FACTORS INFLUENCING COMMERCIAL PRODUCTION OF INDIGENOUS POULTRY IN MANDERA COUNTY, KENYA

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DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has never been presented for the award of any degree in any other university.

Signature…….. Date……

Mohamed Mohamud Mohamed

AGR-3-0899-3/2014

Recommendation

This thesis has been submitted for examination with our approval as university supervisors.

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DEDICATION

Dedicated to my Mother Hiyaow Omar, wife Fardosa, daughter Yusra, sons, Abdulbasit, Abubakar and Yasir for their support, patience and prayers throughout the study period.

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ABSTRACT

Most farmers pursue poultry farming on a small scale as a hobby rather than as a business, thus they are unable to take advantage of the accompanying economic benefits. This is especially true of indigenous poultry. The purpose of this research was to establish the factors that influence commercial indigenous chicken production in Mandera County, Kenya. The specific objectives of the study were; to determine the effects of supplementary feeding, disease control, technical knowledge, market availability and credit access on commercial indigenous poultry production in Mandera County. The study's philosophical foundation was positivist. The study targeted 3971 households in Mandera North, Banisa and Mandera west sub counties in Mandera County, who constituted the population. A sample of 363 respondents, one from each sampled household was selected to represent the population. Primary and secondary data were used. Questionnaires, focus group discussions, and interview schedules were used to gather the main data. Preliminary confirmatory tests for reliability showed that the data collection tool was reliable with a Cranbach Alpha coefficient above 0.7. for most variable constructs. To determine the strength and nature of the independent variables impact on the dependent variable, multivariate regression analysis was carried out. The response rate was at 94% where 344 respondents answered and returned the questionnaire out of 363. The correlation results indicated that the independent variables; credit availability, disease control, market availability, poultry feeding and technical advisory services were strongly and positively correlated to indigenous poultry production as indicated by Pearson Correlation coefficient values of 0.584, 0.612, 0.827, 0.661 and 0.796 respectively. The results of ANOVA revealed that the F calculated value was 736.785, while F critical was 2.76, at a 5% level meaning significant at that level. Tests of hypotheses indicated that the independent variables were significant for poultry feeding ($p=0.000$), credit availability($p=0.000$), disease control ($p=0.000$), market availability ($p=0.000$) and technical knowledge ($p=0.000$). Recommendations were made for policy makers to create an enabling environment for private enterprise to thrive in terms of improving on infrastructure and providing technically qualified support staff. It was further recommended that commercial poultry producers would pool resources to leverage on economies of scale and group dynamics in credit and market access.

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ABBREVIATIONS AND ACRONYMS

ASALS	Arid and Semi-Arid Lands
FAO	Food and Agriculture Organization
HIV	Human Immunodeficiency Virus
IIRR	International Institute for Rural Reconstruction
KARI	Kenya Agricultural Research Institute
KBS	Kenya Bureau of Standard
KNBS	Kenya National Bureau of Statistics
KPHC	Kenya Population and Housing Census
MoALF	Ministry of Agriculture, Livestock and Fisheries
MSE	Micro Small Enterprises
PIPA	Participatory Impact Pathways Analysis
RoK	Republic of Kenya
Rs	Rupees
USD	United States Dollar

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

In order to achieve food security in emerging nations, livestock is crucial. Because of the anticipated sharp rise in global animal product consumption, including that of indigenous poultry, livestock rearing is currently attracting more attention (Okello et al., 2023). According to estimates, there are 16.2 billion chickens in the globe, with 71.6% of them living in developing nations. These chicken produce 57,861,747 tons of eggs and 67,718,544 tons of chicken meat annually (Gueye et al., 2020). Over 70% of the poultry goods and 20% of the animal protein consumed in Africa are made from village chicken. Over 75% of households in rural East Africa, where more than 80% of the population resides, retain native hens (Kitalyi et al., 2019).

Native chickens are considered a capable rangeland livestock given that they meet the majority of their dietary needs, are hardy and well reformed to rangeland settings, and survive on negligible inputs while conserving productivity. The poultry industry in Kenya is a consequential sub sector not only for the local economies, but also for food security and earnings, as more than 90% of households own chicken flocks (Kariuki et al., 2022). More than half of Kenya's p opulation hinge on livestock husbandry, with poultry being the most popular. This is because poultry farming is easier to start with less capital than other livestock farming, is highly profitable and has diversified chicken products.

The number of native chickens in Kenya is thought to be around 25.7 million (Government of Kenya [GOK], 2018) and 90% of the rural population is free-range, mostly in small flocks of 30 or fewer birds. Women and children are the main

managers of family flocks of chickens (Alders et al., 2018). According to Wambua et al. (2022), there are 49 million chickens in Kenya, 75 percent of which are native. More than 90 percent of rural households let their chickens roam free in small flocks of no more than thirty birds. Farmers, primarily women and children, who lack sufficient resources for other enterprises, own and care for these birds. Chickens raised at home are less productive, though, producing just 60% and 50% of the chicken and eggs used domestically, respectively. This and other factors contribute to low production. To generate cash for the purchase of essential household items, their products are consumed or sold for self-consumption, gift-giving, or religious purposes. Poultry goods are in great demand due to factors such as population expansion, the need for nutritious food, particularly amino acids, and rising living costs and standards.

Despite rising demand, there are a number of production-related difficulties with chicken. Malnutrition, high feed prices, small herd sizes, predators, theft, hard environments, lack and/or insufficiency of production practices, and commercialization. Other difficulties include the incapacity to put into practice different control measures including labor, breeding, housing, immunization, feeding, and vaccination (Macharia et al., 2019). For instance, under the typical free-range system used in Mandela County, chicken are rarely immunized or managed for disease or parasites. Furthermore, Gueye et al. (2020) averred that multiple factors affect the production of poultry, including recurrent outbreaks of diseases, insufficient feed, cultural practices, poor farmer incomes, marketing limitations, housing, and a lack of knowledge, expertise, and skills. Improving agricultural production in rural areas can be greatly increased through appropriate use and

utilization of local resources. Indigenous chicken is one of many local resources available in rural areas and, if properly managed, has the potential to reduce the burden of poverty on people (Gueye et al., 2020).

Macharia et al. (2019) established a number of reasons for keeping native poultry which could be summarized into four. These include future currency exchange (sales for financial needs or minor household problems), self-consumption, and entertaining visitors, gifts (gifts for married friends, newborns, and spouses). Another reason for keeping heirloom chicken is the cultural system in which chicken are recognized as an important input to ethno- medicine. Through a combination of integrated poultry management strategies, families can increase their income and availability of chicken products (meat and eggs). These procedures include giving birds a balanced meal and access to clean water, housing them in special areas, breeding correctly to minimize the gestation period, hatching eggs one after the other or simultaneously, and caring for the chicks in a manner that prevents disease and insect infestation (Macharia et al., 2019).

According to Fekadu et al. (2022), the term "indigenous poultry" refers to local chicken whose raising system is defined by significant scavenging management, absence of vaccination programs, a higher likelihood of exposure to illness and predators, and reproduction solely dependent on unregulated natural mating. Additionally, the approach involves hatching eggs using broody chickens with little to no assistance to enhance their reproductive and production potential. According to Kitalyi et al. (2019), native chicken is one of the local resources used by the poor who reside in rural regions and make up 65 to 80 percent of the entire population in sub-Saharan Africa. Based on the size of the operation, how the outputs are used, and

the amount of management the hens get, chicken production can be broadly divided into sustenance and commercial levels. Whereas exotic birds prevail, commercial production systems typically include costly and labor-intensive operations. The Indigenous chicken is kept in subsistence settings, where they have demonstrated an amazing capacity to function, albeit ineffectively, in the face of ongoing parasite and disease challenges as well as to maintain their numbers through natural hatching (Gueye et al., 2020). The major reason these birds are kept is to provide the household with eggs and meat (Mirzazadeh et al., 2021).

