AN ANALYSIS OF ECONOMIC EFFICIENCY AMONG INDIGENOUS CHICKEN FARMS IN KITUI COUNTY, KENYA

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DECLARATION

I understand that plagiarism is an offence and I therefore declare that this Thesis is my original work and has not been presented to any other institution for any other award.

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To my sons Kelvin and Charles

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TABLE OF CONTENTS

CHAPTER FIVE

CHAPTER SIX

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

AD	**:**	Anno Donini (After Christ)
ANOVA	**:**	Analysis of Variance
BC	**:**	Before Christ
DEA	**:**	Data Envelopment Analysis
DFA	**:**	Distribution Free Approach
ES	**:**	Economies of Scale
FAO	**:**	Food and Agriculture Organization
FBOs	**:**	Faith Based Organisations
FDH	**:**	Free Disposable Hull
FEM	**:**	Fixed Effect Model
GDP	**:**	Gross Domestic Product
GOK	**:**	Government of Kenya
IC	**:**	Indigenous Chicken
KARI	**:**	Kenya Agricultural Research Institute
MFC	**:**	Marginal Factor Cost
MLE	**:**	Maximum Likelihood Estimates
MOLFD	**:**	Ministry of Livestock and Fisheries Development
MVP	**:**	Marginal Value Product
NCD	**:**	New Castle Disease
REM	**:**	Radom Effect Model
RUE	**:**	Resource Use Efficiency
SFA	**:**	Stochastic Frontier Approach
SPSS	**:**	Statistical Package for Social Sciences
TFA	**:**	Thick Frontier Approach

DEFINITION OF SIGNIFICANT TERMS

Confined Production System: Chicken kept in closed structures.

Economic Efficiency: The capacity to achieve a given amount of output at the cheapest price feasible.

Free Range System: Chicken left to scavenge for their feed

Household: Comprise a person or group of persons generally bound by ties of Kinship who live together under a single roof or within a single compound and who share community way of life in that they are answerable to the same head and share a common source of food.

Indigenous Chicken: Chicken kept under free range system and scavenge with little subsidy from family food leftovers. Crossbreeds were also considered.

Large Scale Farmers: Farmers keeping more than one hundred chicken.

Production System: The specified method and management practices applied in rearing chicken.

Small Scale Farms: Farmers keeping less than fifty chickens.

Social Economic Factors: The human behavioral factors and all exchange transactions that affect the level of IC production.

ABSTRACT

Chicken production is one of the popular poultry activities worldwide. Chicken constitute the greatest percentage of livestock species reared in rural areas. In Kenya, the poultry sector contributes 30% of the agricultural contribution to Gross Domestic Product (GDP). Despite enhancement programmes such as crossbreeding and the introduction of indigenous chicken-specific foods, indigenous chicken production has remained low with some farmers making minimal profits and huge losses. The influence of social and economic factors on production efficiency or inefficiency has not been empirically established. The main purpose of this study was to analyze the economic efficiency among indigenous chicken farmers in Kitui County. The specific objectives were to: Identify major resources used by farmers in indigenous chicken production, estimate the production function and determine which of the identified resources significantly influenced chicken production in the study area; Determine the farmers level of efficiency in utilizing the identified resources; Com00000pare the relative economic efficiency between small and large scale indigenous chicken farms in Kitui county; Identify the major factors limiting indigenous chicken production, farm profit and propose solutions for the identified challenges . The study was conducted in Kitui County, Kenya. A descriptive survey design was adopted. Primary data was elicited using a structured questionnaire administered on 120 indigenous chicken farmers from selected wards of Kitui County. A stochastic production function was used to estimate the effect of production cost on the level of indigenous chicken production. To assess resource use efficiency among indigenous chicken farmers in the study area, the study used a Cobb-Douglas production function. Statistical package for social sciences version 28 and Frontier 4.1 software were used in data analysis. The results of the study revealed that the main resources used by the indigenous chicken farmers were: poultry house, feeds, feeding traps, water traps, veterinary services and hired labour. The cost of efficiency levels of the sampled indigenous chicken farms ranged from 0.1067 to 0.3498 with a mean of 0.70798. Farmers' education level, experience in indigenous chicken production, farm size and technical advice from veterinary experts were identified as factors that influenced levels of observed cost efficiencies among indigenous chicken farmers in the study area. The production function analysis identified labour, poultry feed and poultry housing as the resources with greatest influence on poultry production. Their coefficients were 0.775, 0.619 and 0.571 respectively. Resource use efficiency for large scale farmers revealed that cost of birds and poultry equipment were underutilized and, therefore, required a cost increase of 72% and 21.5% respectively for optimum production. Small scale farmers were found to underutilize vaccines, drugs, chemicals, amount of feed and cost of equipment necessitating a cost increase of 80.85%, 10%, 65.17% and 52.9 % for optimum allocation. Price analysis indicated that the average price per bird was Ksh.500. Farmers with less than 50 birds reported to have attracted better prices at an average price of Kshs. 530 per bird. The profit function analysis showed that on average farmers realized a profit of Kshs. 147 per bird. However, the results indicate that farmers keeping more than 100 birds realized a profit of Kshs 175, higher than farmers keeping birds less than 50 who earned a profit of Kshs. 130 per bird. Lack of proper chicken housing, conflict with neighbors, poor chicken husbandry skills, low chicken returns, and theft were all factors that influenced indigenous chicken farming. Newcastle disease (NCD) was identified as the most common disease condition affecting indigenous chicken production. Empirical results of the study pointed out that despite some levels of cost inefficiency identified, the indigenous chicken farmers in the study area have the potential of increasing the scale of production and become more profitable. The study recommended that as a matter of policy, extension services should be increased and farmers educated on importance of cooperative societies. Farmers should be encouraged to embrace the improved breeds to maximize on profit. Subsidizing feeds and other production inputs was also pointed out as a step towards expansion of the poultry sector.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

In Kenya, agriculture accounts for 33% of GDP, with poultry accounting for 30% of the agricultural contribution (Lokuruka 2020, GOK 2019). Kenya has a poultry population of 31 million birds. Out of this population, 75 % of the population is made up of native chickens, 22 % of broilers and layers, and 1% of breeding stock. Among many poultry species, 2% of the total poultry population are ducks, geese, turkeys, pigeons, ostriches, Guinean fowls and quails (Delabouglise et al., 2020). Indigenous hens are mostly found in rural regions and play an important economic role (Moussa et al., 2019). Over a million chicks are produced each week in the commercial poultry industry (Aila et al., 2012). An increasing urban population and a developing retail sector, which includes fast food outlets, supermarkets, and restaurants, are the two most important elements of the commercial market. Chicken for sale whether whole, half, pieces, grilled, fried, or eggs, is in high demand and rising (Aila et al., 2012).

According to Gichohi and Maina 1992; and Kamau et al., (2018) majority of the small-scale farmers in Kenya estimated at 90% of poultry farmers rear indigenous chicken. Kenyans eat eggs and meat from indigenous chicken, which help to supplement their protein intake (Njuguna et al., 2017). Furthermore, the sale of chicken products boosts and diversifies revenue in the livestock industry, as well as the rural population's income and sustenance (Mwobobia et. al., 2016). Indigenous chicken farming creates employment and promotes overall economic development (Mwobobia et al., 2016). According to the report, chicken production employs a wide range of people, including poultry farmers, secondary traders, processors, and caterers. For thousands of years, indigenous chicken have been used in traditional medicine and a variety of cultural rites (Dessie, 1996; King'ori, 2004; Moreki et al., 2010). In comparison to other livestock species, chicken production offers the advantages of quick returns on investment and relatively simple management procedures, as well as a diverse range of market outlets for products. Poultry products, particularly eggs, are sold in low-value units, making chicken products accessible to those with lower incomes (Say, 1987; FAO, 1997).

Poultry keeping is an appealing business for low-income families since it requires little initial capital and has cheap operating costs. It is also crucial in mitigating the increasing landlessness caused by rapid population growth, and as a result, it has become the preferred investment because of its low space requirements (Upton, 2012). The native chicken's productivity has been hampered by genotype, low feed conversion efficiency, and a lack of adoption of modern technologies. Because of their hardiness, indigenous chicken are highly adapted to arid conditions, can survive with fewer inputs, and can adjust to irregular fluctuations in available feed resources (Gichohi and Maina, 1992, Nchinda et al., 2011). After crop harvests, indigenous hens scrounge for food around the homestead and in the fields. Consumers' preferences for indigenous chicken meat are linked to its leanness and flavor, as well as the fact that it is assumed to be organic (Islam and Nishibori, 2009). Women, landless youth, and marginalized farmers gain from large-scale chicken farming, which provides them with both income and food. It is a common observation in Sub-Saharan Africa including Kenya indigenous chicken ownership and administration is centered on women and children, and that indigenous chicken are frequently an important source of income for female-headed households (Dessie, 1996; Ahlers et al., 2009). As a result, promoting indigenous chicken production empowers rural adolescents and women economically (Guèye, 2009). Several authors have emphasized the possibility of enhancing indigenous chicken production and productivity in poor countries (Okitoi and Mukisira, 2001; King'ori et al., 2007; Dessie, 1996; Ndegwa et al., 1996c). This can be accomplished by encouraging solid management techniques such as proper housing, illness control, better diet, and genetics.

1.2 Statement of the Problem

The production of indigenous chicken has been encouraged as a way of poverty alleviation as well as a source of food. Government and non-governmental organizations have collaborated to improve indigenous chicken production, making it more viable and sustainable, particularly for smallholder farmers (Baliyan and Masuku, 2017). Despite improvements such as crossbreeding with commercial layers and broilers and the development of feeds designed for indigenous chicken, productivity has remained poor, and some farmers are only making a modest profit, if at all. The impact of socioeconomic factors on production efficiency or inefficiency is yet to be fully investigated. Farmers attribute the high cost associated with poultry and for that matter indigenous chicken production to the cost of feeding the birds as well as the cost of other inputs ignoring the crucial role that cost management can play (Milkias et al., 2019). Efficient cost management or otherwise by the farmers has a direct bearing on their cost of production (Kirui, 2014). If farmers were efficient in allocation of inputs, this would minimize wastage of production resources resulting in minimization of cost and maximization of profit and, hence encouraging them to produce more (Mwangi et al., 2020). This presupposes that low-cost efficiency (high-cost inefficiency) could be a contributory factor to the high indigenous chicken production cost and for that matter low Indigenous chicken (IC) production in Kenya. Studies from other African countries suggest that cost efficiency or inefficiency levels of IC farms are determined by the socioeconomic and demographic characteristics of the farmers/production managers (Oji and Chukwuma, 2007; Udo and Etim, 2009; Ng'eno *et al*., 2010; Ashagidigbi *et al*., 2011).

These characteristics include the information status and management skills measured by the level of education, farming experience, and source and frequency of technical advice. Farmers' readiness to adopt new ideas and innovations is determined by their level of formal education and hence encourage proper cost management methods. More educated farmers are thus more likely to be cost-effective than their less educated counterparts, owing to their superior skills, access to knowledge, and sound farm planning techniques. Continuous practice of a profession over a lengthy period of time is likely to make a person more experienced and productive in practice (Idiong, 2005). Years of experience in chicken production could result in the acquisition of more knowledge on the production processes and practices culminating in efficient utilization of production inputs. However, there are instances where some very experienced farmers become adamant and unwilling to adopt new practices resulting in low cost efficiencies (high cost inefficiencies) (Yusuf and Malomo 2007).

Furthermore, technical assistance is critical for cost management. The quality of advice and its impact, on the other hand, is primarily determined by the source. IC farmers receive technical advice from a variety of sources. The differences in the content and quality of advice from these sources could lead to differences in the production practices among the IC farms. Besides the farmer characteristics, the average cost of production could be reduced through an increase in the scale of production (indication of positive economies of scale). Lower average costs reflect increased productivity and, in the event of market competition, can be passed on to customers at lower prices. However, not all increases in output or scale of production lead to reductions in average production cost. There are instances where the average cost per unit rises as the scale of production increases. In some cases, an increase in production scale does not have any impact on the average production cost per unit. These occur when there are so many inefficiencies within the farm resulting in rising average costs. This study, therefore, addressed the following central research question: What are the allocative, technical, economic efficiency levels and the economies of scale among the IC farms in Kitui County.

1.3 Objectives

1.3.1. General Objective

The overall objective of the study was to analyze economic efficiencies among IC farms in Kitui County, Kenya.

1.3.2 Specific Objectives

The specific objectives were to:

i. Identify major resources that were being used by indigenous chicken farmers, estimate the production function, and determine which of the identified resources significantly influenced indigenous chicken production in the study area,
ii. Determine the farmers level of efficiency in utilizing the identified resources,

iii. Compare the relative economic efficiency between small and large scale indigenous chicken farms in Kitui County and
iv. Identify the major factors limiting indigenous chicken production, farm profits and propose solutions to them.

1.4 Research Hypothesis

That the:

i. Identified resources have no significant influence on indigenous chicken production,
ii. Farmers in the study area do not use resources efficiently,
iii. Small and large indigenous chicken farms do not have equal economic efficiency and
iv. Each identified factor does not significantly influence farm profit.

1.5 Justification of the Study

The main concern of any production activity has been described as that of achieving maximum possible efficiency in the transformation of inputs into outputs. In agriculture, measurement of cost efficiency is an important step in a process that might lead to substantial resource saving which has important implications for both policy and farm management.

Efficiency measures can have important implications for issues related to economic survival, technological adoption and innovations, and the overall input use in the poultry subsector of agricultural sector. They can provide important insights to managers when making operational decisions and to policymakers in the debate on regulatory issues. Furthermore, for individual IC farms, gains in efficiency are of great substance in periods of financial stress since efficient farms are more likely to generate higher incomes and thus, stand a better chance of surviving and prospering. It also helps to determine the under-utilization or over-utilization of factor inputs.

