			
1.15.20 Plough			

1.15.21 Wheelbarrow			
1.15.22 Irrigation device			
1.15.23 Solar panel			
1.15.24 House			
1.15.25 Tractor			
1.15.26 Gas cooker			
1.15.27 Other (specify)			

- 1.16 Rabbit farming experience in years \_\_\_\_\_
- 1.17 Rabbit breeds kept \_\_\_\_\_
- 1.18 Indicate the distance in km to the nearest;
- 1.18.1 Main road \_\_\_\_\_
- 1.18.2 Market Centre \_\_\_\_\_
- 1.18.3 Rabbit processing plant \_\_\_\_\_
- 1.19 Type of nearest road [1] Tarmac [2] Murram [3] Earth [4] Others (Specify)
- 1.20 What is the condition of the tarmac road? (1 = Poor 2 = Very poor 3 = Good 4 = Very good)
- 1.21 Quality of tarmac road [1] Very good [2] Good [3] poor [4] Very poor
- 1.22 Means of transport to the nearest market centre [1] Public service vehicle [2] Own vehicle [3] Bodaboda [4] Walking [5] Bicycle [6] Others..... (Specify)
- 1.23 Transport cost to the nearest market Centre (Kshs.) \_\_\_\_\_
- 1.24 Land size (acres) \_\_\_\_\_

**SECTION 2: RABBIT PRODUCTION INFORMATION**

2.0 How many rabbits do you have currently? \_\_\_\_\_

2.1 How much was the startup capital for your rabbit production enterprise?.....

Cost	Quantity	Amount (Kshs.)
Breeding stock		
Construction of hutches		
Transport		
Feed		
Signing contracts		
Communication fees		
License fee		
Taxes		
Others (specify)		

2.2 What was the main source of the startup capital?

[1] Credit from bank [2] Personal savings [3] Friends and relatives [4] Community-based organization (CBO) [5] Others \_\_\_\_\_ (specify)

2.3 What are the operational costs being incurred in your rabbit production?

Cost	Quantity	Amount (Kshs.)
Labour		
Veterinary services		

Transport to market		
Feed		
Signing contracts		
Communication fees		
License fee		
Taxes		
Storage		
Others (specify)		

2.4 Have you gotten assistance from extension officers regarding production practices over the past 12 months? (1 = Yes 0 = No)

If No, skip to 2.6, if YES,

2.5 How frequently do the extension officers visit your farm? (1= Daily = 2 = once a week 3 = twice a week 4 = once a month 5= Once a year).

2.6 Where do you acquire information on production practices? (1 = Neighbors 2 = Indigenous (Own) knowledge 3 = Television 4= Radio 5 = Newspapers 6 = Community elders 7= NGO's 8= Government support staff 9 = Other (Specify) .....

2.7 Where do you purchase your inputs? (1 = Agro-vet store 2 = Local kiosk 3 = Farmer group 4 = Extension officers 5 = Government supply 6 = Other (Specify) .....

2.8 What kind of labor do you employ in your rabbit production? (1= Family labor 2 = Hired labor 3= Both hired and family 4 = Other (Specify)

2.9 What are the challenges you face in production of rabbits?

(1=Lack of specific drugs for rabbits 2=Extension support 3=Access to credit 4=Access to production information 5=Diseases 6=Other (specify))

2.10 What do you think are the opportunities in production of rabbits?

**SECTION 3: RABBIT MARKETING INFORMATION**

3.1 Where do you sell your rabbits?

[1] Farm gate [2] Local market [3] Urban market [4] Others\_\_\_\_\_ (specify)

3.2 Please fill the table below to show who buys your rabbits and the buying price

Purchaser	Quantity (number of rabbits)	Price per rabbit
Broker		
Retailer		
Wholesaler		
Neighbor/consumer		
Others..... (specify)		

3.3 How do you sell your rabbits?

[1] As an individual [2] as a group [3] Others..... (Specify)

3.4 What do you consider when deciding the person you sell your rabbits to?

[1] Price [2] Road condition [3] Proximity[4] Others..... (Specify)

3.4 Who sets rabbit selling prices?

[1] Yourself [2] Buyer [3] Government [4] Negotiations [5] Others.....