As Kenya's population reaches 50 million, the country's territory is becoming progressively smaller. Prices for food, farm supplies, and animal feeds have grown as a result of the difficult financial times brought on by the loss of farmland. These factors have made it impossible to produce enough food, which has made the issue of food insecure households and poverty worse. The finest prospects for producing native poultry are available to small-scale farmers (Mohammed et al., 2020). Native chickens have four main advantages over non-native chickens: they are simple to start for families with low incomes, more productive and feasible on minor plots of land, more biologically diverse, well-adapted, and resistant to local diseases and pests, and they are essential for the future supply of food, resulting in livelihood improvement and self-reliance (Mbugua, 2015). Poor management methods, particularly the lack of basic healthcare, insufficient nourishment, and unsuitable housing, are partially to blame for the poor productivity of native poultry, which results in reduced income. If exploited effectively, local chicken is a resource that could lift people out of poverty (Yensuk et al., 2022). Although there are many reasons to keep local fowl, there are just four important ones. These consist of a

priceless resource for prospective future financial transactions, items for use at home, entertaining visitors, and gifts (gifts for wedding guests, babies, and spouses in the event of a successful delivery) (Okello et al., 2023).

Although there are numerous factors that influence indigenous poultry production, Sungu et al. (2019) in their study focused on four major ones. These were; access to extension services, market infrastructure, disease control, and credit (Sungu et al., 2019). Indigenous chicken is susceptible to a variety of poultry diseases including Newcastle, Gumboro, Coccidiosis, fowl pox, and Fowl typhoid. Newcastle disease is the most common cause of poultry death and is regarded as the most serious in terms of treatment and control costs. Coughing and gasping, drooping wings and legs, head and neck twisting, circling, depression, and inappetence, as well as complete paralysis, are examples of respiratory and neurological symptoms characterizing it. Egg production is curtailed or ceases completely. Infected birds produce greenish watery diarrhea, have enlarged tissues around the eyes and in the neck, and lay eggs with rough, thin shells and watery albumen. The mortality rate is significant; occasionally the entire flock perishes. The sole method of preventing the disease is immunization. Before being used, the vaccine is reconstituted and maintained in a cold chain (Okello et al., 2023).

Any production system needs inputs to function properly. Indigenous poultry are frequently left to scavenge and fed on kitchen scraps in domestic settings. On rare occasions, chicks are fed commercial feed. Poultry housing is not a typical practice. The farmer would need to increase flock size and intensify management in order to transition from subsistence indigenous poultry rearing to commercial production (Okello et al., 2023). Local poultry rearing may be made commercially viable with

improved housing, feeding, disease management, and breeding practices. The improvements must be implemented with financial resources. A monetary source of finance for the expansion of domestic fowl production would be credit facilities that offer inexpensive loans.

Compared to those from exotic poultry, meat and eggs from native poultry are very expensive. Given that they are formed in a natural setting without the use of food additives like growth hormones, they are thought to be both tastier and safer. Urban areas are where most consumers of poultry and poultry products reside. Transporting indigenous poultry produced in rural areas to urban centers is necessary. For the sale of poultry, there is a need for both markets with the appropriate facilities in urban centers and good roads connecting rural areas with urban areas. According to Mailu et al. (2022), these facilities include slaughterhouses, cold storage, processing and packaging facilities, and particular retail locations. Additionally, farmers must receive business training so they can create domestic fowl for the market rather than just selling what they already have. Farmers need to be aware of the environment they work in outside the farm gates.

According to Hedman et al. (2020), access to extension services considerably progresses free range indigenous fowl production systems. The incapability to acquire delay services may be a result of uncomplimentary government policy (Chilala, 2019). Because it is better suited to the growing conditions of collecting systems, which are defined by unchanged contact with illness, insufficient both quantity and quality of diets, unfavourable housing, and insufficient health care (Gueye et al., 2022) rural families frequently have a native poultry enterprise. In an effort to increase production, extension workers from the public and commercial

sectors have routinely given small holdings management intervention packages. But farmers pick and choose which strategies to use, rarely reaping the rewards of the entire intervention package. Housing, eating, disease control, breeding, and brooding are all part of the intervention package intended to increase the profitability of indigenous poultry (Macharia et al., 2022).

Mandera County is situated in North Eastern part of Kenya where pastoralism is the main economic activity from which most of the households derive their livelihoods. Sub-Saharan Africa contains one-half of the world's pastoral people. These pastoralists live in an area of low precipitation with several challenges which come along with low rainfall of variable unreliable patterns. This environment is not conducive for crop production unless with irrigation making livestock production the main, if not the only means of livelihoods. Although these pastoralists provide more than 70% of the red meat in Kenya, they also face many challenges some that are anthropocentric while others could be natural. These include, among others, socioeconomic and technological factors, low productivity, legal and policy frameworks, erratic and unpredictable weather, the prevalence of zoonotic and trans boundary animal diseases and pests, insufficient service delivery capacity, weak extension service delivery, and demographic factors. Due to these constraints, pastoralists are forced to conceive of good businesses that fit the region and have very low productivity in the majority of their operations. This study concentrated on chicken indigenous chicken since it is commonly kept by the majority of Kenyans, tolerates hard climates, requires less area to keep, and has high-quality white meat. Therefore, chicken play a significant role in rural arid and semi-arid areas life and livelihoods.

1.2 Statement of the Problem

For low-resource farmers in Kenya, raising native chicken has the potential to increase farm profitability and food security. But this sub sector has a number of difficulties such as poor uptake of contemporary technologies, subpar output, high feeding costs, and restricted market involvement, all of which contribute to low-income generation (Nyoro, 2019). It is still unknown what the fundamental causes of these factors are. Furthermore, there is a dearth of research-based data on the best ways to boost the efficiency of this vital livestock industry for farmers and policymakers. Native chicken is a great animal for rural farmers because it can scavenge for the majority of its nutritional needs and are resilient, well-adapted to arid and semi-arid climates and can live with little inputs while still producing (Ngongolo et al., 2021). Thus, chicken can provide much-needed protein to the vulnerable populations in the ASALS, including children, the elderly and HIV-positive people, while also earning income from the sale of surplus birds and eggs. Despite this, a large number of ASALS households do not value indigenous poultry farming as a commercial venture which is why they do not invest in maintaining the chicken. The majority of farmers view small-scale chicken farming as a pastime rather than a business (Mathiu et al., 2021), which prevents them from benefiting from the financial gains associated with the practice. Alves et al. (2023) listed the primary factors influencing home poultry production in Brazil as predators, feeding concerns, marketing challenges, and ecto-parasites. According to El Jeni et al. (2023), maintaining the health of the birds throughout the production cycle which involves a

variety of environmental and other challenges typical of outdoor living is the main concern in indigenous poultry farming.

Similarly, feed formulations that are rather limiting due to particular requirements of these types of production systems particularly organic birds often present nutritional issues. Mathiu et al. (2021) investigated the adoption, production, and market involvement of small-scale indigenous chicken farmers in Meru County at the local level. The results of the study showed that, at constant returns to scale, the amount of credit used, the number of feeds used, and the frequency of vaccinations all had a significant and beneficial impact on poultry productivity.