Moreover, measurement of the extent and determinants of cost efficiency indicates which aspects of IC farms' characteristics can be addressed by public investment to improve efficiency. It also introduces a new dimension to farmers and policymakers on how to increase IC production by determining the extent to which it is possible to raise the cost efficiency of the farms with the existing resources base and the available technology to meet the increasing demand for poultry products such as chicken in Kenya. An improvement in the understanding of the levels of cost efficiency and its relationship with a host of farm level factors can greatly aid policy makers in developing efficiency, enhancing measures as well as in judging the efficacy of present and past reforms.

Furthermore, the result of the economies of scale determination is a very useful decision making tool when considering an expansion in a farm’s scale of production. The result is crucial not only for the IC farmers but also for those who intend to invest in the poultry industry since it enables them to ascertain whether or not an increase in the present scale of production could translate into reduction in the average cost of production and eventually increase farmers’ profits. It enables the other stakeholders including private investors, government to find out whether a possible increase in the present scale of IC production in the study area and in Kenya as a whole, would not disadvantage the farmers in terms of cost/profit. Therefore, an empirical study to determine the cost efficiency levels of the IC farms and the presence of economies of scale among the farms are the necessary first step in our national effort to reduce IC production costs and boost local production.

1.6 Limitations of the Study

Majority of farmers were not keeping production records so the study relied on farmers’ memory. Due to financial constraints and vastness of the area, the study used the minimal sample size. The distance between the households involved in the study was not considered as a factor in selection of respondents because the indigenous chicken farmers were assumed to be homogenous in their characteristics.

1.7 Scope of the Study

The thesis covers the indigenous chicken farmers in the selected sub locations of Kitui county. The study assumed that all households where chicken farms. According to Ndegwa et al., (2000), indigenous chicken are considered as local assets of local people living in rural areas and are therefore kept nearly by all families in rural and peri-urban areas. Therefore, every household had an equal chance of being considered as an indigenous chicken farm.

In order to be consistent and precise the literature review was done in line with the objectives of the study. Households with more than hundred chicken where considered as large scale farms while those with less than fifty where categorized as small scale farms. The recommendations and conclusions were drawn from the results of the study.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Exodus of Indigenous Chicken into Kenya

Indigenous chickens, also known as domestic chickens (Gallus gallus domesticus), have been kept in Kenya for years (Maina, 2000; Upton, 2012). Kenyan chicken varieties are hybrids of Asiatic meat and gamtypes of diverse origins, rather than pure breeds (Apopo et al., 2020). Jungle fowl (Gallus gallus) found in India, Indochina, China, the Philippines, and Indonesia are said to have evolved into the first chicken (Gallus gallus domesticus) (Blench and MacDonald 2000, Moiseyeva et al., 2003). They were first tamed in Southeast Asia and then spread around the world as a result of human migration. Although indigenous chicken in Africa are very important sources of livelihood little is known about the path and dates of their arrival on the continent. Blench and MacDonald (2000), on the other hand, claim that archeological evidence shows that chicken enterprise was present in Egypt as early as between 1425 and 1123 BC. Chicken came into existence in Kenya as a result of Bantu people migrating from central Africa to western Kenya approximately 100 BC (Maina, 2000). It's also thought that the migration of the paranilotics from central Africa around 50 AD, followed by the Nilotics along the Nile valley, brought more chicken to Kenya (Blench and MacDonald, 2000). The number of chicken in Kenya has been on the increase with each county taking a census of its poultry population for the purpose of policy formulation and county income computations. Table 2.1 shows the most recent data on chicken population of Kitui County as per the sub counties.

Table 2.1 Chicken Population In Kitui County.

County/Sub County	Indigenous Chicken	Exotic Chicken Layers	Exotic chicken broilers
Kitui	1,361,190	56,769	27,054
Ikutha	83,618	2,163	1,319
Katulani	67,517	4,205	3,466
Kisasi	62,512	913	466
Kitui Central	97,856	8,673	4,914
Kitui West	95,828	1,764	363
Kyuso	86,087	2,262	1,349
Lower Yatta	82,866	2,405	1,387
Matinyani	68,803	1,740	3,074
Migwani	120,700	7,071	2,062
Mumoni	34,893	3,916	642
Mutitu	60,829	1,158	402
Mutitu North	27,574	887	504
Mutomo	131,538	3,797	1,181
Mwingi Central	129,315	5,685	2,569
Mwingi East	96,615	6,257	931
Nzambani	58,701	2,681	1,588
Thagicu	13,004	566	553
Tseikuru	42,934	626	284

Source: Kenya Bureau of statistics, 2019 National census

2.2 Role of Efficiency in Commercial Poultry Production

The capacity to achieve a given amount of output at the cheapest price feasible is known as efficiency (Farrell, 1957). In both industrialized and developing countries around the world, the importance of efficiency in raising poultry and agricultural output has long been acknowledged (Tran *et al*, 1993). The main concern of any production activity has been described as that of achieving maximum possible efficiency in the transformation of inputs into outputs. According to Lawal (2007), in agriculture, efficiency measurement is a crucial step in a process that can lead to significant cost savings, which has consequences for policy formulation and farm management. The general observation, therefore, is that local farmers, especially in developing countries, are not efficient in the allocation of available resources in agricultural production (Abdullai and Huffman, 2000). Production efficiency is a way of ensuring that products of firms are produced in the best and most profitable way. To prevent waste of resources and for that matter high cost of production, efficiency is of great importance for every sector of the economy (Alrwis and Francis, 2008). Efficiency measurement is critical because it is a component in increasing productivity. It also aids in determining whether factor inputs are underutilized or over utilized (Yusuf and Malomo, 2007). According to Lawal (2007) agricultural production increase through improved efficiency levels are becoming increasingly significant nowadays, as options to expand farm productivity by increasing physical resource use have been dwindling. Production cost is linked to productivity and efficiency, according to Kibaara (2005). As a result, excessive expenses may be due to inefficiency.

According to Lawal (2007), eliminating current inefficiencies among farmers as a way to enhance agricultural productivity and farm household income is more cost efficient than introducing new technologies. Increases in efficiency are important for individual farms in times of financial hardship, according to Tijani et al., (2006), because efficient farms are more likely to earn larger incomes, increasing their chances of surviving and prospering. Farmers' efficiency levels, according to Giroh et al., (2010), have a direct impact on the cost of production, which translates to higher profit for the farmers. If poultry farmers are efficient in their input allocation, this will result in cost minimization, profit maximization, and encourage them to produce more, resulting in food security (Nge'no et al., 2010). This means that improving cost efficiency will yield a decline or decrease in the total cost of indigenous chicken production. According to Alrwis and Francis (2008), production costs may be relatively high due to cost inefficiencies in production, which could be the result of inexperienced management. If it is established that inefficiencies are the cause of the comparatively high production costs, a policy to improve efficiency could be introduced. The resource usage efficiency of chicken farms in Kenya's Bureti District was studied by Ng'eno et al., (2010). The findings revealed that the majority of the resources were being wasted, resulting in high chicken production costs. The poultry feed efficiency indicator (0.0603) revealed that chicken feed was being used inefficiently. This is because, according to Nge'no et al., (2010), when resource-use efficiency (RUE) =1, resources are maximally employed and farmers are efficient; when RUE < 1, resources are over-utilized, implying inefficiency; and when RUE > 1, resources are underutilized, implying inefficiency. According to Ng'eno et al., (2010), a labor efficiency indicator of -0.091 indicated that farmers were not only inefficient in their use of the resource, but also overused it, whereas a poultry equipment efficiency indicator of 60.86 indicated that poultry equipment was underutilized, resulting in cost inefficiency. In the examined area, these inefficiencies resulted in low productivity and high unit costs in poultry production.

2.3 Levels of Cost Efficiency in Poultry Production

In Kenya, there is no empirical evidence of cost-efficiency in poultry production. Seidu (2008), on the other hand, did a study on the technical efficiency of broiler farms in Ghana's Brong Ahafo region and found that the farms' efficiency was fairly poor. The average efficiency index for broiler production was 0.71, with a range of 0.43-0.79, indicating that output could be enhanced by 29% by utilizing the same inputs and existing technologies. According to several researches on the cost effectiveness of chicken production in some developing nations, the farms were relatively inefficient. Ashagidigbi et al., (2011) conducted a study on the technical and allocative efficiency of chicken producers in Nigeria and found that the farms were roughly 27% inefficient; implying that the farms' production costs might be lowered by 27% if they were more efficient. Begum et al., (2010) calculated the cost/economic efficiency of Bangladeshi poultry farms. The estimated mean value or level of cost efficiency in the research area was 0.66, showing significant inefficiencies in poultry production. The authors came to the conclusion that by improving efficiency, it was possible to lower the cost of chicken production and thus increase profit. Research by Alrwis and Francis (2008) on the technical, allocative, and financial efficiency of broiler farms in Saudi Arabia's central region found that, despite input subsidies, the farms were 24 percent inefficient. The predicted cost efficiency level was 0.664, meaning that if the farm was cost-efficient; it could save 33.6% on production costs.

2.4 Factors influencing Cost Efficiency

Factors influencing cost efficiency especially in a developing country's agriculture have been identified by different authors. Inefficiency can be as a result of socioeconomic, demographic, or environmental factors. However, some environmental elements, like weather and government laws are beyond the control of farmers, and hence their impact cannot be attributed to inefficiency on their part (Al-hassan 2008). Farmers' characteristics both socioeconomic and demographic influence farm-specific efficiency or inefficiency which include information status and managerial skills, such as level of education, farming experience, extension contacts, farm size, gender, and age, as well as system effects exogenous to the farm, such as access to credit (Ali and Byerlee,1991).

Age and schooling (level of education) were found as factors impacting efficiency by Battese and Coelli (1995). The findings revealed that younger farmers were more productive than older farmers. Farmers with more years of education were also more efficient, according to the researchers.

In Imo State, Nigeria, Oji and Chukwuma (2007) investigated technical efficiency among small-scale producers of poultry-eggs and found that the size of the farm has a substantial beneficial effect on efficiency at the 1% level of significance. The authors determined that the farmers were not operating at full capacity and that increasing the number of birds raised would enhance output. At a 5% level of significance, extension contact and education level were found to have a favorable impact on efficiency. Furthermore, access to loans by farmers was found to have a positive impact on efficiency. This means that farmers who have access to use credit in their production were more productive than those who did not. This could be due to the fact that individuals who acquire credit can raise their output and take advantage of cost reductions that come with scale in some circumstances.

According to Ng'eno et al., (2010), the level of education and experience of poultry farmers in Kenya's Bureti District had a considerable and favorable impact on their efficiency. These conclusions are based on the notion that farmers with more years of training and experience have a higher degree of dynamism and, as a result, more open to adopt new practices, resulting in lower production inefficiencies. In Uyo, AkwaIbom State, Nigeria, Udoh and Etim (2009) examined the farm level efficiency of broiler production and concluded that increased experience and education lower inefficiency. This backed up the findings of other researchers, who found that a farmer's level of experience and education increases his or her efficiency. In addition, the effect of age on inefficiency was positive, corroborating previous studies indicating older farmers were inefficient. In a study of technical and allocative efficiency of chicken producers in Nigeria, Ashagidigbi et al., (2011) found agricultural experience, educational level, access to extension services and financing, as well as the gender of the farmers as factors that influence their cost-efficiency.

Farming experience and loan availability were both statistically significant at 1%; educational attainment was significant at 5%, but access to extension services and gender were not. The findings revealed that agricultural expertise and the availability of credit facilities have a significant impact on cost inefficiency. According to various scholars, the negative value and significant coefficient of farming experience and access to credit facilities imply that an increase in years of experience and access to credit facilities reduces cost inefficiency. Farmers with more experience have a better understanding of their resources and procedures, leading in better input use. Farmers' age, experience, and stock/farm size all influence cost efficiency, according to a study by Taru et al., (2010) on the economics of broiler production in Cameroon's Meme Division. As a result, increasing these variables has the potential to reduce cost inefficiencies. Furthermore, a study by Alrwis and Francis (2008) on the technical, allocative, and cost efficiencies of broiler farms in Saudi Arabia's central region confirmed that farm size affects cost efficiency and explains the near extinction of small plants and the dramatic shift in production to large plants, whose share of output increased from less than 30% in 1967 to over 80% in 1992. During that time, expanding the capacity of chicken plants resulted in significant cost savings due to economies of scale. According to the authors, wholesale chicken costs were 12 percent lower in 1992 than they would have been if plant sizes had remained constant between 1972 and 1992.

A research conducted by Udoh and Etim (2009) in Uyo, AkwaIbom State, Nigeria, on the farm level efficiency of broiler production confirmed that the effect of increasing output size on efficiency could be neutral (constant economies of scale). This means that at the current level of broiler production in the research area, the benefits of increasing output size may not be achieved. According to Canbäck (2006), if all increases in output sizes result in high efficiency or cost benefit, the firm's growth and size should be unrestricted.

2.5 Commercializing of Indigenous Chicken Production

The poultry industry is either directly or indirectly linked with the other sectors of the economy such as industry. Many industries provide inputs required in poultry production such as feed, day-old chicks, drugs, chemicals, and vaccines. Other factories/industries manufacture poultry equipment such as feeders, drinkers, brooders among others (Aning, 2006). This implies that the poultry industry indirectly offers employment to many people thereby contributing tremendously to the economic development of the country.