(Specify)

3.4 Do you sign contracts with buyers to supply rabbits in future?

[1] Yes [2] No

3.4.1 What is the cost of signing the contract in Kshs.?

---

3.5 Do traders offer different prices based on rabbit breeds?

[1] Yes [2] No

3.6 Is price determination based on a standard formula? [1] Yes [2] No

3.6.1 If yes, is the formula known to you? [1] Yes [2] No

3.7 Can consumers change their mind after buying rabbits?

[1] Yes [2] No

3.7 Do some traders lobby politicians or city council officials to control markets or collection of market dues?

[1] Yes [2] No

3.8 Are you accessed to market information on;

(a) Prices [1] Yes [2] No

(b) Quantities required [1] Yes [2] No

(c) Stipulated standards [1] Yes [2] No

3.9 What are the sources of market information and how often do you access?

Sources of information	How often do you access?
Neighbors	
Friends and relatives	
Radio, TV	
Print media e.g newspapers, brochures	
Others	

3.10 What are the costs involved in marketing of rabbits?

Activity	Cost (Kshs.)
Transport	
Storage	
Processing	
Packaging	
Tax	

#### **SECTION 4: INSTITUTIONAL INFORMATION**

4.1 Are you a member of any development group?

<b>Type of group</b>	<b>Member to a group (1=yes, 0=no)</b>	<b>1=formal 2=informal</b>	<b>If yes, duration of membership (years)</b>	<b>One major service offered by the group (1=credit services, 2=marketing information, 3= marketing of produce 4=transport services, 5= input purchase, 6=other, specify.....)</b>
Youth group				
Women group				
Religious group				
SACCO/credit groups				
Environmental group				
Other group[specify]				

4.2 In the past 12 months please explain how you have participated in the following group activities, in any of the groups you belong to?

<b>Group activity</b>	<b>Have you participated (1=yes, 0=no)</b>	<b>If yes Frequency/amount</b>
Attendance of group meetings		
Registration		

Payment of subscription fee		
Decision making in key activities		
Election of group officials		
Other[specify _____]		

4.3 In your opinion how important are the following factors in influencing your decision to join/form a group.

Group factor	Relative importance		
	1=very important	2=important	3= not important
Participating in the same type of activity			
Number of group members			
Leaders who are dedicated to serve			
Fairness in distribution of benefits among the group members			
Good quality of services offered			
Group leaders transparency in financial matters			

4.4 Have you accessed extension services for the past 12 months? (1=yes, 0=no)

4.5 How frequently do the extension officers visit your farm? (1= Daily = 2 = once a week 3 = twice a week 4 = once a month 5= Once a year).

4.6 Where do you acquire information on marketing of rabbit? (1 = Neighbors 2 = Indigenous (Own) knowledge 3 = Television 4= Radio 5 = Newspapers 6 = Community elders 7= NGO's 8= Government support staff 9 = Other (Specify) .....

4.7 Have you ever applied credit for the 12 months? (1=yes, 0=no)

4.7 *If yes* please explain the credit details

Source of credit	Did you get (1=yes, 0=no)	If you got, what amount did you get compared to what you applied for?	Main use of credit (1=food,2=school fees,3=relocation to another area,4=purchase of land,5=farm inputs,6=livestock/livestock feeds, 7=household items,8=clothing,9=others[specify])	How much have you repaid?
Agricultural finance cooperation				
Developmental/farmer group				
SACCOS/ merry-go-rounds				
Local Community Based organization				
Local non-governmental organization				

Relative/ friend				
Money lender/shylock				
Other[specify]				

5.8 If you did not apply for credit what was the **main reason** that made you not to apply for it? (1=not aware, 2=lack of security, 3=doesn't need it, 4=don't know the procedure, 5=loans are deceiving, 6=other [specify.....

4.9 Do you carry out any value addition/preservation procedures on your vegetables before selling? (1= Yes 0 = No)

4.10 What challenges do you face in the marketing of rabbits?

(1=Lack of specific drugs for rabbits 2=Extension support 3=Access to credit 4=Access to market information 5=Diseases 6=Other (specify))

5.1 What are the available opportunities in marketing of rabbits?

**Thank you for your participation!**

(ii) Traders' Questionnaire

**SECTION 1: SOCIOECONOMIC CHARACTERISTICS OF RABBIT TRADERS**

1.25 County

[1] Kiambu [2] Nakuru [3] Nyeri

1.26 Sub-county \_\_\_\_\_

1.27 Location \_\_\_\_\_

1.28 Sub-location \_\_\_\_\_

1.29 Name of the trader \_\_\_\_\_

1.30 Status of the respondent: 1. Wholesaler { } 2. Retailer { } 3. Broker { } 4. Others  
(specify) \_\_\_\_\_

1.31 Sex [1] Male [2] Female

1.32 Phone number \_\_\_\_\_

1.33 Age in years \_\_\_\_\_

1.34 Formal education level of the respondent

Years of formal schooling completed (primary and above)	Highest level of formal education completed [1] none [2] primary [3] secondary [4] tertiary [5] certificate [6] undergraduate degree [7] master degree [8] PhD