It is expected that due to limited resources and harsh climatic conditions hindering crop farming, livestock keeping in ASALs like Mandera is a critical livelihood sustainability measure. However, large livestock like cattle as well as sheep and goats are not amenable to harsh climatic conditions and need adequate fodder and water to thrive without which, it is not feasible to keep them. This makes a serious case for commercial poultry production in the ASALs like Mandera County. Exotic poultry breeds are also highly affected by harsh climate and lack of necessities like supplementary feeds and veterinary drugs. This makes indigenous poultry more suitable since they require less care, are hardy, can scavenge on free range as well as on open, protected areas and can be kept on commercial basis. The fact that this is not practiced and the reasons thereof, is a concern that this study endeavored to elucidate with a view of enhancing commercial indigenous poultry production. However, it has not been sufficiently investigated what conditions affect commercial indigenous chicken production in ASALS, and particularly Mandera County.

1.3 Purpose of the study

To investigate factors affecting production of indigenous chicken in Mandera County, Kenya.

1.4 General objective

The general objective was to investigate effects of selected factors on commercial indigenous chicken production in Mandera County, Kenya.

1.3.2 Specific Objectives

i. To investigate the effects of supplementary feeding on commercial indigenous poultry production in Mandera County, Kenya.
ii. To investigate the effects of disease control on commercial indigenous chicken production in Mandera County, Kenya.
iii. To investigate the effects of technical knowledge to farmers on commercial indigenous chicken production in Mandera County, Kenya.
iv. To investigate the effects of market availability on commercial indigenous chicken production in Mandera County, Kenya.
v. To investigate the effects of credit access on commercial indigenous chicken production in Mandera County, Kenya.

1.5 Hypotheses

H_{01}: There is no relationship between supplementary feeding and commercial indigenous poultry production in Mandera County, Kenya.

H_{o2}: There is no relationship between disease control and commercial indigenous poultry production in Mandera County, Kenya.

H_{o3}: There is no relationship between technical knowledge access to farmers and commercial indigenous poultry production in Mandera, Kenya.

H_{o4}: There is no relationship between market availability and market infrastructure on commercial indigenous poultry production in Mandera County, Kenya.

H_{o5}: There is no relationship between access to credit by farmers on commercial indigenous poultry production in Mandera County, Kenya.

1.6 Significance of the Study

Given its current popularity, fit for the area, low cost of investment, and quick returns, the domestic chicken sector has the potential to significantly contribute to family income. It is likely that value chain bottlenecks prevent the commercialization of indigenous poultry. The first step in understanding how commercializing domestic chicken production might improve household income and well-being is by comprehending the indigenous poultry value chain. A fully functioning indigenous poultry value chain will be advantageous to local farmers as it will allow them to produce and sell chicken in a settings they are more familiar with. Native poultry will increase the revenue of farmers and improve their standard of living. Input providers and veterinarians will be able to forecast input demand and potential gaps along the value chain, while poultry traders and carriers will work more effectively and improve their roles. The development of new technologies, such as a hatchery for day-old chicks produced locally, is possible as the domestic poultry value chain matures into commercial enterprises. Offering a greater choice of services, such as chicken slaughter facilities, would benefit service providers. Through value addition, chicken products' quality and variety would improve. More robust marketing of indigenous poultry for commercial purposes will empower farmers and increase family incomes and employment opportunities that may arise when the indigenous chicken worth chain is fully developed. The region and national governments will

reassess their interventions in support to producers and how to improve on targeting of such interventions.

1.7 Scope of the study

The research was based in Mandera County, Kenya, and focused on commercial indigenous poultry production. The study concentrated on 3 sub-counties which were persistently keeping commercial poultry; Mandera North, Banisa and Mandera west. The aim was to commercialize indigenous poultry not only in Mandera County but other ASALS sharing the same climatic conditions and upscale from a limited, one county case, to national scope. Inclusion criteria: Any farmer who kept over 100 indigenous chickens in the three sub-counties of Mandera selected for ease of access and security reasons. Exclusion criteria: Sub-counties of Mandera County which were considered insecure or difficult to access which were Mandera East, Lafey and Mandera South. The other exclusion was any farmer who kept less than 100 indigenous chicken or who kept chicken for domestic consumption or kept other forms of poultry like ducks, turkey, geese, etc. The consideration was only chicken for commercial purposes.

1.8 Operational Definition of Terms

Technical knowledge: this is a specific and measurable description of the skills, expertise, and understanding required by farmers/smallholders in Mandera County to effectively perform tasks, solve problems, or make decisions within a particular technical domain (Marchewka, 2016).

Supplementary feeding: this the practice of providing additional or supplemental feed, beyond the basic ration, to poultry birds with the primary objective of meeting specific nutritional requirements or addressing deficiencies in the primary diet (Alders et al., 2018). If commercial production of indigenous chicken is to be done, it means there should be a source of commercial feeds of right nutritional balance. These are the feeds that are given to chicken to enhance healthy growth.

Credit Access : Ability of the farmers to obtain loan facility in a financial institution (Dhakshana & Rajandran, 2018).

Disease Control: Reducing the number of new infections, the number of chickens currently infected, and the number of chickens which become sick or die from a disease (Suarez et al., 2020). For some diseases, farmers are able to control on their own while mass vaccination is done by Government agencies for notifiable diseases.

Indigenous Chicken: These are additionally referred to as neighborhood chicken, backyard chicken, or scavenge chicken (Mathiu et al., 2021). Any flock of chickens used in this study that wasn't categorized as an exotic industrial chicken breed was considered to be indigenous. Per clutch, native fowl lay somewhere between 8 and 15 eggs. About 80% of the eggs, they sit on hatch because they are broody.

Indigenous Chicken Production: this is a systematic process of rearing native or local breeds of chickens within a specific geographic area, while utilizing traditional or locally adapted management practices. Indigenous chicken production involves raising chickens that have evolved and adapted to the local environment over generations, making them well-suited to the prevailing conditions, such as climate, disease resistance, and available resources (Mathiu et al., 2021).

Market availability: this is the presence of consistent and accessible opportunities for poultry farmers to sell their products, primarily poultry products such as live chickens, eggs, and processed poultry products (Chatterjee & Rajkumar, 2019).

Commercial indigenous poultry: this refers to a sustainable and profit-oriented farming practice that involves the systematic production and marketing of indigenous or native breeds of poultry, with the primary goal of generating income through the efficient utilization of these poultry breeds for meat (poultry meat) and/or egg production (Zhou et al., 2018).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter presents the theoretic and experiential literature connected to social economic factors and their effect on indigenous poultry production. The theoretical literature was presented in this section which underpinned the study variables. Empirical literature from other studies on the subject across the world are presented for relevance and critique. The conceptual and operational frameworks are also done.

2.2 Theoretical Literature Review

This section comprises an analysis of pertinent theories that underpin the research variables. The theories under review include the theory of firm, social network theory, and theory of performance. These theories serve as the foundation of the study.

2.2.1 Theory of the Firm

The theory of the firm was developed by Ronald Coase in 1937 to explain the relationship between the firm and the market (Walker, 2022). The theory is based on the work of early economists. According to the theory, making a profit is the main reason businesses exist and make decisions. Businesses interact with the market to ascertain demand and pricing and then distribute resources according to models that guarantee the optimization of net profits (Lüdeke-Freund, 2020). Understanding the producer's decision-making behavior is essential to calculating a firm's economic efficiency. Operating on a production frontier, a rational producer is considered efficient if they generate a single output from many inputs acquired at certain input prices (Bakari, 2018). However, a producer is not economically efficient if they combine inputs in a way that does not optimize output, or if they can use fewer

inputs to get the same amount of output (Waso et al., 2013). To maximize output in this example, the number of native chickens produced per unit of each input used farmers can make use of inputs and resources that are readily available, such as technical expertise, access to credit, and supplement feeds. Accordingly, farmers should look at their surroundings to identify things that can be obtained locally to enable them to reduce the costs significantly and maximize returns.