According to Creevey (1991), Alders and Pym (2009), indigenous chicken plays a significant function as a source of animal protein and income for smallholder farmers in developing nations. Farmers grow a modest number of domestic chickens primarily for home consumption in indigenous chicken production systems, according to Farrelly (1996), with minor, generally seasonal surpluses sold in villages. Investments in indigenous chicken farming can help reduce poverty and increase food security by increasing production and generating additional revenue (Mack and Otte, 2005; Pica-Ciamarra and Otte, 2010). Indigenous chicken is frequently connected with superior quality/size of eggs and meat flavor, hard eggshells, high dressing percentages, and low production costs, according to Gueye (1998). Despite the importance of indigenous chicken to developing countries' economies, many farmers indicate that the primary function of indigenous chicken is to provide meat and eggs for domestic consumption (Andrews, 1990; Cairns and Lea, 1990). In the previous 10 years, there has been a surge in the consumption of chicken products, particularly in emerging nations, which has increased by 5.8% per year, outpacing the growth of the human population (Sonaiya and Swan, 2004). Commercializing indigenous chicken production could be timely in terms of satisfying the growing population's requirements (Odwassy et al., 2006). Feed expenses, market prices, stock sizes, and the number of birds sold and consumed all influence profitability (Masuku, 2013). The increased reliance on modern technologies and inputs is as a result of the commercialization of indigenous chicken (Farrelly, 1996). Indigenous chicken farming can be more sustainable, according to Reddy (1998), if farmers use indigenous chicken with appropriate and economical technologies and low external inputs.

2.6 Constraints of Poultry Production

Studies from other African countries suggest that cost efficiency or inefficiency levels of broiler farms are determined by the socioeconomic and demographic characteristics of the farmers/production managers (Oji and Chukwuma, 2007; Udo and Etim, 2009; Ng'eno et al., 2010; Ashagidigbi et al., 2011). These characteristics include the information status and management skills measured by the level of education, farming experience, and source and frequency of technical advice. Farmers' readiness to adopt new ideas and innovations, and hence encourage proper cost management methods, is determined by their level of formal education. A study done by Idiong (2005) revealed that farmers who were educated proved to be cost effective compared to their uneducated or less educated counterparts More educated farmers are thus more likely to be cost-effective than their less educated counterparts because they possessed superior skills, knowledge, and farm planning techniques. In addition, long-term practice of an occupation is likely to make a person more experienced and productive in practice. Years of experience in broiler production could result in the acquisition of more knowledge on the production processes and practices culminating in efficient utilization of production inputs (Alrwis et al., 2008). In his study on the influence of social demographic characteristics on cost efficiency Idiong (2005) observes that some experienced farmers were reluctant in adopting new technologies and hence low cost efficiency.

Technical advices from experts are very instrumental in improving cost management skills. Farmers who raise broilers receive technical assistance from a variety of sources. Different sources of extension services resulted to the differences in production practices among different IC farmers. Despite rising demand, chickens face a variety of challenges, including disease, predators, theft, a harsh environment, a lack of and/or insufficient production skills, poor nutrition, high feed costs, flock sizes, and marketing (KARI, 2006; Kirwa et al., 2010; Ochieng et al., 2013).

Second, different management treatments including feed augmentation, vaccination, brooding, housing, and labor are being implemented (Ochieng et al., 2013). For example, under free range production system, which is commonly practiced in Kitui County, chicken are rarely vaccinated or treated against diseases and parasites (FAO, 2009). It is important to understand how farmers respond to these diseases. In times of disease, smallholder chicken producers in free range production systems may opt to do nothing, utilize ethno-veterinary medicine, use contemporary (conventional) medicine, and/or employ human medicine (Mapiye and Sibanda, 2005). Besides the farmer characteristics, average cost of production could be reduced through an increase in the scale of production (indication of positive economies of scale).

2.7 Economies of Scale

Economies of scale, according to Coelli et al., (2005), are defined as the change in the marginal cost of producing a given output as a function of a change in the output's production level. That is, the advantage of large scale production that results in lower average cost per unit. Mathematically, economies of scale (Es) is determined as the inverse of the sum of all the elasticities of total production cost with respect to all outputs, according to Ogundari et al. (2006) and Coelli et al. (2005). If Es is larger than 1, economies of scale (Es) prevail, and if Es is less than 1, diseconomies of scale exist. There are no economies of scale or diseconomies of scale in the situation of Es=1. Most studies, according to Allen and Liu (2004), discover very minimal economies of scale in a firm's cost structure. The assessed economies of scale were found to be stronger in small to medium sized farms than in big farms in those studies that identified evidence of growing returns to scale (Allen and Liu 2004).

According to Filippini and Farsi (2004), unexploited economies of scale exist when a firm's output is less than the optimal level, but diseconomies of scale exist when a firm's output is greater than the optimal level. The amount of production that minimizes the average cost of producing a unit of output is characterized as the optimal size of a firm. The unexploited economies of scale could translate into inefficiencies and eventually high production cost. According to Yusuf and Malomo (2007), efficiency measures can have significant ramifications for issues such as farm size distribution and overall input utilization in the poultry sub-sector. According to their research, the predicted cost efficiency level was 0.664, meaning that if the farms were cost efficient, production costs might be reduced by 33.6 percent.

2.8 Research Gap

The relevant literature review in this chapter assisted in defining the meaning of efficiency. Different studies revealed different levels of resource use efficiency among poultry farmers. Studies by Seudu (2008), Ashagidigbi et al. (2011), Begum et al.(201 Ngeno et al,.(2010) all identified resources as less than one, implying underutilization of the resources. This study was based on poverty alleviation among people living in rural areas. Therefore, the study used the same models in analyzing levels of efficiency but targeted the rural poor keeping indigenous chicken under free range or semi confined systems.

2.9 Theoretical/Conceptual Framework

2.9.1 Theoretical Framework

Farrell (1957) distinguished between technical and allocative efficiency in empirical efficiency measurement and analysis (or price efficiency). According to him, technical efficiency is defined as a firm's ability to produce maximum output from a given set of inputs, whereas allocative efficiency is defined as a firm's ability to employ inputs in optimal proportions given their pricing and available technology. Access to credit reduces cost inefficiency. The product of technical and allocative efficiencies equals overall economic efficiency, according to Farrell's paradigm. Farrel's methodology, on the other hand, has been widely used over the years, even as it continues to be refined and improved.

The classical and frontier techniques are the two approaches currently used to quantify efficiency. The classical technique, according to Oji and Chukwuma (2007), relates the output (for example, the number of eggs laid in a poultry farm daily) to a specific input (for example, quantity and cost of feed given to the laying birds). The traditional technique was employed for this study since it ignores other elements that affect output as well as production costs, such as feed quality, ambient temperature, and humidity, to name a few. This means that the traditional approach ignores additional environmental/exogenous elements that influence the cost of production and farmer efficiency. The residuals are used in the frontier approach to measure the difference between the inefficient units and the border.

The goal of frontier analysis is to create a best practice frontier against which individual producers' performance may be measured (Lovell, 2008). Performance is defined as the ability to reduce expenditure required to achieve a given output in light of the input cost/price vector and other exogenous variables whose elements characterize the operating environment. According to the cost efficiency frontier, efficient firms are those that operate on the cost frontier. As a result, the amount by which a farm or firm exceeds its cost frontier is used to calculate cost inefficiency (Lovell, 2008). To put it in another way, cost frontier analysis presupposes that each farm/firm spends more than it should owing to inefficiency. As a result, the frontier technique will be used in this research. Unlike production frontier analysis, which is concerned exclusively with technological efficiency and does not impose any behavioral assumptions, cost frontier analysis involves cost minimization, according to Khumbakar and Lovell (2000). When input prices, rather than input quantities, are strictly exogenous, the cost minimization assumption is appropriate. Furthermore, cost efficiency frontier measurements, according to Chirwa (2002), can be classified as non-parametric or parametric.

2.9.2 Non Parametic Frontier Analysis Methods

When a farmer produces several outputs, non- parametric borders can be used. Data envelopment analysis (DEA), free disposable hull (FDH), Malmquist Index, Tornqvist Index, and Distance Functions are some of the most often used non-parametric frontiers. The Data Envelopment Analysis is the most used non-parametric frontier analysis method. Non-parametric approaches, such as data envelopment analysis, use linear programming techniques to create a cost/production frontier that is efficient. The cost/production frontiers are not given a functional shape, and no assumptions about the error term are made with non-parametric frontiers.

This trait, according to Coelli et al., (2005), makes estimate of non-parametric borders rather simple. Nonetheless, one of the fundamental disadvantages of non-parametric frontiers like DEA is that any deviations from the frontier are attributed to the firm's inefficiency. Another critique of the non-parametric technique, according to Bhasin (2002), is that the highest feasible output is produced utilizing only marginal data and not all observations in the sample, which may undermine the outcome's believability. This method has also have been chastised because it does not allow for hypothesis testing or statistical inference (since non-parametric frontiers do not impose a functional form on the cost frontiers and do not make assumptions about the error terms).

2.9.3 Parametic Frontier Analysis Methods

The parametric approach differs from the non-parametric approach in that it includes employing multiple econometric tools to model the cost/production frontier. The benefits of parametric techniques, such as the stochastic frontier approach, are that they account for random error (factors outside of the farmers' control that affect output costs) and separate the inefficiency component from it. The Stochastic Frontier Approach (SFA), Thick Frontier Approach (TFA), Distribution Free Approach (DFA), and Fixed and Random Effects Models (FEM and REM) are some of the most often utilized parametric methodologies for efficiency analysis. However, the most popular parametric method is the stochastic frontier methodology. This parametric method/approach necessitates the imposition of a particular functional form for the relationship between input prices, output prices, and production costs, as well as data assumptions. When the functional form is established, the unknown parameters of the function can be approximated using econometric techniques, according to Coelli et al., (2005). Since its inception, the parametric method has faced no credible criticism. Nevertheless, some researchers are of the view that the procedure involved in the determination of efficiency using parametric methods is quite complex compared to the non-parametric methods.

2.9.4 Choice of Efficiency Measurement Method

In this study, the parametric approach was chosen over non-parametric approach due to the following reasons. To begin with, parametric approaches analyze both technological and cost/allocative efficiency, according to Podpiera and Pruteanu (2005), but non-parametric techniques solely look at technological efficiency. Furthermore, the parametric technique is the greatest alternative for disentangling inefficiency effect from environmental factors that affect production cost (random error) and making solid statistical inferences. According to Boshrabadia et al., (2007), the stochastic frontier methodology/analysis has become the most popular parametric method in recent years due to its ability to account for measurement error in output/costs as well as stochastic elements of production/costs, thereby distinguishing the effect of noise from the effect of inefficiency.

2.9.5 Stochastic Production Frontier Model

The stochastic frontier methodology, which is a parametric approach, will be employed in this study since it is well established, widely used and recommended by several researches for efficiency analysis.

The stochastic production frontier model was independently introduced by Aigner et al., (1977) and Meeusen and van den Broeck (1977). Each of the two error terms in this model (assembled error structure) was established in the setting of a production frontier. However, after further research, the model was modified to assess cost efficiency by altering the sign of the stochastic production frontier's second error term from negative to positive (i.e., expv+u) and changing the production function to a cost function. A cost function must be defined before the stochastic cost frontier can be introduced. The cost of production is determined by the prices of output and inputs.

2.9.6 Conceptual Framework

This study conceptualizes independent variables as those factors that influence increased productivity of indigenous chicken. Determinants of profitability level were also considered as independent variables while social economic and demographic characteristics influenced the efficient use of resources thus taken as intervening variables. The dependent variables included level of production, efficiency and profitability. Figure 2.1 demonstrates the relationship between the variables:

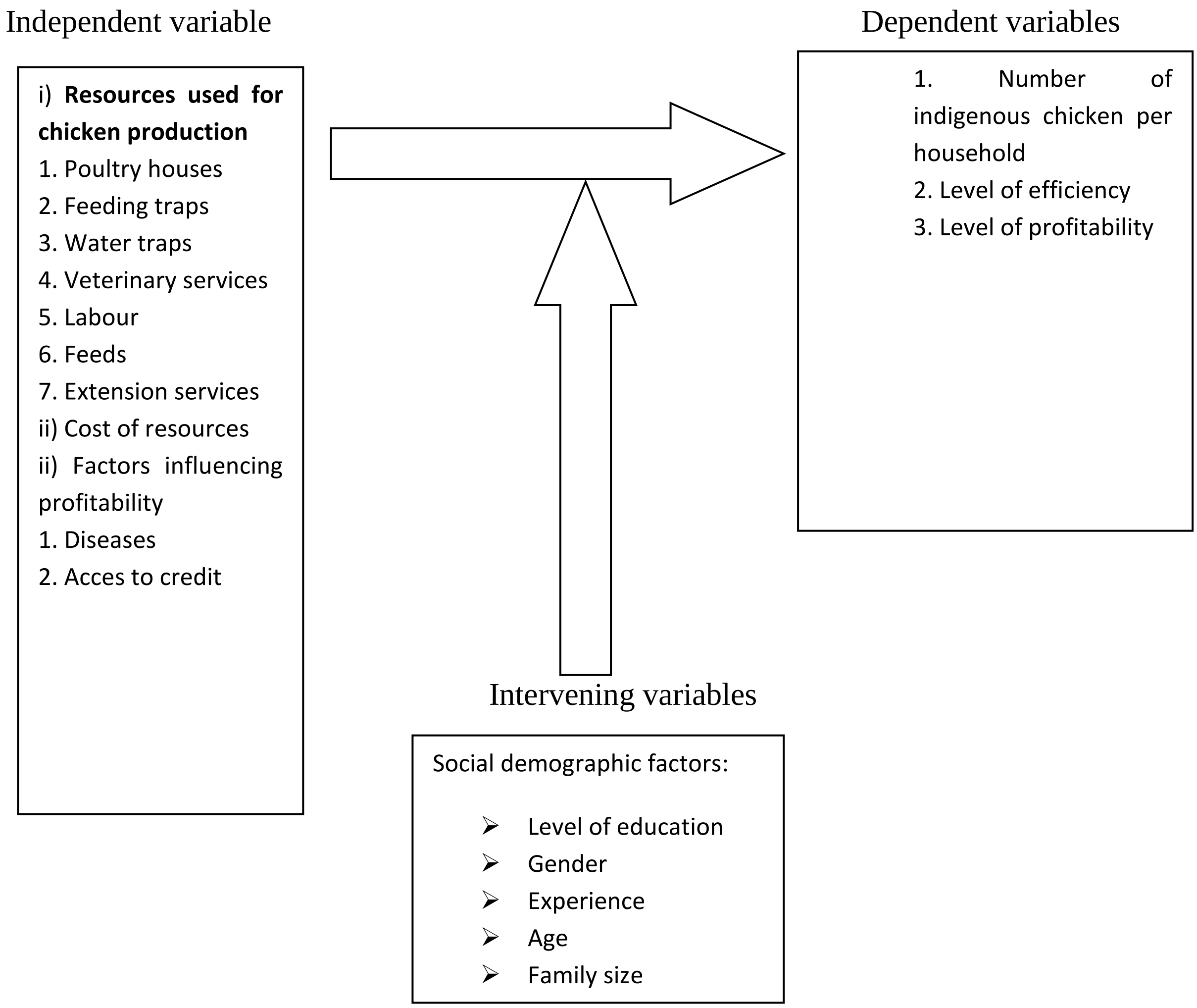

Figure 2.1 Conceptual Framework

Source: own perception

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

The chapter introduces the research topic and provides information on the data sources and collection methods used in this study. It also includes information about the survey instrument and how it was used. It also goes through the analytical framework and the empirical model specification.