1.35 Marital status [1] Married [2] Single [3] separated [4] Divorced/divorcee [5] widow/widower

1.36 Other source of income [1] Crop farmer [2] Livestock keeper [3] Trader [4] civil servant [5] Teacher [6] Boda boda operator [7] Remittances [8] Others, specify \_\_\_\_\_

1.37 Household size \_\_\_\_\_

1.38 Rabbit trading experience in years \_\_\_\_\_

Type of nearest road [1] Tarmac [2] Murram [3] Earth [4] Others (Specify)

1.39 Quality of road [1] Very good [2] Good [3] poor [4] Very poor

1.40 Transport cost to the nearest market Centre (Kshs.) \_\_\_\_\_

1.41 Average household monthly net income

Income category	Tick category	Indicate average amount (Kshs)
Below ksh. 20,000		
Ksh. 20,001- 50,000		
Kshs 50,001-100,000		
Kshs 100,001-150,000		
Above Kshs 150,000		

1.22 Breeds of rabbits traded \_\_\_\_\_

**SECTION 2: RABBIT MARKETING INFORMATION**

2.1 How much was the startup capital for your rabbit trading enterprise?

Cost	Quantity	Kshs.
First rabbit stock		
License		
Slaughtering costs		
Tax		
Transport		
Others (specify) .....		

2.2 What was the main source of the startup capital?

[1] Credit from bank [2] Personal savings [3] Friends and relatives [4] Community-based organization (CBO) [5] Others\_\_\_\_\_ (specify)

2.3 Please fill the table showing the source and buying price of rabbits traded.

Purchaser	Quantity (number of rabbits)	Price per rabbit in kshs.	Distance in km
Broker			
Retailer			
Wholesaler			
Neighbor/consumer			
Others..... (specify)			

2.4 What determines the choice of whom to buy your produce from?

[1] Price [2] proximity [3] Trust [4] Other\_\_\_\_\_ (specify)

2.5 Who sets the price you buy the rabbits for?

[1] Myself [2] farmer [3] trader [4] negotiation [5] group [6] market

2.6 Did you know the market prices prior to purchasing the rabbits?

[1] Yes [2] No

2.7 If yes, what was the source of rabbit price information?

[1] The cooperative [2] Radio [3] Newspapers [4] marketing group [5] barazas

2.8 How do you contact your customers?

2.8 Please indicate where you sell your rabbits after acquisition?

Where do you sell?	Selling price	Distance in km
Supermarket/shops		
Consumers		
Other traders		
Restaurants		
Others (specify)		

2.9 How long does it take for you to re-sell the acquired rabbits?

[1] Immediately [2] Less than a week [3] More than a week [4] Months [5]

Others\_\_\_\_\_ (specify)

2.10 In what form do you sell your rabbits?

[1] Live rabbits [2] Meat after slaughtering [3] Others\_\_\_\_\_ (specify)

2.11 Do you have storage facility for the rabbit meat?

[1] Yes [2] No

2.12 If yes, which type of storage facility?

[1] Modern (refrigerated) [2] traditional [3] other\_\_\_\_\_ (specify)

2.13 Who sets the selling price of rabbits or products?

[1] Myself [2] buyer [3] marketing group [4] Negotiations [5] other\_\_\_\_\_

(specify)

2.14 Do you know the market prices for rabbits before you selling?

[1] Yes [2] No

2.15 If yes, what is the source of the market price information for rabbits?

[1] The cooperative [2] Radio [3] Newspapers [4] marketing group [5] barazas

2.16 What are the marketing costs incurred?

<b>Cost type</b>	<b>Amount (Kshs)</b>
Transport	
Packaging	
Market charges	
City council levy	
Produce loss (cause:_____)	
Trading license	
Slaughter charges	
Others (specify)	

2.17 Do you possess a trading license for your rabbit trading enterprise?

[1] Yes [2] No

2.18 If yes, what was the cost of the trading license?

---

2.19 Do you sign contracts with sellers or buyers to supply rabbits in future?

[1] Yes [2] No

2.19.1 If yes, who are the buyers or sellers you contract with?

2.20 What are the characteristics considered during pricing of rabbits?

[1] Size [3] Sex

[2] Breed [4] Others (Specify)

2.21 If yes, is the formula known to you? [1] Yes [2] No

2.22 Can consumers after purchasing from change their minds?

[1] Yes [2] No

2.23 Do some traders lobby politicians or city council officials to control markets or collection of market dues?

[1] Yes [2] No

2.24 Are you accessed to market information such as prices, quantities and standards of rabbits?

[1] Yes [2] No

2.25 What are the sources of market information?

[1] Neighbors [2] Friends and relatives [3] Radio, TV [4] Print media such as newspapers, brochures e.t.c [5] Others..... (Specify)