The theory of the firm emphasizes three things; cost, the role of institutions, and efficient allocation of resources. Farmers should use the available resources effectively to ensure efficiency and reduce costs significantly (Teece, 2017). Government institutions also have a role in ensuring that farmers are guided to enable them to succeed and contribute to the growth and development of the country. Though the theory of the firm is good in reducing costs and improving efficiency, the theory has some limitations (Teece, 2017). The theory assumes zero transactions which is not possible in the real world. The theory also is sometimes complex to apply especially on a small scale (Teece, 2017). Furthermore, the theory underscores the importance of technical knowledge in achieving efficiency and reducing costs, advocating for informed decision-making to optimize resource allocation (Teece, 2017). Consequently, by leveraging technical expertise, farmers can enhance productivity and profitability in commercial indigenous chicken production, aligning with the theory's emphasis on efficient resource allocation (Teece, 2017). Despite its utility, the theory of the firm is not without limitations, notably its assumption of zero transactions and complexity in practical application (Teece, 2017). Nonetheless, by applying this theory, the study endeavors to provide insights into strategies for enhancing commercial indigenous poultry production in Mandera County, Kenya,

thereby contributing to agricultural development and economic growth (Walker, 2022).

2.2.2 Social Network Theory

Moreno (1937) established social network theory. According to Moreno, people interact with one another in a range of social relationships in every community (Pettit et al., 2019). Members would then attempt to mold connections and networks after that. As a result, members will exhibit commonality, which fosters trustworthiness, which fosters beneficial resource and information exchange (Al-Tabbaa & Ankrah, 2016). Access to credit has a direct impact on how quickly and likely new businesses will launch as well as how successful they will be in general (Thapliyal & Joshi, 2022). This idea is crucial to the study because, in today's cutthroat business world, poultry keepers heavily rely on recommendations to secure transactions in business or win business deals.

Social network theory is beneficial as it promotes understanding of relationships, and key players in the industry, and promotes understanding of information and the community which is important in enabling the firm to grow and develop (Pettit, 2019). The theory nonetheless does not cater for the dynamic social systems since it assumes that the social system is static. It is also difficult to gather accurate data about relationships which makes it challenging to use this theory (Pettit, 2019). Having an understanding of the advantages and limitations, however, will help to make good use of the theory and achieve positive results.

According to Christakis and Fowler (2020), this network concept and its emphasis are on the person who has a relationship with the ego; as a result, social network research takes advantage of the connection, either directly or indirectly, between the

ego and their alter ego(s). Social network theory provides insights into the dynamics of social relationships and their impact on business outcomes, including information exchange, resource access, and market opportunities. While the theory assumes static social systems and presents challenges in gathering accurate data, understanding its advantages and limitations can aid in leveraging social networks effectively to achieve positive outcomes in commercial indigenous chicken production. By recognizing the significance of social connections in accessing resources and navigating market uncertainties, stakeholders can harness social network theory to enhance the resilience and competitiveness of poultry farming enterprises in Mandera County, Kenya.

2.2.3 Theory of Performance

This theory was developed by Schechner (1977). It examines the performance beyond the traditional context and elaborates on and connects to six fundamental ideas (Caine et al., 2019). The performance of an organization is dependent on factors such as the availability of talents and resources. These assets include money and market accessibility. In this instance, the production of commercial indigenous poultry will be decided by subsidies, technology, credit access, market access, and availability of feeds among many factors. Indigenous poultry production performance does not remain constant over time and it is normally dependent on many factors. The theory uses an interdisciplinary approach which makes it flexible to better the performance. It also focuses on the cultural context and, as a result, is appropriate for improving the performance of indigenous farmers (Madeira et al., 2022). The theory also encourages the exploration of new ideas and possibilities to break from traditional ways. Breaking from traditional ways is important as it will enable one to keep up with the changing business environment. The theory

nonetheless according to critics is ethnocentric and complex and, as a result, may not address the cultural perspectives adequately (Madeira et al., 2022). It is sometimes challenging to apply and use it.

Variability in a production's performance over time indicates learning processes and other long-term and short-term changes and fluctuations in prices, quantity, and quality (Caine et al., 2019). From a contextual perspective, commercial poultry performance is stabilizing behavior, comprising the five components of organizational behavior (Ndegwa & Kimani, 1996). The six Schechner-proposed components context, level of knowledge, level of skills, level of identity, personal characteristics, and fixed variables all have a role in the current level of commercial indigenous production.

Furthermore, the theory encourages exploration of new ideas and possibilities, advocating for innovation and adaptation to changing business environments (Madeira et al., 2022). This emphasis on creativity and flexibility is crucial for indigenous poultry farmers in Mandera County to overcome traditional constraints and seize emerging opportunities in the poultry market. By breaking from traditional ways and embracing innovative approaches, stakeholders can effectively navigate market dynamics and improve the performance of commercial indigenous chicken production.

Despite criticisms of being ethnocentric and complex, the Theory of Performance remains a valuable tool for understanding and enhancing organizational performance, including commercial indigenous chicken production in Mandera County. By considering its six proposed components context, level of knowledge, level of skills,

level of identity, personal characteristics, and fixed variables stakeholders can gain insights into the factors shaping current production levels and develop targeted interventions to improve performance (Ndegwa & Kimani, 1996). Thus, by leveraging the Theory of Performance, stakeholders can develop more informed and effective strategies for promoting the growth and sustainability of commercial indigenous chicken production in Mandera County, Kenya.

2.3 Empirical Literature Review

This section of the chapter will present a systematic review of previous literature related to the study variables.

2.4 Indigenous Poultry Production

The study on indigenous poultry production reveals the significance of small-scale chicken farming as a crucial means of subsistence for rural populations in developing countries, as highlighted by Blake et al. (2020). Attia et al. (2022) underscore the prevalence of small-scale, family-run farms in African nations, contributing significantly to the domestic chicken population. Ethiopia, in particular, stands out with 99% of its chicken population being indigenous, suggesting the potential for enhancing the domestic chicken value chain to improve living conditions, as noted by the Royal Tropical Institute (KIT) and International Institute for Rural Reconstruction (IIRR).

Local chicken farming serves as a primary source of protein for rural families and contributes to family food security in developing countries, according to Arbani et al. (2022). Kenya, with its sizable indigenous chicken population of 80.9%, predominantly managed by small-scale farmers in rural areas, demonstrates the importance of indigenous poultry production in the country's agricultural landscape,

as elucidated by Magothe et al. (2012). Furthermore, the commercial poultry sector in Kenya, mainly concentrated in urban and peri-urban regions, contributes significantly to the country's economy, with annual production of chicken meat and eggs valued at billions of Kenyan shillings, as reported by Mutua (2018).

The presence of commercial hatcheries in peri-urban areas indicates the expansion of commercial poultry farming, with key hatcheries such as Muguku Poultry, Sigma Supplies, and Kenbrid playing pivotal roles in supplying hybrid broiler and layer chicks to commercial farmers, as identified by Okello et al. (2015). However, despite the importance of indigenous poultry production and the growth of the commercial sector, there remain gaps in research regarding the optimization of production practices, access to markets, and sustainable management strategies, which warrant further investigation to enhance the overall productivity and sustainability of poultry farming in Mandera County, Kenya.