3.2 Study Area

This study was carried out in Kitui County. Kitui County has a population of roughly 1,012,709 people and covers approximately 30,520 square kilometers. It is located between 0°10 South and 3°0 South latitudes and 37°50 East and 39°0 East longitudes (Owade et al., 2020). The semi-arid agricultural zone, semi-arid ranching areas, arid-agro-pastoral area, and arid-pastoral zone are the four agro-ecological zones in the county, all of which portray arid and semi-arid conditions. In terms of rainfall and temperature, the climatic conditions vary across the county. The County receives bi-modal rainfall between 300mm and 1050 mm, both of which are quite irregular and inconsistent. Small-scale farmers have an average land size of 4.38 hectares, whereas large-scale farmers have an average land area of 50 hectares. Agricultural activities are carried out by 87.3 % of households. Maize, green grams, beans, cowpeas, peas, millet, and sorghum are the principal crops grown. Livestock farming is a major source of revenue for the county. Cattle (Zebu, Boran, Sahiwal, Freshian, and Ayrshire), goats (East African, Galla, Torgenberg), and sheep (Black headed, Passion, Red Masai) are the most common livestock breeds kept. The county has a 63.8 % (648,108) absolute poverty rate, which is 0.55 % of the national absolute poverty rate. Kitui County is likewise food insecure, with a 55.5 % (n=598,212) food poverty rate (GOK, 2014). Figure 2.2 is the map of Kitui county demonstrating all administrative boundaries with highlighted parts where primary data was collected.

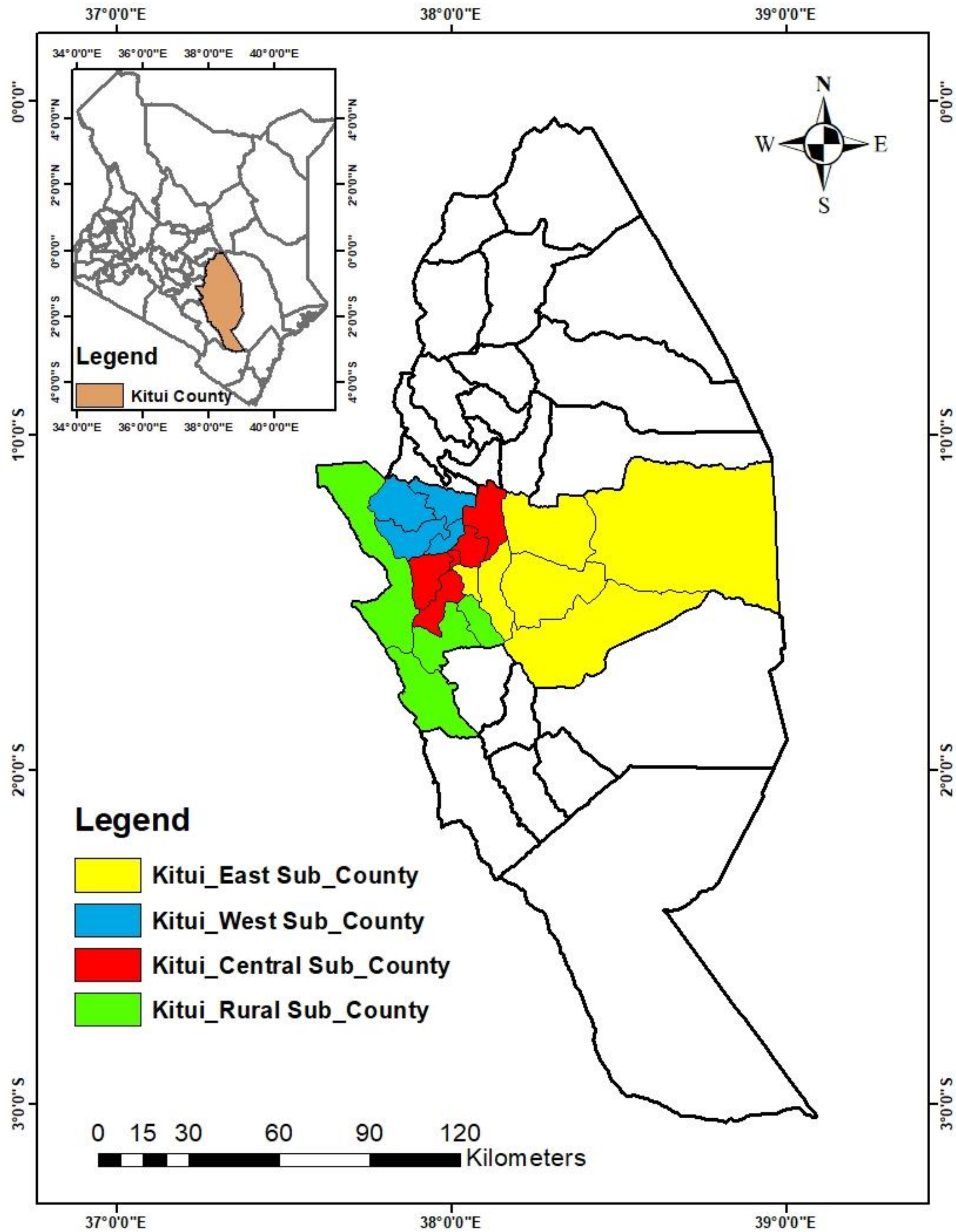

Figure 3.1 Map of Kitui

Source: Generated through GIS and remote sensing.

3.3. Research Design

According to Mugenda & Mugenda (2003), a descriptive survey approach is preferred because it focuses on phenomena, events, and concerns as they already exist. As a result, a descriptive survey design was used in this investigation. The purpose of a descriptive survey is to make an accurate assessment of the inference, distribution, and relationship between phenomena (Edwards, 2006). Furthermore, the design allows for an accurate descriptive examination of a sample's features, which can be utilized to draw conclusions about the population (Kerlinger, 1973).

3.4 Types and Sources of Data

This study gathered both primary and secondary data. Primary data was gathered from local chicken farmers and household caretakers. Secondary data/information was gathered from individual researchers' publications as well as reports/bulletins from various governmental (Ministry of Agriculture, for example) and non-governmental organizations.

3.5 Sample Size and Sampling Technique

The study conducted a multistage selection of 120 indigenous chicken farmers in Kitui County as demonstrated in table 3.1. Firstly, four sub counties were selected randomly from the county. Second, three wards were chosen at random from each sub county, and ten farmers were chosen from each ward in the final stage. Using the simple random procedure, ten farmers were chosen from each ward. A sample size of 2000-3000 is considered as the extreme upper limit while 30 cases is the extreme lower limit for statistical analysis (Singleton, 1993). The study population had one community with similar livestock keeping practices and in same geographical locality. Due to time and resource constraints a sample size of 100 would be considered adequate where the study population is considered to be homogenous (Mutai, 2000). The sampling procedures are summarized in table 3.1.

Table 3.1: Distribution of the selected 10 farmers from the various Sub Counties

Constituency/sub county	Ward	Number of respondents
Kitui central	Miambani	10
	Kitui township	10
	Kyangwithya east	10
Kitui east	Kyuluni	10
	Nzambani	10
	Zombe	10
Kitui west	Mutonguni	10
	Kauwi	10
	Kwamutonga	10
Kitui rural	Yatta	10
	Kanyangi	10
	Kisasi	10

3.6 Survey Instrument and Administration

A questionnaire was developed and tested in Yatta Sub County on 40 indigenous chicken farmers. The questionnaire was created to collect data on output, input, and some of the farmers' primary socioeconomic traits as well as production restrictions. The input data included the costs of feed, human labour, total number of chicken, medication, transportation and other running costs required in indigenous chicken production. Since input costs/prices vary by time, data was collected on the cost of the various inputs used during a particular production period/cycle. Data was collected on socio-economic characteristics such as the sampled farmers' educational level, farming experience, frequency of technical guidance, loan availability, and farm size in order to investigate their impact on the anticipated cost efficiencies of the indigenous chicken farms. Data was also sought on the constraints faced by the indigenous chicken farmers and the severity of each constraint. The data on the severity of the constraints was sought by asking the respondents to rank the constraints on the scale of 1 to 12 in order to test the agreement of the various respondents to their constraints. The 12 represents the number of constraints listed for the respondents to rank. The constraint ranked 1 by a respondent represents that respondent's severe or topmost constraint and 12 represents the least severe constraint.

On the basis of the questionnaire, all respondents were visited on their farms and interviewed. The surveys were given out in English as well as the local language for individuals who had difficulty with English through the help of local field assistants.

3.7 Data Analysis Procedures

To estimate the technical and allocative efficiencies of indigenous chicken production, the researchers used a stochastic frontier model. The costs and returns to farmers were calculated using a profit function model. In order to estimate the efficiency indicators of poultry feed, labor, and use of poultry equipment, the Cobb-Douglas production function was used. A linear regression model was used to investigate the influence of socioeconomic factors on the farmer's technical efficiency. Percentages were used to determine the frequency of the responses. Statistical Package for Social Sciences (SPSS) and Frontier 4.1 software were used to analyse the data.

3.7.1 Descriptive Analysis

This method involved the use of frequency distributions, calculations of means, percentages and tabulations of inputs, outputs and their prices and socio-economic indicators. This method was useful in examining the socioeconomic characteristics of indigenous chicken farmers. Several aspects of chicken production, as well as the problems farmers faced in the study area, were evaluated. The analysis of the farmers' socioeconomic characteristics aided in identifying problems and recommending possible interventions to address those identified problems.

3.7.2 Production Functional Analysis

The indigenous chicken production function analysis was based on cobb-douglas production function stated as:

$Q=f(A\,k^{\alpha}\,L^{\beta})$ and where $\alpha + \beta = 1$……………………………………………1

The farmers' production technology was specified by the linearized stochastic production function reflecting Cobb-Douglas production technology (Henderson and Quant (1971)) as shown below:

$$\ln Y = \ln + \beta 1 \ln X1 + \beta 2 \text{In} X2 + \beta 3 \ln X3 + \beta 4 \ln X4 + \beta 5 \ln X5 + \beta 6 \ln X6 + \beta 7 \ln X7 + \beta 8 \ln X8 + + \mu - U \quad \ldots\ldots 2$$

Where Y is the annual total chicken produce inform of eggs chicken, broilers or manure sold/produced in Kenyan Shillings,

X1 = Total number of birds purchased in Kenyan shillings,

X2 = Amount of labor assessed in man days,

X3 = Cost of vaccines, medications, and chemicals (Kshs),

X4 =Amount of food purchased in Kenyan shillings,

X5= Years of experience in poultry farming,

X6= Feeds in bags/Kilograms purchased (Kshs).

X7= Poultry Equipment Cost in Kshs,

X8= Other Costs (Other charges) in Kenyan Shillings,

μ = Random error term,

U= Technical inefficiency impacts,

ß0= Constant term,

ßis= Slope parameters, where β represents the intercept and 1,..., n are the parameters that specify the transformation ratios when the Xs have different magnitudes (quantities) and (e) is the natural exponent.

The computed parameters were then used to assess the factors influencing the supply of chicken and poultry products by the county's sampled farmers.

3.7.3 Profit Function Analysis

The profitability of indigenous chicken farms was calculated as a profit-to-total-feed-cost ratio. This is due to the fact that feed costs are a significant operational cost in poultry production, accounting for approximately 60% of total costs.

Therefore:

Profit = Average total output per bird -Total average cost of inputs per bird ---------------1

Hence:

Profit from an Input X = Net Revenue– cost of Input X -------------------------------------2

That:

Profit from cost of feed =Total net revenue per Annum –Total cost of feed per Annum-3

The empirical analysis of indigenous chicken profitability was based on the estimation of a Cobb-Douglas production function, with both the output and inputs expressed in logarithmic form. The Cobb-Douglas functional form is widely used to represent an output's relationship to its inputs (Bravo-Ureta and Pinheiro, 1997. There are various functional forms for estimating the physical relationship between inputs and outputs, according to Khai and Yabe (2011), but the Cobb-Douglas functional form is favoured over others because it is easier to use when there are three or more independent variables in the model. The Cobb-Douglas production function was utilized to describe the relationship between the dependent variable (profitability of indigenous chickens) and the explanatory variables (factors determining profitability) and is expressed as follows:

Q = f (K, L) = A k α L β, Where A, α, β are constants.