**SECTION 3: INSTITUTIONAL INFORMATION**

3.1 Are you a member of any development group?

<b>Type of group</b>	<b>Member to a group (1=yes, 0=no)</b>	<b>1=formal 2=informal</b>	<b>If yes, duration of membership (years)</b>	<b>One major service offered by the group (1=credit services, 2=marketing information, 3= marketing of produce 4=transport services, 5= input purchase, 6=other, specify.....)</b>
Youth group				
Women group				
Religious group				
SACCO/credit groups				
Environmental group				
Other group[specify]				

3.2 In the past 12 months please explain how you have participated in the following group activities, in any of the groups you belong to?

<b>Group activity</b>	<b>Have you participated (1=yes, 0=no)</b>	<b><i>If yes</i> Frequency/amount</b>
Attendance of group meetings		
Registration		
Payment of subscription fee		
Decision making in key activities		
Election of group officials		
Other[specify _____]		

3.3 In your opinion how important are the following factors in influencing your decision to join/form a group.

<b>Group factor</b>	<b>Relative importance</b>		
	<b>1=very important</b>	<b>2=important</b>	<b>3= not important</b>
Participating in the same type of activity			
Number of group members			
Leaders who are dedicated to serve			
Fairness in distribution of benefits among the group members			
Good quality of services offered			
Group leaders transparency in financial matters			

3.4 Have you accessed extension services for the past 12 months? (1=yes, 0=no)

3.5 *If yes* above how many times? \_\_\_\_\_

3.6 Have you ever applied credit for the 12 months? (1=yes, 0=no)

3.7 *If yes* please explain the credit details

Source of credit	Did you get (1=yes, 0=no)	If you got, what amount did you get compared to what you applied for?	Main use of credit (1=food,2=school fees,3=relocation to another area,4=purchase of land,5=farm inputs,6=livestock/livestock feeds, 7=household items,8=clothing,9=others[specify])	How much have you repaid?
Agricultural finance cooperation				
Developmental/farmer group				
SACCOS/ merry-go-rounds				
Local Community Based organization				
Local non-governmental organization				
Relative/ friend				
Money lender/shylock				
Other[specify]				

3.9 If you did not apply for credit what was the **main reason** that made you not to apply for it?

(1=not aware, 2=lack of security, 3=doesn't need it, 4=don't know the procedure, 5=loans are deceiving, 6=other [specify.....

4.0 Highlight challenges you face during marketing of rabbits

4.1 What the available opportunities in marketing of rabbits?

**Appendix II: Key informant interview checklists**

(i) Checklist for interviewing representatives from Ministry of Agriculture, Livestock and Fisheries' in the sub-County

1. What is your position and responsibility in the ministry?
2. Which areas of the county is rabbit farming being practiced?
3. What are some of the services you offer to rabbit farmers?
4. How do you work with rabbit farmers in respective areas?
5. How do you provide guidance to rabbit farmers both in production and marketing of their products?
6. Do farmers respond to services provided? Do they put them in practice?
7. Do you inspect farms to check if the guidelines have been followed?
8. What are some of the challenges you experience while working with farmers?
9. What do you think are the challenges facing rabbit industry in this area?
10. Do you keep records of the state of rabbit farming in this area? If yes, kindly provide them.
11. Where do farmers sell their rabbits after maturity?
12. What is your view on the presence of brokers in the rabbit value chain in this county?

13. What is your view on the present development of rabbit industry in this area?
14. What are the visions/goals for the future of rabbit production in this area?

## **2. Checklist for interviewing community elders**

1. What is your general view of rabbit farming in this community?
2. How many farmers are practicing rabbit farming here?
3. Where do farmers sell their rabbits after maturity?
4. What are the main challenges facing rabbit farming in this area?
5. Is your community visited by extension officers and veterinary technicians?
6. What is your general impression of the presence of the extension officers and health technicians in the area and their relationship with rabbit farmers?
7. Have you ever had government or NGO projects in your village related to rabbit farming?
8. Do you have rabbit processing plants (lead firms) in your area?
9. Where do farmers sell their rabbits and products?
10. What usually determine the choice of marketing channels?
11. What are the challenges facing marketing of rabbits in this area?

## **3. Checklist for interviewing representatives from Rabbit farmers Association (RABAK)**

1. What is your role at RABAK association?
2. When was the association established?
3. Why was the association established?
4. How is the management structured?