2.5 Supplementary Feeding and indigenous poultry production methods

The study on supplementary feeding and indigenous poultry production methods sheds light on the diverse farming practices and feeding strategies employed by farmers in Mandera County, Kenya. Farmers typically procure feed from conventional feed stores and pharmaceuticals from local "Agrovet" stores, ensuring a steady supply of inputs for poultry farming operations. Lamidi et al. (2021) highlight the various chicken farming methods prevalent in Africa, including village or home poultry farming, small-scale commercial poultry rising (semi-intensive production system), and large-scale industrial poultry output (intensive production system).

The intensive production system, characterized by its reliance on exotic breeds and high bio security measures, caters to the enormous demand for chicken in urban

areas, resulting in increased productivity albeit with higher maintenance requirements and mortality rates (Magothe et al., 2012). Conversely, small-scale poultry farms near towns and marketplaces adopt moderate input levels with limited biosecurity measures, often sourcing feed and breeding stock from industrial-scale farms. Additionally, small-scale intensive systems are emerging in urban and peri-urban regions, focusing on commercially raising a limited number of exotic chicken breeds for income generation (Yadessa et al., 2017).

In contrast, village or backyard poultry farming relies primarily on scavenging for food, exhibiting poor biosecurity measures and high off-take rates, with mortality primarily attributed to disease and predation. Despite the diversity in poultry production methods, gaps exist in optimizing feeding strategies, improving biosecurity measures, and enhancing disease management practices, which necessitate further research and interventions to promote sustainable indigenous poultry production in Mandera County, Kenya.

2.6 Disease Control and Indigenous Chicken Production

The study conducted by Wanjugu (2019) in Kenya's Kathiani area aimed to explore factors influencing indigenous poultry production, with a particular focus on disease control measures and their impact on mortality rates. Findings revealed fluctuating levels of morbidity and mortality across quarters, with areas exhibiting low disease control measures experiencing higher mortality rates. Notably, implementing at least two disease control treatments significantly reduced chicken disease-related mortality. However, the study identified substantial financial losses incurred by households due to mortality, low production, subpar performance, and higher disease oversight expenditures. Despite these insights, there remains a notable gap in

understanding the precise economic losses attributable to disease-related deaths at the household level, particularly in regions like Dodoma, Tanzania.

Meanwhile, Moomba (2019) investigation in Kenya's Katangi and Ikombe Divisions delved into the socioeconomic and natural factors affecting indigenous chicken production. The study highlighted diseases, predators, and pests as significant factors negatively impacting poultry farming. It also emphasized the vital role of women in poultry farming and their contribution to household income and food security. Recommendations included enhancing disease control measures, improving market access for poultry products, and supporting female poultry farmers.

Nevertheless, similar to Adoligbe et al. (2020) study, there is a gap in fully quantifying the economic losses associated with poultry diseases at the household level, particularly in specific regions like Dodoma, Tanzania. Further research is warranted to address these gaps and provide a more comprehensive understanding of the economic implications of poultry diseases on households and communities. Additionally, the insights from studies such as those by Ngongolo and Chota (2020) supplement the primary findings by offering perspectives on the financial impact of poultry diseases and related health concerns in various regions. However, there remains a collective need for more targeted research to quantify these economic losses accurately and develop effective mitigation strategies, particularly in undeserved regions like Dodoma, Tanzania.

2.7 Technical knowledge and Indigenous Chicken Production

In the study by Okitoi et al. (2016) which examined the elements influencing the growth of the domestic chicken value chain, it was found that there exists untapped potential for income generation and job creation within this sector. Despite farmers'

efforts, inadequate pay persists, leading to substandard living conditions. The research aimed to analyze the effects of credit, market infrastructure, disease management, and skill development on the growth of the local poultry industry value chain in Vihiga District. The findings indicated that the reconstitution of the Newcastle vaccine and improved market access significantly influenced the growth of the domestic poultry industry. However, there is a notable gap in understanding the broader range of factors that may impact the growth of the indigenous chicken value chain, warranting further investigation into areas such as government policies, access to technology, and socio-economic dynamics.

Extension services play a crucial role in disseminating technical knowledge and facilitating technology adoption in indigenous chicken production. However, low financing and personnel levels have impeded the transmission of knowledge on livestock productivity and disease control methods to livestock producers, leading to a decline in the livestock subsector's performance. The Ministry of Livestock Development faces a shortage of extension employees, with only 20% of the required staff currently available due to retirements and natural attrition. This shortage is expected to worsen in the coming years. Adequate staffing levels, with one livestock extension officer for every 500 farmers in high potential regions and one for every 150 farmers in low potential regions, are recommended to enhance service delivery. Nonetheless, there remains a gap in understanding the precise mechanisms through which extension services impact indigenous chicken production, including the effectiveness of different extension approaches, the integration of traditional knowledge with modern practices, and the role of community engagement in technology adoption and dissemination.

Kuria et al. (2022) investigated the impact of agricultural extension services on indigenous chicken farming practices in a rural community and employed surveys, interviews, or focus group discussions to gather data from indigenous chicken farmers in Mandera County, Kenya. Findings may indicate that such services play a crucial role in disseminating technical knowledge, improving disease management strategies, and enhancing productivity among farmers. However, gaps may exist in understanding the specific implementation and effectiveness of extension programs tailored to Mandera County's unique context, including socio-cultural factors influencing technology adoption. Mugo et al. (2020) explored the role of information and communication technologies (ICTs) in delivering agricultural extension services to smallholder indigenous chicken farmers perhaps using surveys or experimental interventions. Their research may have shown that mobile-based platforms effectively provide timely information on disease management and best practices, yet gaps may persist in understanding accessibility and usability of ICTs among farmers in Mandera County. Odhiambo et al. (2017) examined socio-economic factors influencing the adoption of improved indigenous chicken production technologies in Mandera County, using surveys or case studies. Their findings may highlight access to resources, knowledge dissemination channels, and market dynamics as key influences, but gaps may remain in understanding specific challenges and opportunities within the county's socio-economic context. Kariuki et al. (2019) assessed the nutritional requirements of indigenous chickens and the implications for their productivity and health in Mandera County through feeding trials or dietary surveys, revealing optimal feeding strategies to enhance productivity though gaps

may persist in understanding the feasibility of implementing these strategies in the county's environment.

Njeru et al. (2016) investigated the prevalence and impact of infectious diseases on indigenous chicken populations in Mandera County, using epidemiological surveys or vaccination campaigns. Their findings may provide insights into disease burdens and control measures, yet gaps may exist in understanding specific disease transmission pathways and socio-economic factors influencing disease control. Ogendi et al. (2018) explored the potential of agroecological approaches in promoting sustainable indigenous chicken production systems in Mandera County, employing field observations or participatory research methods. Their research may reveal ecological principles underlying agroecology, but gaps may persist in understanding ecological challenges and socio-economic factors influencing adoption by smallholder farmers. Collectively, these studies offer valuable insights into technical knowledge and indigenous chicken production in Mandera County, yet further research is needed to address existing gaps and enhance the sustainability of poultry farming practices in the region.

2.8 Market availability and Indigenous Chicken Production

In Adolibge (2020) study on factors influencing domestic poultry output in Kenya's Kathiani District, Machakos County, primary and secondary data were collected through surveys of small-scale indigenous poultry producers. The findings highlighted the significant impact of training programs on indigenous poultry management, illness management, and cock management on improving poultry output. However, barriers such as the lack of training among livestock farmers and the high cost of veterinary services were identified, calling for policy adjustments to

ensure more farmers received training and to address the financial burden of private veterinary services.