The Cobb-Douglas production function for indigenous chicken profitability was defined by applying the general model, Y, to a set of resources, X, and additional conditional elements as follows:

Y = β0X1β1 X2 β2 X3β3 X4 β5 X4 β5X6 β6μV-U--4

This function was linearized so that least squares estimations could be used, resulting in the following regression specification:

$$\ln Y_i = \alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \mu; \text{-----------}5$$

Where Yi denotes profitability (profit per unit cost of feed)

X1 = The farmer's total number of chicken produced each year (stock size);

X2 = The farmer's total number of chicken sold in a year;

X3 = Total number of chicken consumed per year by the household;

X4 = Chicken market price per unit;

X5 = Total annual vaccination expenses;

X6 = Total feed costs by farmers;

μ = Random error term;

βi= coefficients of Independent variable Xi.

3.7.4 Resource Use Efficiency Index

The economic efficiency of the resources used in chicken production was determined by comparing the marginal value product (MVP) of each resource with its marginal factor cost (MFC) and computing the efficiency indicators. Economic efficiency is defined as the combination of technical and allocative efficiency. Its goal is to maximize benefits while minimizing costs. According to Nicholson (1978), economic efficiency is the same as Pareto efficiency if no one (or activity) can be improved without making another individual (or activity) more disadvantageous. This allocation of resources is also said to be efficient for Pareto optimality. The concept of Pareto efficiency, according to Hardwick et al., (1988), might be used to evaluate different approaches of allocating resources. The log-linearized Cobb-Douglas production function's mean estimations (output returns and input costs) were utilized to compute MVPs for each resource (input) with its MFC. A statistically significant disparity between a resource's MVP and MFC indicates that it is being used inefficiently. The study used Oladeebo's (2007) method, in which the MVPs (marginal value productivities) for each resource are estimated and compared to their acquisition costs (MFC).

3.7.5 Relative Efficiency between Indigenous Chicken Firms

Different authors have used different approaches to distinguish between large and small scale farms. A study by Omar (2014) on technical and economic efficiencies of broiler farms in Egypt classified small farms as those with less than 5000 birds while large farms had more than 10000 birds. In his study Omar (2014) he used a sample size of 50 farms with a mean of 5500 birds per farm. Akter (2003) conducted a study on competitiveness and efficiency among poultry and pig production in Vietnam in which poultry farms with less than 500 birds were classified as small and those with more than 2000 birds as large. The same study classified pig firms with less than 50 pigs as small while those with more than 100 heads as large. Therefore, for easy of analysis this study classified farms with less than 50 birds as small farms while farms with more than 100 birds as large scale. Farmers rearing chicken between 50 and 100 were regarded as medium farms.

CHAPTER FOUR

4.0 RESULTS

4.1 Introduction

This chapter deals with the data analysis and results presentation on the economic efficiencies among indigenous chicken farms in Kitui County. The study sought to establish; the major resources that were being used by farmers in indigenous chicken production, estimate the production function and determine which of the identified resources significantly influenced indigenous chicken production in the study area, to determine the farmers level of efficiency in utilising the identified resources, compare the relative economic efficiency between small and large scale indigenous chicken farms in Kitui County and identify the major factors limiting indigenous chicken production, farm profits and seek solutions to them. The study had a sample size of 120 respondents, however only 100 returned their questionnaires which were used for data analysis, thereby giving a response rate of 83.3%.

4.2 Diagnostic Test

Several statistical tests were conducted before analyzing the questionnaires. These included; normality, multicollinearity, homoscedasticity and heteroscedasticity. The results were presented in the subsequent sections.

4.2.1 Test for Normality

In this section, normality tests for the dependent and independent variables were performed to determine whether the data collected was a normal curve. This study's dependent variable was indigenous chicken production. The Kolmogorov–Smirnov and Shapiro–Wilk tests were used to determine whether the data set was from a specific distribution and whether it confirmed the normality. This is a non-parametric test that can be used with continuous distributions. The Kolmogorov-Smirnov test is a non-parametric goodness of fit test that compares the cumulative distribution function for variables inside a given distribution (Mugenda & Mugenda, 2003). The Shapiro– Wilk Test was performed to assess normality numerically, with a p-value larger than 0.05 indicating that the data is normal. The Kolmogorov-Smirnorv and Shapiro tests were both performed – Wilk Test and presented in Table 4.1.

Table 4.1: Shapiro – Wilk Test For Normality.

	Kolmogorov-Smirnov Test			**Shapiro – Wilk Test**		
Variables	**Statistic**	**DF**	**Sig**	**Statistic**	**DF**	**Sig**
Major resources	0.401	99	0.608	0.442	99	0.611
Farmers level of efficiency	0.300	99	0.608	0.352	99	0.611
Relative economic efficiency	0.321	99	0.608	0.421	99	0.611
Factors limiting indigenous chicken production	0.598	99	0.608	0.621	99	

Table 4.1 revealed that the p-value for both Shapiro – Wilk Test and Kolmogorov-Smirnorv test for, the independent variables were 0.608 and 0.611 respectively. This implies that the data was from a normally distributed population since all the p-values were greater than 0.05.

4.2 Test for Multicollinearity

Collinearity means that the two variables are near perfect linear combination. The estimates for linear regression cannot be uniquely computed when there is a perfect linear relationship among predictor variables. When more than two variables are involved, it is called multicollinearity. The test for multicollinearity helps to determine whether the independent variables are correlated. When multicollinearity increases, the regression model estimates of the coefficients become unstable. The results were presented in table 4.2

Table 4.2: Test for Multicollinearity.

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Coefficient Model	B	Std. Error	Beta	T	Sig	Tolerance	VIF
(Constant)	.068	.255		.267	.022		
Major resources	.084	.036	.154	2.312	.000	.111	2.351
Farmers level of efficiency	.237	.053	.278	4.484	.718	.221	2.048
Relative economic efficiency	.092	.072	.084	1.282	.019	.238	2.124
Factors limiting IC production	.228	.063	.239	3.620	.059	.241	3.417

a) Dependent Variable: Production of indigenous poultry farming

Table 4.2 revealed that, all the tolerance values were more than the recommended minimum of 0.1 (Cooper and Schindler, 2014). This implies that, there was no multicollinearity problem. Also, it was observed that all the variance inflation factors (VIF) were all below 5, meaning the variables were not moderately correlated and there was no cause of concern.

4.2.3 Test for Homoscedasticity and Heteroscedasticity

Heteroscedasticity occurs when the error term's variance varies from observation to observation. When there is a difference in residue variance from one observation period to another, it is useful to investigate. The results were presented in Table 4.3.

Table 4.3: Homoscedasticity and Heteroscedasticity.

	Coefficients	Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig
1	(Constant)	.568	.226		2.516	.522
	Major resources	.068	.074	.060	.919	.128
	Farmers level of efficiency	.175	.055	.188	3.207	.085
	Relative economic efficiency	.012	.076	.011	.153	.071
	Factors limiting indigenous chicken production	.215	.072	.205	2.968	.054
	Major resources	.149	.041	.217	3.607	.325
	Farmers level of efficiency	.050	.011	.307	4.440	.547

a) Dependent Variable: Production of indigenous poultry.

Table 4.3 demonstrates that all of the Sig. is more than 0.05, indicating that there was no evidence of Heteroscedasticity. This means that the independent and dependent variables investigated have the same residue variance.

4.3 Descriptive Analysis

This section presents the descriptive data on the economic efficiencies among indigenous chicken farms.

4.3.1 Demographic Characteristics of the Respondents

Table 4.4 shows that majority (58%) of poultry farmers were female while the men were 42%. Majority (75%) of the respondents were married while 25% were single. On education, majority (40%) had attained primary education as their highest level followed by 31% with secondary education. It was also established that, majority (93%) of the respondents were mainly farmers while only 7% were doing business and other occupations. On dependants, the study established that majority (40%) of the respondents had 4-6 dependants followed by 31% with 7 - 9 dependants. The data on land size shows that majority (44%) of the respondents had 2.1 - 3.0 acres of land. This was followed by 40% who had less than two acres. This means that only 16% of the respondents have more than 3.0 acres. It was also established that, the major activities for the respondents was pure poultry keeping (85%) with 15% mixing poultry keeping with other farming activities such as; crop farming, livestock farming and bee keeping. It was also revealed that the majority of respondents (41%) had kept indigenous chicken for more than ten years.

Table 4.4: Social Demographic Characteristics of Respondents.

Variable		
Gender	**Frequency**	**Percent**
Male	42	42.0
Female	58	58.0
Total	**100**	**100.0**
Marital Status		
Married	75	75.0
Single	25	25.0
Total	**100**	**100.0**
Academic Level		
None	10	10.0
Primary	40	40.0
Secondary	31	31.0
Tertiary	19	19.0
Total	**100**	**100.0**
Number of dependants		
3 and below	20	20.0
4-6	40	40.0
7-9	31	31.0
Above 9	9	9.0
Total	**100**	**100.0**
Forms of activities		
Crop farming	28	28.0
Poultry keeping	51	51.0
Livestock farming	16	16.0
Bee keeping	5	5.0
Total	**100**	**100.0**
Years of keeping indigenous chicken		
1 year and below	13	13.0
2 -5	13	13.0
6-10 years	33	33.0
More than 10 years	41	41.0
Total	**100**	**100.0**

4.3.2 Multiple Regression Model for Demographic Data

To test association between, Land size, Occupation, Marital status, Age, Gender, Education Level, Number of dependants and number of indigenous chicken, a Multiple linear regression model was also used as presented below.

$y=\beta_0+\beta_1 X_1 + \beta_2X_2+ \beta_3X_3+ \beta_4X_4+ \beta_5X_5+\beta_6X_6+\beta_7X_7$---1

Where,

y = Number of indigenous chicken

β_0 = Constant

X_1 = Age

X_3= Gender

X_4=Education Level

X_5=Number of dependents(X_5)

X_6=Occupation(X_6)

X_7=Land size(X_7)

ε = Error term

The linear regression analysis results were presented in the Table 4.5 below. The model summary shows that the Adjusted R Square is 0.958, implying that the demographic characteristics of the farmers influence 95.8 percent of the number of indigenous chicken farmers.

Table 4.5: Model Summary.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.980(a)	.961	.958	.23125

a) Predictors: (Constant), Land size, Occupation, Marital status, Age, Gender, Education Level, Number of dependants

The ANOVA results indicated that the model was statistically significant, F (7, 93) =321.96. (Table 4.6)

Table 4.6: Anova (B).

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	120.520	7	17.217	321.960	.000(a)
	Residual	4.920	93	.053		
	Total	125.440	100			

a. Predictors: (Constant), Land size, Occupation, Marital status, Age, Gender, Education Level, Number of dependants.

b Dependent Variable: Number of indigenous chicken

$Y= 0.306 + 0.192X_1 + 0.611 X_2+0.265 X_3+0.15 X_4+0.608 X_5- 0.898 X_6+0.665 X_7$-----------1

According to the regression model, the variables Land size, Occupation, Years of experience, Gender, Education Level, and Number of Dependents all had a significant influence on the number of indigenous chicken kept by farmers. It was, however, noted that marital status did not significantly influence the number of indigenous chicken kept by farmers. The number of dependants in a household had the greatest influence on the number of indigenous chicken kept by farmers. It was also discovered that the years of experience of the farmers had a positive impact on the number of indigenous chickens kept by a farmer (Table 4.7). These results imply that the more years a farmer was involved in chicken production the higher the level of chicken production.

Table 4.7: Coefficients (A).

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	0.306	.181		1.691	.094*
	Years of experience (X_1)	.192	.051	.292	3.747	.000*
	Gender(X_2)	.611	.129	.269	4.721	.000*
	Marital status(X_3)	.265	.095	.102	2.781	.007*
	Education Level(X_4)	.150	.071	.122	2.101	.038*
	Number of dependants(X_5)	.608	.080	.481	7.637	.000*
	Occupation(X_6)	-.898	.157	-.205	-5.714	.000*
	Land size(X_7)	.665	.087	.487	7.652	.000*

*Significant at $p \leq 0.05$

a) Dependent Variable: Number of indigenous chicken

4.3.3 Production Information

The study sought to establish the production information of the indigenous chicken farmers in Kitui County. The respondents were first required to indicate the number of indigenous chicken they had in the last one year. Figure 4.1 shows that, majority (40%) of the farmers in Kitui County had 50 chicken and below in the last one year. This was followed by 24% who had 61-70 chicken in that year.

Figure 4.1 Number of Indigenous Chicken per household

4.3.4 Chicken Type

Table 4.8 reveals that the majority of respondents (52%) had 50 or less chicks, while those with the largest numbers (70 or more) accounted for only 12% of the total. On the other hand, majority (41%) of the respondents had 50 and below indigenous layers whiles those with the highest number (above 70) indigenous layers were 16%. Table 4.8 also shows that the majority of respondents (55%) had 50 or fewer indigenous cocks, while those with the most (over 70) indigenous cocks were 10%. Responding to the sources of chicks, all the respondents indicated that chicks were hatched by the hen through natural methods.

Table 4.8: Categories of Chicken.