5. How many members does the RABAK association have? i. How many of these members are active members?
6. What characterizes farmers as members of this association?
7. Is RABAK as an association licensed?
8. Are there specific requirements to join the association?
9. How much is the membership fee? i. Do the farmers have to pay to rejoin the association if they have been inactive?
10. How many collection points do you have?
11. Is there specific time when you pick the rabbits?
12. Have there been changes in the rabbit quantity from the farmers over the years?
13. Have the structure of the association changed over the years?
14. Do the farmers elect the board members?
15. How many rabbits do you receive in a day/week?
16. Is there a limit to number of rabbits you can receive?
17. Do you keep records?
18. Do you process the rabbits here?
19. How much do you pay the farmers for each rabbit?
20. When and how do you pay the farmers?

21. Who do you sell the rabbits/meat to? i. At what price do you sell the meat or meat products?

### **Members' Information**

1. Do you provide any husbandry or marketing services to you members? If yes, what services?

2. Do rabbit farmers use these services?

3. What are the benefits for the association in providing these services?

4. Why should the farmers sell the rabbits at the cooperative and not the hawkers?

5. How do you try to get new members of the association?

6. Do the government in anyway support the association? 9. What are the main obstacles in your work?

7. Who are your greatest competitors?

8. Is your association profit-oriented?

9. Do you get any money in support from the government?

10. What are the main obstacles/challenges facing rabbit marketing ?

11. What are the strengths facing rabbit industry?

12. What are the opportunities facing the industry?

13. What are the threats facing rabbit industry?

14. How is rabbit pricing done?

15. What are the different rabbit breeds kept by farmers?

18. Do you get any other products apart from meat? Mention them. How are they utilized?

### **Appendix III: Focus Group Discussion Checklist**

#### **Discussion Questions**

##### **Rabbit production**

1. What motivated you into rabbit farming?
2. What breeds of rabbits do you keep?
3. What is the main purpose of rabbit keeping?
4. What do you consider as the main challenges facing rabbit farming in this area?
5. Have you ever had a visit from the health technician from the veterinary department?
6. If yes, what did you get out of the visit?
7. Have you ever gone to the offices of the district's Ministry of Agriculture, Livestock and Fisheries department for advice?
8. If yes, why and what did you get out of the visit?
9. If no, are you aware of the advisory services they provide and would you ever make use of them?
10. What are some of the costs incurred in rabbit farming?
11. Have you ever had government or NGO projects in your village related to rabbit farming?
12. What are they and what activities have they done?

13. Have they helped you? How?
14. Are you members of rabbit self-help groups? If yes, what are the main activities of the group?
15. Apart from rabbit meat, what other rabbit products do you get from your rabbit farming?  
How do you benefit from them?
16. Do you have credit facilities in this area? Which ones? What are the conditions for you to qualify for credit? Have you ever applied for credit to improve your rabbit farming in the last five years?

### **Rabbit Marketing**

1. Where do you sell your rabbits and their products?
2. How do you do pricing of your rabbits?
3. What determines the choice of your marketing channel?
4. What is the average selling price of the above (rabbits and their products) and how does it vary with different buyers?
5. Do you have any lead firms in your area? Mention them. What activities are they involved in?
6. What are the qualifications of supplying the lead firms with your rabbits?
7. Do you sell your rabbits through cooperatives or groups? If yes, what do you see as the main advantages of selling your rabbits and their products to the co-operative?

8. What do you think as the main obstacles in selling your rabbits to the co-operative?
9. Are you satisfied with the services offered by the cooperatives? If no, how should they be improved?
10. For farmers selling their rabbits to middlemen or brokers, what do you think are the main advantages of selling to such buyers?
11. What are the main challenges of selling rabbits to middlemen or brokers?
12. What are some of the cost involved in marketing of your rabbits?

Using the writing materials provided, draw a value chain of how your rabbits flow starting from you up to the final consumer.

Any question for us?

**Thank you!**

**Appendix IV: Regressors' VIF for Nakuru, Kiambu and Nyeri**

Variable	VIF $(1 - R_j^2)^{-1}$		
	Nakuru	Kiambu	Nyeri
Age	1.067	2.343	1.661
Household size	1.204	1.059	1.495
Education	1.112	1.167	1.426
Gender	1.341	1.504	1.375
Land size	1.184	2.397	1.310
Number of rabbits	1.219	1.155	1.309
Group membership	1.649	1.283	1.280
Extension	1.305	1.631	1.235
Credit	1.519	1.425	1.197
Wealth index	1.774	1.180	1.133
Income	1.280	1.071	1.105
Mean VIF	1.332	1.474	1.321