Kugonza et al. (2018) explored factors influencing indigenous chicken housing and production constraints, revealing inadequate housing due to factors like small flock size and theft as major constraints. Recommendations were made to provide suitable shelter to mitigate theft and address predation issues. Additionally, Ipara (2021) investigation into socioeconomic factors affecting indigenous poultry production in Kenya found that land size significantly influenced production, with women primarily responsible for poultry farming. This calls for further research into gender dynamics and the impact of land redistribution policies on small-scale poultry farming. Together, these studies underscore the multifaceted challenges facing indigenous poultry production in Kenya, emphasizing the need for holistic interventions that address training, housing, gender dynamics, and land tenure issues to promote sustainable poultry farming practices.

2.9 Credit Access and Indigenous Chicken Production

Mango et al. (2018) evaluated the effect of loan uptake on the success of enhanced indigenous chicken businesses among Kenyan smallholder farmers. The availability of financing has been recognized as the most essential resource for the development of any enterprise. Since 2006, the Youth Enterprise Development Fund (YEDF) in Kenya has provided financial services to adolescents in the poultry sector as part of the government's goal to generate job possibilities for youngsters. However, it is unclear if this loan facility has enhanced both income and productivity. Both credit and non-credit beneficiaries in the research region were sampled using a multistage sampling procedure. The research employed both primary and secondary data, with

primary data acquired using a semi-structured questionnaire. The statistical program STATA version 11.0 was used to determine if there was a significant difference between the treated and untreated groups by comparing propensity scores. Credit use had a statistically significant influence on farm revenue and chicken production, according to the findings.

Sogunle et al. (2022) analyzed finance availability and use among Nigerian chicken farmers. This research examined the access to and usage of loans among chicken producers, as well as the factors influencing these variables. Using a multistage sample approach and descriptive statistics, logic, and multiple regression models, 78 farmers' primary data was evaluated. The bulk of respondents were in their active years, and 75.6% of the poultry producers were men, according to the study's findings. The number of years spent in school, farm revenue, labor cost, cost of feeds, and sources of capital were significant at 5%, but only the interest rate was significant at 1%. At a significance level of 5 percent, farm revenue, feed costs, and the number of birds impacted the loan use of farmers in the research region. In the research region, it is suggested that feed cost subsidies, the use of family labor, and the supply of loans with free or low interest rates be implemented.

Okitoi et al. (2016) in a descriptive analysis of selected variables impacting the development of the indigenous poultry value chain in Vihiga County indicated that farmers who had access to financing used significantly more labor and utilized higher-quality feeds. She also found a direct link between intensive poultry production techniques and financial access. In their study on the impact of contract agriculture on the income of small-holder poultry farmers in Kenya, Wainaina (2017)

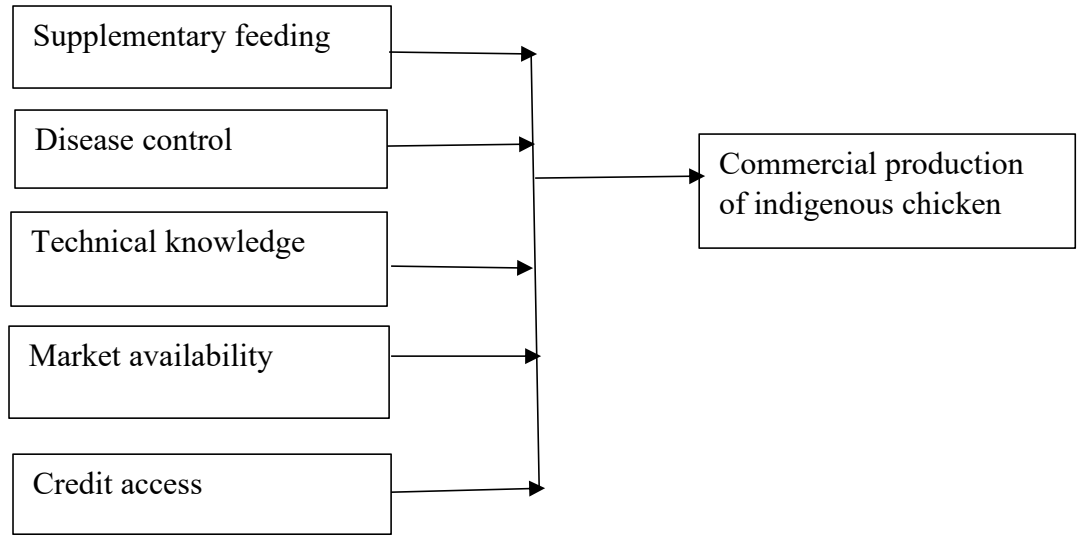
discovered that producers need access to finance in order to successfully participate in contract farming.

2.10 Conceptual Framework

Conceptual framework is a diagrammatic presentation of the study variables showing the association of the stated variables. Conceptual framework aids the researcher to quickly see the proposed relationship of the study variables.