Variables	Frequency	Percentage
Indigenous Chicks		
50 and below	52	52.0
51-60	20	20.0
61-70	16	16.0
70 and above	12	12.0
Total	**100**	**100.0**
Indigenous Layers		
10 and below	41	41.0
11-20	23	23.0
21-30	20	20.0
30 and above	16	16.0
Total	**100**	**100.0**
Indigenous Cocks		
50 and below	55	55.0
51-60	21	21.0
61-70	14	14.0
70 and above	10	10.0
Total	**100**	**100.0**

4.4 Resources that were being used by farmers in indigenous Chicken Production

The study aimed to identify the critical resources utilized by farmers in indigenous chicken production, estimate the production function, and determine which of the identified resources had a significant impact on indigenous chicken production in the study area.

4.4.1 major Resources used by Farmers in Indigenous Chicken Production

Table 4.9 shows that, 31% of the respondents which was the highest percentage had used Kshs 10,000 and above on construction of poultry house. The bulk of the respondents

(45%) spent Ksh 1,000 or less on feeding traps, while 60% spent Ksh 1,000 or less on water traps, according to the survey. On veterinary products, a majority (55%) had used Ksh 1,000 and below. It was also noted that the bulk of the respondents (67%) relied on free labor from their families. While 33% of labour used was hired at a cost of between Kshs 1000 to above Kshs 2000 per month. Finally, the majority (56%) of the respondents were keeping free range chicken as opposed to confined ones.

Table 4.9: Type of Resources used for Indigenous Chicken Production.

Variables	Frequency	Percentage
Poultry House Cost		
1000 and below	12	12.0
1001-5,000	20	20.0
5001- 10,000	25	25.0
10,000 and above	31	31.0
Total	**100**	**100.0**
Feeding troughs Cost		
1000 and below	45	45.0
1001-1500	25	25.0
1501- 2000	20	20.0
2000 and above	10	10.0
Total	**100**	**100.0**
Water troughs cost		
1000 and below	60	60.0
1001-1500	21	21.0
1501- 2000	11	11.0
2000 and above	8	8.0
Total	**100**	**100.0**
Veterinary services cost		
1000 and below	55	55.0
1001-1500	20	20.0
1501- 2000	20	20.0
2000 and above	5	5.0
Total	**100**	**100.0**
Labor Cost		
Free (family)	67	67.0
1001-1500	21	21.0
1501- 2000	6	6.0
2000 and above	6	6.0
Total	**100**	**100.0**
Feed Cost		
Free range	56	56.0
1001-1500	24	24.0
1501- 2000	12	12.0
2000 and above	6	6.0
Total	**100**	**100.0**

4.4.2 Stochastic production and Cost Frontier Functions Estimation

All of the Coefficients had the expected positive signals, according to the estimates of the stochastic production frontier function (Table 4.10). The coefficients of poultry house (X_1), Feeding troughs (X_2), water troughs (X_3), veterinary services (X_4), labour (X_5), extension services (X_6) and Cost of Feed (X_7) were significant at 5% significance level. The gamma (γ) was 0.633, which was high enough and significant at the 5% level of significance. It suggests that the major sources of random errors are unexplained variations in output. It also demonstrates that technical inefficiency accounts for approximately 63.3 %t of the variations in output of poultry farmers. The sigma square (δ^2) estimate was 0.622 and significant at 1%, indicating that the composite error distribution is well-fitting and the distributional assumptions are accurate. The variables with the greatest influence on poultry production were labour with a factor of 0.775 followed by poultry feed and poultry house each with a coefficient 0.619 and 0.571 respectively. The generalized likelihood test yielded a value of 21.6, indicating that Kitui County's indigenous chicken farms are not fully technically efficient.

Table 4.10 Maximum Likelihood Estimation of the Stochastic Production Frontier for Kitui County Indigenous Chicken Production.

Variables	**Coefficients[a]**	t-ratio
Constant	6.646	4.452
Poultry house (X_1)	.571	1.109
Feed troughs (X_2)	.053	2.851
Water troughs (X_3)	.187	1.104
Veterinary Services (X_4)	.105	2.085
Labour (X_5)	.776	2.120
Extension services (X_6)	.435	3.338
Feeds (X_7)	.619	6.561
Diagnostic statistics		
Gamma (γ)	0.633	1.899**
Sigma square (δ2)	0.622	2.113*
Log likelihood function	-96.42	
LR test	21.63	

***significant at 5%,*significant at1% Source: output of Frontier 4.1 by (30)*

4.5 Framer's Level of Efficiency in Utilizing Indigenous Chicken Production Resources

The assessment of efficiency has been a focus of research, with the goal of determining the level of efficiency of farmers engaged in farming operations. The main task is that of identifying determinants of efficiency levels in efficiency analysis. The study's second goal was to figure out how efficient farmers were at using locally available chicken production resources. Stochastic cost frontier models were utilized to attain this goal. According to Kumbhakar and Lovell (2000), the implied stochastic cost frontier is described below:

$$C = f(y, w;\ \boldsymbol{\beta}).\exp\{v + \mu\} \qquad \text{------1}$$

Where:

C is the farm's or firm's total output cost/expenditure.

y denotes level of output.

$\boldsymbol{w}$ denotes a vector of prices of input.

β is a set of parameters that must be approximated.

$f\ (y, w;\ \boldsymbol{\beta})$ Represents the minimum cost frontier

v represents random effects that are beyond the control of the production unit, such as measurement errors and other statistical noise common in empirical relationships

μ represents the cost inefficiency.

The implication of the stochastic cost frontier regression model above is that actual total expenditure/cost (C) equals minimum required total expenditure/cost plus the product of two error components. Thus, the left hand side of the model depicts the observed/real total cost of production whereas the right hand side depicts the expected minimum total cost of production (minimum frontier cost). Using the above model, the Stochastic Frontiers and Efficiency Measurement was presented in Table 4.11. Any parameter in a function that is inefficient with a negative sign indicates that the associated variable has a positive effect on efficiency, and vice versa. A variance parameter estimate suggests that the inefficacy effect is responsible for roughly 86 % of the variance in the two variables. The predicted output elasticity for all resources employed in indigenous poultry production deviated from zero at the 5% significance level. The elasticity for poultry production is the greatest among the other elasticity (0.3498). This suggests that a 10% enhancement in of Poultry Houses would result in a 3.498 % increase in output. The cost of labor has the second highest elasticity, at 0.2417. The elasticity for the cost of water traps is the lowest in terms of elasticities (0.0495). The efficiency with which indigenous chicken production resources are utilized is expected to be influenced by socioeconomic, demographic, farm characteristics, environmental, and nonphysical factors. The results of technical inefficiency impacts are shown in Table 4.11. The findings show that the farmers' age and education level have a favorable impact on their efficiency in utilizing local chicken production resources. In addition, a farmer's experience with indigenous chicken production and revenue has a good impact on resource utilization.

Table 4.11: Stochastic Frontiers and Efficiency Measurement.

Variable	**Parameter (β)**	**Standard error**	**t-value**
Constant	6.4678	0.7804	8.288302
Poultry house	0.3498	0.0873	4.007471
Feed traps	0.0925	0.0356	2.59807
Water traps	0.0495	0.014	3.541024
Veterinary Services	0.0837	0.0231	3.623108
Labour	0.2417	0.0643	3.756363
Extension services	0.1067	0.024	4.439266
Inefficiency model			
Constant	0.1394	0.0177	7.877153
Age	-0.0301	0.0129	-2.33671
Experience	-0.0324	0.0143	-2.257748
Income level	-0.0294	0.013	-2.261518
Education level	-0.0214	0.0101	-2.11087
Variance Parameters			
Sigma-square	0.0335	0.0118	2.844298
Gamma	0.8629	0.0839	10.2801
Log likelihood function			150.9281
Likelihood Ratio			15.9122

The sample's average efficiency is around 89%, with a minimum of 65 % and a maximum of 98 % (Table 4.12). These findings suggest that by adopting the technology and procedures employed by the best-practice indigenous chicken farms, the study's chicken output might increase by 11%. Furthermore, with a particular combination of production resources, chicken producers may accomplish 89% of potential output.

Table 4.12: Summary Statistics of Efficiency Estimates from the Stochastic Frontier Model

Statistic	Efficiency score	Statistics	Efficiency score
Mean	0.887719	Standard Deviation	0.070798
Minimum	0.651553	Kurtosis	0.689109
Maximum	0.980862	Skewness	-1.14221

The frequency distribution of the efficiency estimates generated from the stochastic frontier model is shown in Table 4.13. As shown by the table, 51% of poultry producers operate at a level of efficiency greater than 90%. Only 14% of farmers have an efficiency of less than 80% when it comes to using indigenous chicken production resources.

Table 4.13: The Stochastic Frontier Model's Frequency Distribution of Efficiency Estimates

Efficiency Score	Number of farmers	Percentage of Farmers
0.55-0.70	2	2
0.70-0.75	4	4
0.75-0.80	6	8
0.80-0.85	10	10
0.85-0.90	17	17
0.90-0.95	35	35
0.95-1.00	16	16

4.6 Resource Use Efficiency for Small and Large Scale Indigenous Chicken Farms

This study sought to compare the resource use efficiency between small and large scale indigenous chicken farms in Kitui County. Large scale farms were taken as farms with more than one hundred birds while those with less than one hundred birds but more than fifty were classified as medium scale farms. All farms with less than fifty indigenous chicken were classified as small scale farms. The study adopted Cobb-Douglas production function to assess resource use efficiency following the methods mentioned by Henderson and Quant (1971),

Where:

$Y = \beta_0 X_1 \beta_1\ X_2\ \beta_2 X_3 \beta_3\ X_4\ \beta_4\ X_5\ \beta_5\ \ X_6\ \beta_6\ \ X_7\ \beta_7 \mu V\text{-}U$---1

where

Y = Amount of poultry products sold/produced (e.g., eggs, chicken, broilers, or manure)

X1 = Total number of birds purchased in Kshs,

X2 = Amount of labor measured in man days,

X3 = Cost of vaccines, drugs, and chemicals (Kshs),

X4 = Amount of feeds purchased in bags/Kilograms (Kshs),

X_5= Years of experience in poultry production

X6=Education of the household head

X7= The cost of poultry equipment in Kenyan shillings,

βo = Intercept

V-U = Error term

β1, β2, ….. β_7 are the regression coefficients that need to be calculated. Natural logarithms were used to alter both dependent and explanatory variables. For convenience of computation, the preceding equation was converted to linear form and written as follows:

$\ln Y = \ln + \beta_1 \ln X_1 + \beta_2 \text{In} X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7 + \mu - U$ -------2

The formular used to calculate the resource use efficiency was as follows:

$r = \frac{MVP}{MFC}$, ---3

Where;

r = Ratio of Efficiency

MVP stands for Marginal Value Product, which is the value of an extra unit of output produced as a result of an additional unit of input.

MFC = Marginal Factor Cost, which is one since both the dependent and explanatory variables are transformed to monetary value, and is defined as the rise in the cost of inputs owing to the acquisition of extra units of inputs.

b_i = Estimated regression coefficient of input X_i

$\bar{Y}i$ = Geometric mean value of output.

r= 1; Means Efficiently used resource

r>1; Means Underused resource

r<1; Means Overused resources

Lastly, the following approach was used to compute the relative percentage change in MVP:

D = $(1 - \frac{MFC}{MVP}) x\ 100$

or

D = $(1 - \frac{1}{r}) x\ 100$

That:

D = absolute value of each resource's percentage change in MVP (Mijindadi1980)

Values from Table 4.14 were used to calculate many parameters used in resource efficiency computations.

4.6.1 Resource Use Efficiency among Large Scale Poultry Framers

The current resource use efficiency analysis revealed that the major inputs in indigenous poultry production, such as labor, vaccines and drugs, feeds, experience, and education level, were overused and needed to be reduced in cost for optimal allocation (Table 4.14). It was also discovered that the cost of birds and poultry equipment were underutilized, necessitating an increase in cost of at least 72 % and 21.5 %, respectively, for optimum allocation

Table 4.14: Estimation of Resource Use Efficiency for Large Farms.

Variables	Coefficient	MVP	MFC	R	D	Efficiency
Ln-Cost of birds	0.655	3.581	1	3.581	72.077	Under used
Ln-Cost of Labour	0.155	0.488	1	0.488	104.92	Over used
Ln-Cost of Vaccines, drugs and Chemicals	0.075	-1.305	1	-1.305	176.62	Over used
Ln- Amount of feeds	0.032	0.666	1	0.666	50.15	Over used
Ln-Experience in poultry production	0.048	-1.191	1	-1.191	183.9	Over used
Ln- Education level	0.062	-0.222	1	-0.222	550.45	Over used
Ln- Equipment	0.321	1.022	1	1.022	21.5	Under used

4.6.2 Resource Use Efficiency for Small Scale Poultry Farmers

The resource use efficiency analysis for small scale indigenous poultry farmers revealed that the major inputs in indigenous poultry production, such as labor, experience, and education level, were underutilized and needed to be increased in cost to ensure optimal allocation (Table 4.15). It was also discovered that the cost of birds, vaccines, drugs, and chemicals, amount of feed, and cost of poultry equipment were all underutilized, necessitating an increase in cost of at least 80.85 %, 10%, 65.17%, and 52.9 %, respectively, for optimum allocation.

Table 4.15 Estimation of Resource Use Efficiency for Small Farms.

Variables	Coefficient	MVP	MFC	r	D	Efficiency
Ln-Cost of birds	0.741	5.222	1	5.222	80.85	Under used
Ln-Cost of Labour	0.655	0.521	1	0.521	91.94	Over used
Ln-Cost of Vaccines, drugs and Chemicals	0.0881	1.111	1	1.111	10.0	Under used
Ln- Amount of feeds	0.055	2.871	1	2.871	65.17	Under used
Ln-Experience in poultry production	0.049	0.191	1	0.191	423.6	Over used
Ln- Education level	0.072	0.622	1	1.622	60.87	Under used
Ln-Cost of poultry Equipment	0.366	0.654	1	1.654	52.9	Under used

4.7 Factors Limiting Indigenous Chicken Production and Profits

The study's final objective was to identify the major factors limiting indigenous chicken production and farm profits and to propose solutions to address them. The results under this objective start by analysing the price per bird for the different scales of production among the indigenous chicken farmers (Table 4.16). Further the study assessed the profitability of the indigenous chicken based on the scale of production (Table 4.17). Diseases, parasites, predators, and insufficient feeds were identified as the major challenges confronting chicken farming in the study area (Table 4.18). further lack of suitable chicken housing, Crossing to neighbours farms, poor poultry husbandry skills, low bird returns, theft, and rodents were affecting chicken farming. The common disease affecting chicken was identified as New Castle Disease (NCD), closely followed by Infectious Bursal Disease (Gumboro), fowl pox, coccidiosis, and respiratory diseases. Other disease conditions included leg paralysis (Mareks) and a few of unspecified ones.

4.7.1 Price per Bird

According to the survey, the sampled respondents sold their chicken at prices ranging from Ksh 400 to Ksh 600 per bird, with a mean of Ksh 500 per bird. According to the analysis, respondents who produced fewer than 50 birds sold their birds for a price ranging from Ksh 460 to Ksh 600 per bird, with a mean of Ksh 530 per bird. Respondents who produced between 50 and 100 birds were paid Ksh 420 to Ksh 560 per bird, with a mean of Ksh 490. The remaining respondents who produced more than 100 birds sold them for a price ranging from Ksh 400 to Ksh550 per bird, with a mean of Ksh 475. Table 4.16 displays the price paid per bird by respondents. This is most likely due to the lower production costs they reported compared to the rest of the respondents. Similarly, the mean price received per bird among respondents who produced 50 to 100 birds was lower than the mean price received per bird among respondents who produced less than 50 birds.

Table 4.16: Price(S) Received per Bird.

Number of birds	Minimum Price(Kshs)	Maximum Price(Kshs)	Mean Price(Ksh)
Less than 50	460	600	530
50-100	420	560	490
More than 100	400	550	475

4.7.2 Profit obtained per Bird

The profit per bird obtained by the sampled farms ranges from Ksh 110 to Ksh 185 per bird, with a mean of Ksh 147. The analysis also reveals that the profit per bird obtained by respondents who produced less than 50 birds ranges from Ksh110 to Ksh150 per bird, with a mean of Ksh 130. Profits for producers of 50 to 100 birds ranged from Ksh145 to Ksh160 per bird, with a mean of Ksh152. The remaining respondents who produced more than 100 birds earned profits ranging from Ksh 165 to Ksh185 per bird, with a mean of Ksh 175. The profit per bird obtained by the respondents is shown in Table 4.17. According to the findings, as flock size increases, so does the profit per bird obtained by respondents.

Table 4.17: Profits Received Per Bird

Number of birds	Minimum profit(Kshs)	Maximum Profit(Kshs)	Mean Profit(Ksh)
Less than 50	110	150	130
50-100	145	160	152
More than 100	165	185	175

4.7.3 Major Factors Limiting Production and Profitability of Indigenous Chicken Firms

Diseases, parasites, predators, and feeds were identified as the major challenges faced by chicken in the study (Table 4.18). Other constraints identified included a lack of proper chicken housing, conflict with neighbours, poor chicken husbandry skills, low chicken returns, theft, and rat menace. The study ranked the main diseases as; New Castle Disease (NCD), closely followed by Infectious Bursal Disease (Gumboro), fowl pox, coccidiosis, respiratory diseases and leg paralysis (Mareks) as sown in figure 4.2.

Table 4.18: Major Factors Affecting Indigenous Poultry Farming.

Major factors	Frequency.	Percentage.
Diseases	25	25.0
Parasite attacks	14	14.0
High cost of feeds	8	8.0
Lack of proper chicken housing	7	7.0
Lack of chicken husbandry skills	7	7.0
Small returns	4	4.0
Theft	5	5.0
Conflict with neighbours	2	2.0
Predator attacks	28	28.0
Total	**100**	**100.0**

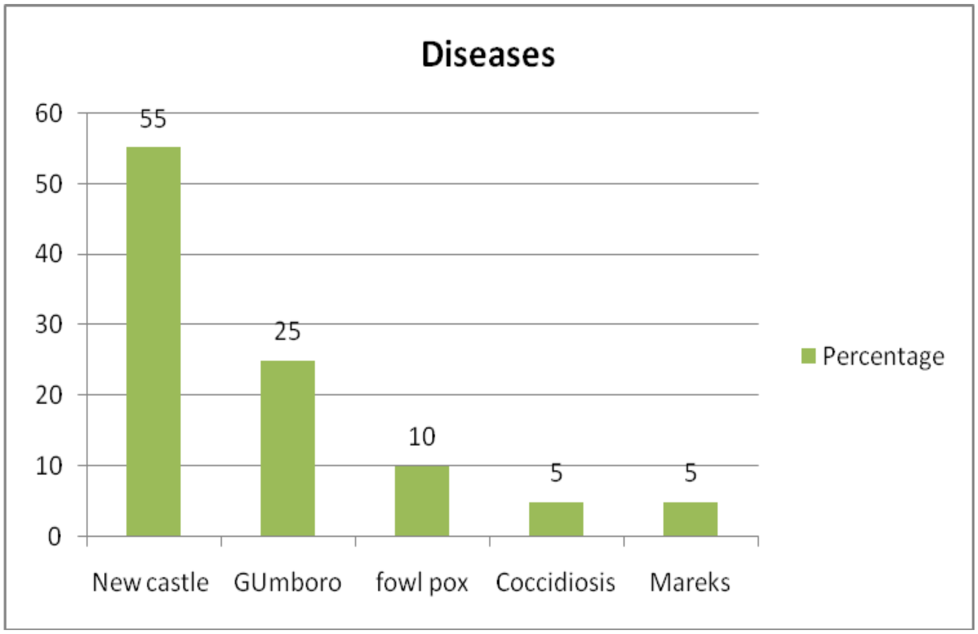

Figure 4.2 Poultry Diseases

Table 4.19: X^2 On Constraints/ Challenges Of Indigenous Chicken Production

Major Challenges	F (Observed variables)	Expected cell totals	Chi-square statistic for each cell.	p-value
Diseases	25	21	0.22	0.00082
Parasite attacks	14	15	0.15	0.00090
High cost of feeds	8	6	1.47	0.00070
Predators attacks	28	23	1.92	0.00150
Others	25	26	0.09	0.00090
Total columns	100			

The chi-square statistic is 7.7554. The p-value is 0.000961. The result is not significant at $p < 0.05$

Constraints affecting indigenous chicken production were significantly influencing farm profit at the study site when submitted to chi-square statistics at p=0.05 (Table 4.19 above).

4.7.4 Management of Poultry Diseases

To avoid disease outbreaks, farmers used ethno-veterinary and conventional veterinary medications to treat chicken ailments, as well as immunization and selling flocks (Table 4.20). About 43% of the respondents used herbal medicine to treat chicken diseases. Among the herbs used to treat chicken ailments were aloe, Mexican marigold, Black jack leaves, Croton roots, Star grass leaves, and hot pepper. Herbal treatment was the primary method of dealing with disease outbreaks (43.0 %). 29% of the respondents administered treatments themselves, while others used veterinary professionals. Another method of dealing with disease outbreaks was slaughtering the infected chicken for consumption by the family.

Table 4.20: Disease Management

Disease Management	Responses	Percentage
Treatment using herbs	43	43.0
Self-administer veterinary drugs	29	29.0
Vaccination	13	13.0
Call veterinary officer	7	7.0
Selling mildly affected chicken	7	7.0
Give affected chicken to pets	1	1.0
Total	**100**	**100**

Respondents in the research area said they used a variety of parasite management measures. The two most popular and widely used methods were the use of parasite dusting powders and regular cleaning of poultry housing units. Other parasite control methods used include the use of wood ash, motor oil, detergents, splashing water, and acaricides. The researcher also attempted to establish a link between disease management and indigenous poultry farming production, as shown in Table 4.21. The tudy revealed that there is a strong positive relationship between disease management and indigenous poultry farming production (r (100) = 0.646, p0.05).

Table 4.21: Correlation for Disease Management And Production Of Indigenous Chicken

		Disease management	Production of indigenous poultry farming
Disease management	Pearson Correlation	1	0.646(**)
	Sig. (2-tailed)		.000
	N	100	100
Production of indigenous poultry	Pearson Correlation	.646(**)	1
	Sig. (2-tailed)	.000	
	N	100	100

** At the 0.01 level, the correlation is significant (2-tailed).

4.7.5 Indigenous Chicken Farming Extension Services

According to the survey, chicken growers received most of their extension support from government personnel. Agricultural extension services were offered in the research region by private professionals, community-based service providers, Faith-Based Organizations (FBOs), and non-governmental organizations. The vast majority of respondents expressed satisfaction with the chicken production extension services they received. Extension services on chicken management in the study area were impeded by solutions that didn't address the challenges that poultry farmers faced such as low value placed on birds, and low literacy levels (Table 4.22). The language used in delivery, the high cost of extension materials, and trainings attended by an audience (mostly men) who were not true chicken keepers on a daily basis were all factors contributing to the poor reception of extension services provided.

Table 4.22: Extension Services

Extension services		Frequency	Percentage
Access to extension services	Yes	73	73.0
	No	17	17.0
Extension services provider	Government	68	68.0
	NGOs	14	14.0
	Private Companies	16	16.0
	Others	2	2.0
Frequency of extension services	Weekly	5	5.0
	Monthly	55	55.0
	Others	40	40.0

The researcher further sought to establish the association between extension services and production of indigenous poultry farming. The study established from Table 4.23 that the Pearson Chi-Square is $\chi^2_{(1,4)} = 25.221$, $p = .000$. This indicates that there is a statistically significant association between extension services and indigenous poultry farming production.

Table 4.23: Chi-Square Test for Extension Services and Production of Indigenous Chicken Farming

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.221(a)	4	.000
Likelihood Ratio	15.874	4	.000
Linear-by-Linear Association	24.112	1	.000
N of Valid Cases	100		

A total of 23 cells (92.0%) had an expected count of fewer than 5. The expected minimum count is .05. This study established a statistically significant link between extension services and indigenous poultry farming production. This means that improving extension services would improve the production of indigenous poultry farming significantly.

4.7.6 Suggestions for Solutions to improve on Extension Service Delivery

Respondents proposed a variety of approaches to addressing the issues identified as impeding the delivery of extension services (Table 4.24). The priority solutions proposed by respondents were to increase government extension officers (28%), train more community-based service providers (20%), improve marketing (13%), and provide financial extension services (11%). The other methods mentioned were the provision of better chicken breeding stock (9%), extension through farmer-to-farmer field schools (8%), packaging of chicken extension materials in local dialect, and construction of model chicken houses (4%). A 3% of respondents proposed that vaccines be made available near farmers.2% supported expansion of private services, while 2% proposed that more written materials, such as booklets and brochures, be made available.

Table 4.24: Solutions to The Improve Extension Service Delivery

Solutions to the identified challenges	**Frequency**	**Percentage**
Increase Government extension officers	28	28.0
More community service providers need to be trained	20	20.0
Marketing enhancements	13	13.0
Financial extension services	11	11.0
Provision of improved chicken breeding stocks	9	9.0
Farmer-to-farmer field schools to be used for extension.	8	8.0
Chicken extension material packaging	4	3.0
Obtaining vaccines in close proximity to farmers	3	2.0
Increase in private services	2	3.0
Supply of more written materials	2	2.0
Total	**100**	**100.0**

4.7.7 Financial Credit

Capital is a very vital factor in any economic activity. The main sources of finance, according to the respondents, were commercial banks, cooperative societies, Shylock, microfinance organized groups. A chi-square test was carried to test the effect of credit on indigenous chicken production and results tabulated in table 4.25 presented here below;

Table 4.25: X^2 On Access to Credit

Access to Financial credit	F (Observed variables)	Expected cell totals	Chi-square statistic for each cell.	p-value
Commercial banks	22	20	1.25	0.00055
Co-operative societies	48	42.0	0.90	0.00048
Shylock	5	3	1.47	0.00070
Micro financing	20	18	5.35	0.0056
Others	5	6	1.33	0.00093
Total columns	100			

The chi-square value is 18.5523. 0.000642 is the p-value. At p 0.05, the result is significant.

Methods used to obtain credit have a significant influence on chicken farming, according to chi-square statistics at p 0.05. (Table 4.25).

CHAPTER FIVE

5.0 DISCUSSIONS AND INTERPRETATION OF RESEARCH FINDINGS

5.1 Introduction

The discussion and interpretation of research findings based on the research objectives are presented in this part. The Overall objective of this study was to analyze economic efficiency in indigenous chicken production in Kitui County.

5.2 Demographic Characteristics of Indigenous Chicken Framers in the Study Area

The findings revealed that women were more likely than men to be involved in indigenous chicken rearing. Women look after small livestock, while men look after cattle and small ruminants. Men, on the other hand, entrust their animals to their wives and children (Keambou et al.,2016). Other studies with similar results include Haoua et al (2015) in Cameroon's sudano-sahelian zone and Fosta et al., (2007) in Cameroon's forest. According to the findings of a study conducted by Mathiu et al., (2021), the gender of the household had a positive and significant correlation with indigenous chicken production in Tigania, west Kenya. According to the study the marginal effect of increasing chicken production among respondents increased by 19.69%. Honfoga et al., (2017) discovered that when the head of the household was male, agricultural production increased significantly more than when the head of the household was female. According to Ndirangu et al., (2018), this is due to males having easier access to resources than females.