Figure 2.1

Conceptual Framework

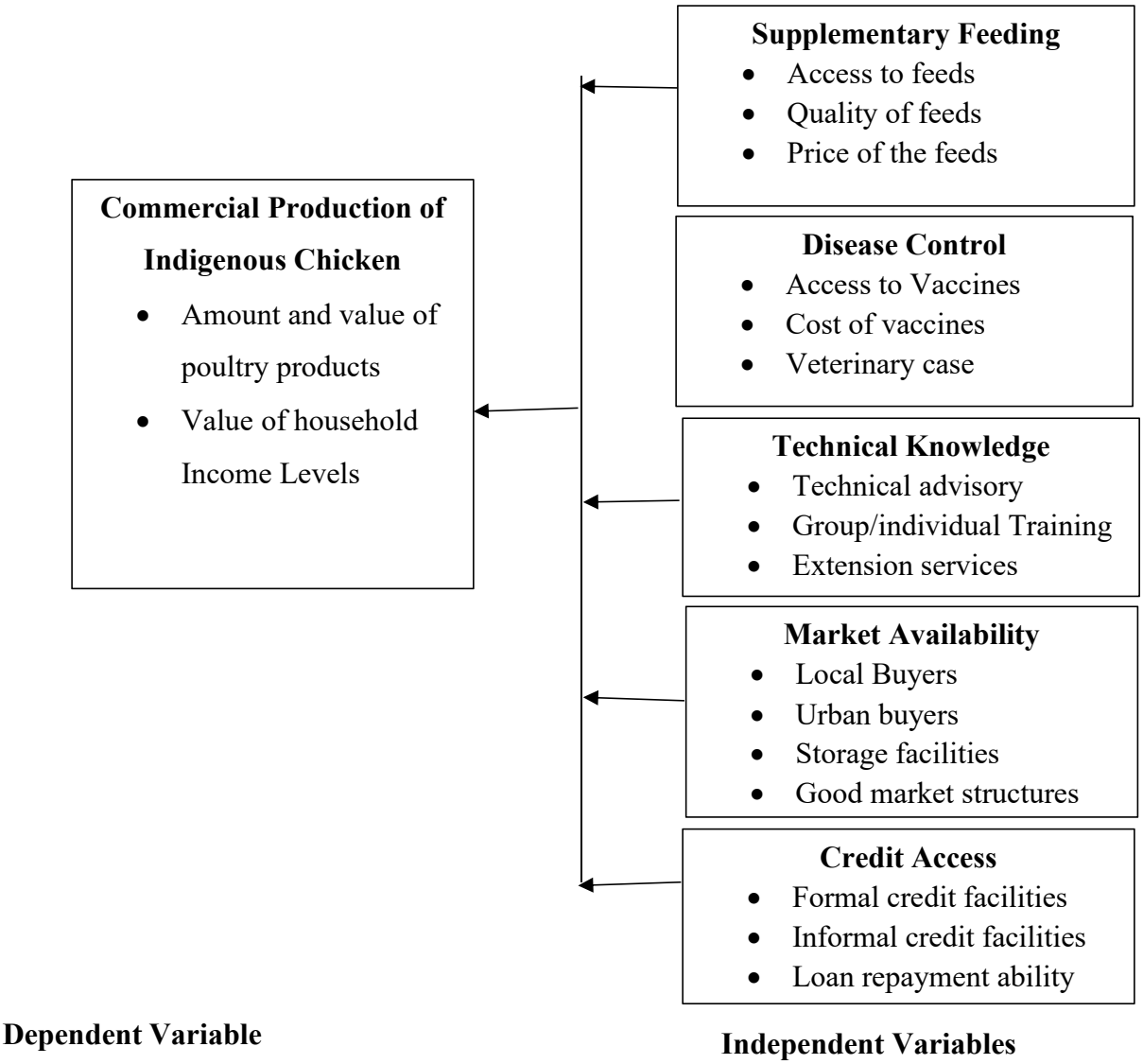


2.11 Operational Framework

The operational framework is depicted in Figure 2.2. It not only presents the variables under investigation but also illustrates the indicators associated with each variable.

Figure 2.2

Operational Framework



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The main objective of this chapter was to present an overview of the study's design and its execution.

3.2 Philosophy of the Research

The study's philosophical foundation was positivist. Positivism presupposes that knowledge is factual and does not consider subjective variables, and that reality is continuous and can be defined and explained objectively without affecting the events under investigation. Saunders et al. (2013) claim that a positivist worldview supports a quantitative research strategy based on the presumption that objective reality can be characterized in numerical form with predictive and explanatory significance. The study employed objective data collection and analysis to process primary data in order to provide findings that could be used to assess and respond to study hypotheses, which was why this philosophy was chosen. The goal of the study was to gather factual data that was used to investigate any probable relationships between the specified components as well as the strength of that link. According to the study, objective reality could be expressed numerically with predictive and explanatory capacity, laying the groundwork for positivist philosophy (Begeç & Arun, 2021).

3.3 Study Area

Kenya's North-Eastern region includes Mandera County. Ethiopia and Somalia are its neighbors to the North and East, respectively. The area is about 26,474 km^2 in the County. Average annual rainfall is only 255mm, and it is sporadic and unreliable. Due to the high average temperature of 30 degrees Celsius, neither food production

nor cash crops can be grown on the huge tracts of land. The study area has few irrigation systems, despite the fact that the poorest agro-climatic zones, as determined by rainfall and soil characteristics, experience the highest levels of food insecurity. The region is made up of a wide plateau with some slender plains slicing through it. Due to the sands' porosity, the landscape is comparatively flat and has limited surface drainage.

3.4 Research Design

Cross-sectional descriptive survey design was used for the investigation. A descriptive study approach's main objective was to describe the current condition. Descriptive research, in accordance with Mugenda and Mugenda (2003) is the process of obtaining data to address questions regarding the current state of the study's subjects. The design of this study was acceptable because it ensured in-depth analysis and descriptions of the numerous variables under investigation. The study generated both quantitative and qualitative information. A behavior's current status could be investigated and described thanks to the design. Because it permitted the use of an organized survey as the research instrument, the design was thought to be adequate. Additionally, statistical data on the state of domestic poultry production was generated.

3.5 Target Population

According to Afroze and Rista (2022), a population is a collection of people, or things from which samples are taken for measurement. There were 6785 households in Mandera County who kept dual purpose poultry as at the time of study. Out the 6785 households, 5545 kept commercial indigenous poultry of which 3971 were based in Mandera North, Banissa and Mandera west sub counties. Therefore, the

3971 households which comprised of individuals and group farmers formed the study target population. The study also targeted the county agricultural extension and veterinary officers in Madera County as key informants.

3.6 Sample Size and Sampling Procedure

The sample is a collection of objects drawn from a population for analysis. Every item in the overall population must have an equal probability of being chosen for the sample; hence this selection must be done in that fashion. The study adopted a simple random sampling procedure to identify the respondents. This was informed by the fact that the random sampling procedure ensured that representativeness was attained and bias was reduced. Then, the simplified universal formula given by Yamane (1967) was used to produce a sample size with a 95% confidence interval that is at 5% precision level. The following formula was used, thus;

$$n = \frac{N}{1 + N(\mathrm{e})^2}$$

Where,

N = Population

n = Sample size

e = error term (level of precision)

Thus;

Giving,

$$n = \frac{3971}{1 + 3971(0.05)^2}$$

n = 363

From this population, a sample size of 363 households was selected. The study also purposively selected households which kept over 100 birds on commercial basis (mostly for sale of eggs and chicken for meat) and used some form of commercial or supplementary feeding. This was done through referencing by government officers in

the sub-counties, the administration like assistant chiefs and fellow farmers to identify the specific households. The County extension officers in charge of animal production and veterinary care were included in the study purposefully as they were deemed to have valuable knowledge on extension services offered to the poultry farmers in the county.

3.7 Research Instruments

In this study, primary data was gathered. Primary data is information a researcher gathers directly from the field, i.e., from the participants in the sample they have chosen. The study utilized structured questionnaires, interview schedules and focus group discussion guides to gather both quantitative and qualitative data. A questionnaire is a tool for data collection and measurement. In the study, a questionnaire was utilized to collect data from a specific group or category of respondent's especially commercial indigenous poultry producers. Interview guide is a structured tool used to facilitate and guide the process of conducting interviews with participants or subjects. It is a document that outlines the key questions, topics, and prompts that the interviewer should cover during the interview. The guide helps ensure consistency across interviews, helps the interviewer to stay focused on the research objectives, and ensures that relevant information is gathered from participants. The questions in the interview guide are typically designed to elicit specific information, insights, or experiences from the interviewee, and may be open-ended or follow a predefined format, depending on the research goals and methodology.

A popular qualitative research technique in the social sciences and market research is the focus group discussion (FGD). It entails gathering a small group of people

usually between six and twelve to talk about a particular subject or research question in a controlled, supported environment. A focus group discussion (FGD) aims to collect a range of viewpoints, thoughts, and views from participants in order to produce comprehensive qualitative data that may be utilized to investigate attitudes, beliefs, preferences, and experiences.

3.7.1 Questionnaires

The study made use of the questionnaires to gather primary information from the sampled households. The questionnaires were structured and guided by the study specific objectives, and were made of several sections where; section A contained questions about respondent's demographic characteristics, section B contained statements on supplementary feeding, section C was on diseases control, section D was on technical knowledge, section E was on market availability, section F on credit access and section G on factors describing effects of indigenous commercial poultry production on farmers (dependent variable).

A respondent was required to provide a response to structured statements in the questionnaire. The statements were used to gather personal data about the households, including information about the marketing channel, availability and affordability of supplementary feeding, the reasons people kept chicken, the cost of chicken and chicken products, the locations where people sold their animals, the difficulties they encountered when doing so, and their opinions and suggestions about what should be done to ensure effective marketing of chicken. Because they made it possible to compare a single person's score with the distribution of values from a well-defined sample, Likert scales were chosen as the measurement scale. Most of the statements in the questionnaire were closed-ended.