In terms of education, the majority (40%) had completed primary school. Farmers' literacy is a crucial advantage for adopting and disseminating innovative chicken production techniques and farm management, as well as for integrating local farmers into local chicken value chain development programs (Keambou et al., 2016). The majority of the farmers (30%) had 6-10 years of experience raising indigenous chicken. Experience with indigenous chicken can be attributed to the fact that they are mostly maintained in a free range system and have a strong attraction among the general public due to their numerous benefits (Kaembou et al., 2016). Elder farmers, on the other hand, are conservative and resistant to change (Fosta et al., 2008).

5.3 Resources used by Framers in Indigenous Chicken Production

The study aimed to identify major resources used by farmers in indigenous chicken production, estimate the production function, and determine which of the identified resources had a significant impact on indigenous chicken production in Kitui County. The most common resources used by poultry farmers were determined to be poultry houses, feeding traps, veterinary services, and hired labor. All of these resources required money to acquire, resulting in a certain amount of production cost, with the majority (31%) of respondents indicating that they had spent Kshs 10,000 or more on the construction of a poultry house. This appeared to be the most expensive resource. However, it was discovered that the vast majority (67%) of respondents used free labor from their families. These findings support the argument made by Ashagidigbi et al., (2011) that the cost of poultry production inputs such as poultry houses, drugs, and feeding traps has a significant impact on indigenous chicken production. Nzomoi (2006) discovered that the amount of labor force employed by producers had a significant influence on the average amount of output and profitability.

5.4 Farmers Level of Efficiency in Utilizing the Indigenous Chicken Production Resources

The purpose of this study was to ascertain the farmer's level of efficiency in utilizing the identified indigenous chicken production resources. According to the findings, the variables with the greatest influence on poultry production were labour with a factor of 0.775 followed by poultry feed and poultry house each with a coefficient 0.619 and 0.571 respectively. The gamma (γ) results were 0.633 which was statistically significant at 5% level, implying that about 63.3 % of the variations in output of poultry farmers are caused by technical inefficiency. Similar results were established where the generalized likelihood test gave a value of 21.6 which indicated that the indigenous poultry farmers in Kitui County were not fully technically efficient.

According to Yusuf and Malomo, (2007), efficiency measurement is very important because it is a factor for productivity growth and helps to determine the under utilization or over utilization of factor inputs. The results above agree with Oji and Chukwuma (2007) who argued that technical inefficiency is determined by the socioeconomic and demographic characteristics of the farmers while production managers determine utilization of resources. According to Abdullai and Huffman (2000), efficiency in production is a way to ensure that firms' products are produced in the best and most profitable way possible; however, local farmers, particularly in developing countries, are inefficient in the allocation of available resources in agricultural production.

5.5 Economic Efficiency between Small and Large Scale Indigenous Chicken Farms in Kitui County

This objective compared the relative economic efficiency between small and large scale indigenous chicken farms in Kitui County. The study revealed that, experience in chicken production by farmer and income has positive effect on utilization of resources for both small scale and large scale chicken farmers. The resource use efficiency analysis for both small and large scale indigenous chicken farmers revealed that significant inputs in indigenous poultry production, such as labor, experience, and education level, were underutilized and that their costs needed to be increased for optimal allocation (Table 4.9). It was also discovered that large-scale poultry farmers were more affected than small-scale poultry farmers by the cost of birds, vaccines, medications, and chemicals, as well as the amount of feed and cost of chicken. According to the findings, the farmers' age, education level, and experience all had a favorable impact on their efficiency in utilizing local chicken production resources. These results agree with Ochieng et al., (2013) who argued that some major socio-economic characteristics of the farmers and production constraints affect the large scale farmers more than the small scale farmers. In their study large scale farming influenced the costs of feed, human labour, day old chicks, medication, transportation and other running costs required in broiler production.

5.6 Factors limiting Indigenous Chicken Production

The last objective was to identify the major factors limiting indigenous chicken production, farm profits and propose solution to them. The study established that the major challenges facing chicken were diseases, parasites, predators, and inadequate feeds. To avert disease outbreaks, farmers were found to use ethno-veterinary and conventional veterinary medications, immunization, and flock sales to manage chicken diseases. Increased number of government extension officers, more trained community-based service providers, and strengthened marketing and finance extension services, according to respondents, were among the proposed solutions to these challenges.

These results agree with Ochieng et al., (2013) who argued that the cost of inputs like; feed supplementation, vaccination, brooding, housing and labour are limiting factors to poultry production. This is the reason why majority of the small scale farmers have adopted free range production system, where chicken are rarely vaccinated or treated against diseases and parasites. It is important to understand how farmers respond to these diseases. Mapiye and Sibanda, (2005) argued that smallholder chicken farmers under free range production system respond differently in times of disease occurrence; they may choose to do nothing or use ethno-veterinary medicine, use modern (conventional) medicine and/or human medicine which are expensive to the farmers.

An increase in extension contacts, according to Mathiu et al., (2021), would increase poultry production by 9.48 %. Farmers benefit from extension services because they are educated on new production technology that enhances efficiency in production. Agricultural training, according to Ntabakirabose (2017), has a beneficial and significant impact on technical knowledge, as it provides farmers with skills and technical knowledge in the adoption of upgraded technologies, resulting in increased levels of productivity.

CHAPTER SIX

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This section presents the research findings' conclusions, as well as recommendations and proposals for future research. The aim of this research was to investigate the economic efficiency of Kitui County's indigenous chicken production.

6.2 Conclusions of the Study

The study identified chicken houses, feeding traps, water traps, veterinary services, labour and chicken feed as the most critical resources for indigenous chicken production in the study area. The study revealed that the cost efficiency levels of the sampled farms of indigenous chicken ranged from 0.1067 to 0.3498 with the mean of 0.070798. This implies that, on average, the indigenous chicken farms in the study area incurred about 7.08% cost above the frontier cost (an indication of about 7.08% cost inefficiency). Thus, on average, the farms could have produced the same levels of outputs using about 92.92% of the total cost incurred if they were to be efficient. The results of a regression model showed that the variables, Land size, Occupation, Years of experience, Gender, Education Level and Number of dependants significantly influenced the Number of indigenous chicken kept by the farmers in the study area. Farmers' educational level, experience in indigenous chicken production, farm size and technical advice from veterinary services were identified as factors that influenced levels of observed cost efficiencies on indigenous chicken in the study area. However, the empirical result showed that large farm sizes, farmers' educational level and technical advice from veterinary professionals were the factors that significantly improved cost efficiency among the indigenous chicken farmers in the study area.

Indigenous chicken farming was influenced by a variety of factors, including lack of suitable chicken housing, conflict with neighbors, limited chicken husbandry skills, low bird returns, and theft. The most common disease affecting chicken productivity is New Castle Disease (NCD), which is followed by Infectious Bursal Disease (Gumboro), poultry pox, Coccidiosis, and respiratory diseases. Leg paralysis (Mareks) and a few of other unexplained diseases were among the other diseases. The empirical results of this study point to fact that, despite some levels of cost inefficiencies identified, the indigenous chicken farmers in the study area have the potential of increasing their scale of production and become more profitable. The analysis on profitability confirmed that the respondents with larger farm sizes recorded higher profit per bird due to the lower production cost they recorded per bird arising from economies of scale.

6.3 Recommendations

Based on the empirical results obtained in this study the following recommendations are deemed very expedient to improve on the cost efficiency levels among indigenous chicken farms in Kitui County. From the findings of this study it is evident that farmers' level of education has a crucial role to play in improving the cost efficiency levels of indigenous chicken farms. The government and nongovernmental organisations could organise trainings and workshops which will enable farmers attain the minimum level of knowledge necessary for efficient indigenous chicken farming.

The County Government of Kitui through the Ministry of Agriculture, Livestock and Fisheries could organise to train more veterinarians to be deployed in villages. This will enable indigenous chicken farmers to receive technical advice from professional sources instead of relying on their fellow farmers for technical advice.

The empirical findings on the most critical resources needed for production of indigenous chicken reveal that the cost of poultry house construction was high while nature of these houses significantly influenced the level of chicken production. Therefore, the study recommends that the County Government of Kitui could assist farmers put up modern poultry houses through its various financing plans.

The study revealed that the farm size (scale of production) significantly improved cost efficiency among the sampled farms in the study area. The farmers with large flocks were more cost efficient than those who operated with small flocks. This could be attributed to utilization of production inputs and specifically the fixed resources of the farm. An increase in farm size (scale of production) could result in reduction of average cost per bird and eventually increase profit. Therefore, it is recommended that the county government should support the farmers by funding them to increase their scale of production.

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APPENDICES

Appendix 1: Questionnaire

1. Interview Date --------------------------------Questionnaire number--------------------------

2. Enumerators Name--

3. Respondent's Name---

4. Household head relationship to the respondent --

5. County -------------------------------------sub county--

6. Ward-------------------------------Sub location---

7. Date of Birth--------------------------------Mobile Number-------------------------------------

8. Sex: Male/Female

9. Marital status Married/Single/Windowed

10. What is your highest level of education? (None, Primary, Secondary, Tertiary)

11. How many dependents are there in the family?

12. Primary occupation of the respondent--------------------------------

13. Land acreage (in acres)--

14. Farming practiced by the respondent

i)-------------------------------------- ii)---

iii)-------------------------------------- iv)--

15.Number of indigenous chicken reared by the respondent in the last one year-------------

16.Specify the type and number of chicken kept during that year.

Chicken type	Number
Indigenous	
Exotic	

17. Main source(s) of chicks for production

Hutched Within the farm	
Buy from commercial hatcheries	
Others specify	

18. Method used to breed chicks

Natural method	
Artificial method	
Alternatives	

19.Indicate your main sources of labour?

	Members of family	Paid Workers	Other sources
Source			
Labour use			
Constructing poultry structures			
Poultry house cleaning			
Feed supplementation			
Provision of water			
Marketing of chicken and chicken products			
Treatment			

20. What resources do you own in your farm?

Resource	**availability**	**number**	**Describe the nature**
Poultry house			
Feed traps			
Water traps			
Veterinary services			
Labour			
Extension services			

22 Do you have a poultry house in your farm (a) yes (b) no

If yes is it modern or traditional

If no where do your birds sleep?

23 What system of poultry rearing do you practice

a) Confined system

b) Free range

c) Others (specify)

24 If you practice confined system fill the table below

Number of chicken	Type of feed	Amount in kgs

25. How much water do you give the chicken per day in litres?

26. Apart from scavenging do you provide your chicken with other feed (supplementation).

Yes/No

27. If you practice feed supplementation at what time do you feed your chicken?

a) Very early in the morning

b) Late in the evening

c) Mid day

d) Any other time (specify)

28. How much feed do you use to supplement your chicken?

29. How much money (income in Kshs) do you earn from the following sources?

Income source	Amount in KSH per Month
Salaries and wages	
Livestock sales	
Crop sales	
Any other	

30. Do you know of any traditional belief or practice related to rearing, consuming or marketing of chicken? Yes/No

If yes:

i. State type belief /practice-------------------------------------

ii. What type of birds do these practices apply------------------------------

iii. Is there any special group of people that these taboos apply----------------------------

31. Why do you rear chicken?

a) As a source of income b) Eggs c) Meat d) Both meat and eggs

32. Indicate whether you sold any chicken in the last three months?

YES	
NO	

33. If the answer to question 32 is yes indicate the number as per the table below

	cocks	layers	growers	chicks
Local market				
Hotels/shops				
Farm gate				
Others (specify				

34. What was the average price of each bird during that period?

	cocks	layers	Growers	Chicks
Local market				
Hotels/shops				
Farm gate				
Others (specify				

35. Have you ever sold any of your chicken/eggs on contract terms?

YES	
NO	

36. If yes to question 35 are you still serving the contract?

YES	
NO	

37. Do you keep record for your farm transaction?

YES	
NO	

38. Fill in the table below the amount of resources used and their costs for the last one year

Feed resources	amount	Cost in ksh
Feeds		
Water		
Labour		
Veterinary services		
Drug		

39. How much did it cost you to do the following vaccines?

VACCINE	TOTAL COST (KShs)
Mareks	
Newcastle disease	
Gumboro	
Fowl pox	
Fowl typhoid	

40.a) How many times have you sought the services of a veterinary officer in the last six months.

b) What was the approximate cost for these services

41. If you incubate your eggs artificially what is the average variable cost per egg.

42. If you do value addition fill the table below

PRODUCT	PRICE PER UNIT e.g per chicken egg
Cooked chicken	
Boiled or fried eggs	

43. Approximate the cost of transporting the chicken/eggs to the place of selling

PRODUCT	QUANTITY	COST OF TRANSPORT (KShs)
EGGS		
CHICKEN		

44.Flock dynamics (last 6 months)

	CHICKS	GROWERS	HENS	COCKS
Vented				
Killed through infections				
Consumed by family members				
Used as rewards to others				
Alternatives				

45. Are poultry diseases a problem on your farm (check the box where applicable)?)

Yes	
No	

46. Have you used disease prevention methods in the last six months? (Check the appropriate boxes)

Yes	
No	

47. If you answered yes to Q46 above, what method of disease control did you employ? (Check the appropriate boxes)

Modern	
Traditional	

48. Has your chicken been vaccinated in the recent six months? (Insert a check mark when applicable.)

Yes	
No	

49. Do you have a problem with chicken predators on your farm? (Check the appropriate boxes)

Yes	
No	

50. Are extension services accessible?

YES	
NO	

51. Indicate the source of extension services

Nongovernmental organizations	
Government and government agencies	
Private firms	
Others (specify)	

52. Report the frequency of the extension services

Weekly	
Monthly	
Any other (Specify)	

53. Do you get any financial credit?

54. Indicate the source of the financial credit

i) commercial banks ii) cooperative societies iii) Microfinance institutions iv) Shylock

v) Others specify.

Thank you.