3.7.2 Interview schedule

The study conducted interview with the county agricultural extension officers in terms of animal production and veterinary services. Interview schedules were deemed useful in this study because they ensured that each participant was asked the same set of questions in the same order. This standardization helped in reducing bias and ensured consistent qualitative data collection. Further, the structured nature of an interview schedule allowed the interviewer to maintain control over the interview process. It helped in keeping the interview on track, ensuring that all relevant topics were covered.

3.7.3 Focus Group Discussion

In addition to the primary data that was gathered from the homes, in-depth focus group talks were carried out to solicit general information regarding the farmers who were keeping indigenous commercial poultry as groups and other issues pertaining to the chicken industry in general. These farmers were part of the initial target population though they were considered for focus group discussion for they had formed self-help groups and shared information and experiences as a group. To identify obstacles to indigenous poultry farming, discussions were deemed very fruitful to the study.

3.8 Pilot Study

The validity of the data gathering tools was examined in a pilot study. To assess the validity of the questionnaires, 36 randomly chosen households in Mandera County were used for pre-testing. These respondents were excluded from the actual study. A pilot survey aims to preemptively solve some of the issues that the main survey is expected to experience (Kohls, 2002). This involved reviewing feedback from respondents during the pilot survey, as well as conducting interviews or focus group

discussions to gather in-depth insights into the clarity, relevance, and comprehensiveness of the questionnaire items. Qualitative data allowed for the identification of any ambiguous or confusing questions, as well as the exploration of additional themes or factors that may need to be included in the final survey instrument. The tests conducted during the pilot study provided valuable feedback on the effectiveness of the data gathering tools. The combination of quantitative and qualitative approaches allowed for a comprehensive assessment of validity, ensuring that the questionnaires accurately measured the intended constructs and were suitable for use in the main survey. The supervisors also checked the content of the question and rectified to capture the data able to achieve the study objectives. Any identified issues or areas for improvement were addressed before the commencement of the full-scale data collection, enhancing the reliability and validity of the research findings.

3.9 Validity of the Research Instruments

Validity can be defined as how closely research findings correspond to the real or physical world. Trustworthiness and credibility are indicators of a qualitative data set's validity or integrity. Triangulation, submitting questions to a committee of experts, preliminary testing of the tool, comparing findings to the writing, training assistants, guaranteeing respondent confidentiality, and maintaining a thorough record of design and methodology were all used to ensure the validity of the questionnaires. Based on this, it was found that the research instruments were valid.

3.10 Reliability of the Research Instruments

Cronbach's Coefficient Alpha was used to evaluate the instruments' dependability. The range of the Cranbach alpha coefficient is 0 to 1. A reliability rating of 0.7 to 1 is the acceptable alpha coefficient for an instrument to be considered very reliable. A reliability value of 0.80 or higher indicates that the data is highly reliable and that the items correlate strongly with one another (Mugenda & Mugenda, 2003).

3.11 Data Collection Procedure

The researcher collected data by addressing the relevant respondents using the necessary tools and procedures described above after obtaining a letter of consent from Kenya Methodist University and a research license from the National Commission on Science, Technology, and Innovation (NACOSTI). A research assistant was trained on how to administer the questionnaire before the data collection exercise. The drop-and-pick approach of administering the data gathering instrument was carried out with the help of the research assistant. The researcher also booked for an appointment with the county extension officers in charge of animal production and veterinary care for an interview in their offices and focus group discussions were conducted on the poultry farmers who had group dynamics like group chicken rearing or sharing of information and experiences during their weekly meeting at their farms. These group projects were mostly initiated under Uwezo Fund through self-help group.

3.12 Data Analysis

From the returned questionnaires, data were coded, uploaded into an excel spreadsheet, and then subjected to Statistical Package for Social Sciences (SPSS)

analysis. Before analysis, the data was examined for consistency and completeness. To describe the results, descriptive and inferential statistics were utilized. With the help of a few indices or statistics, descriptive statistics were designed to help researchers meaningfully characterize the distribution of scores or measures. The findings were displayed in tables. To examine the influence of the independent variables on the dependent variable, multivariate regression was carried out. In multivariate regression, the following model was used;

$Y= ß_0 + ß_1X_1+ ß_2X_2 + ß_3X_3+ ß_4X_4+ ß_5X_5 + Ɛ$

Where;

Y-Commercial indigenous poultry productivity

$ß_0$ –y-intercept or the constant; $ß_1$– $ß_5$ –regression coefficients

X_1 – Effect of Poultry feeding

X_2 - Effects of disease control on commercial indigenous chicken production

X_3–Effects of technical knowledge by farmers

X_4- Effects of market availability and market infrastructure

X_5- Effects of credit availability

Ɛ-error term

Further, Correlation analysis was done from the findings of the multiple regression analysis to establish magnitude and effects of the independent variables on the dependent variable.

3.13 Ethical Considerations

Before gathering data, the respondents' willing and clear consent to participate in the study was requested. They were also informed and made clear that the study was solely done for academic purposes. The respondents received a guarantee that the

information they provided would be kept private. This was done during the visit to their residences. Prior to conducting interviews, the researcher scheduled sessions with the County extension officers at Mandera County. The researcher clearly disclosed that the study exercise was purely voluntary and the participants were free to withdraw at any stage without notice.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter shows the outcomes of the data analysis and discusses them in light of the study's goals. The findings are presented in Tables and descriptive statistics used to discuss them. Results of multivariate analysis and hypotheses testing are discussed. Correlation analysis is presented and interpretation made. Results of qualitative analysis are also presented.

4.2 Response Rate

The numbers of the respondents targeted were three hundred and sixty-three (363) who were sampled and given the questionnaires in the three identified sub-counties. Table 4.1 shows the response rate.

Table 4.1

Response Rate

Sub County	Sampled Number	Responses (X)	Percentage (X/Sampled)	Overall Percentage (X/344)
Mandera North	193	188	97.4	54.65
Banissa	92	85	92.4	24.71
Mandera West	78	71	91.0	20.64
Aggregate	363	344	94.8	100%

The study recorded a response rate of 94.8% where, out of 363 respondents, 344 completely filled and returned the questionnaires. This response rate was sufficient for reporting the findings. The high response rate was due to high mobilization. Texts messages were sent to remind the participants to undertake the research. The

researcher also explained areas that were challenging to the participants. The participants were also encouraged through text messages to seek clarification where they did not understand.

4.3 Reliability Results

Reliability was tested using Cranbach's alpha coefficient where excellent coefficient was taken as 0.7 or above. Table 4.2 displays the findings of the constructs employed to characterize each of the dependent variables.

Table 4.2

Reliability Results

Constructs	Alpha Score	No. of Items	Comments
Poultry Production	0.765	5	Accepted
Poultry Feeding	0.754	6	Accepted
Disease Control	0.744	6	Accepted
Technical Knowledge	0.757	7	Accepted
Market Availability	0.799	6	Accepted
Credit Availability	0.801	6	Accepted

The researcher was able to characterize the results and make inferences about the study variables using the research instruments because the Cronbach Alpha scores were more than 0.7.

4.4 Demographic Characteristics

The purpose of the study was to look into the respondents' backgrounds. This data included the person's gender, the length of time they had been in the poultry business, age, marital status, and the highest level of education achieved.

4.4.1 Gender of the Respondents

The finding on gender disaggregation of respondents is presented in Table 4.3.

Table 4.3

Respondents Gender

		Frequency	Percent
Valid	Male	151	43.9
	Female	193	56.1
	Total	344	100.0

According to Table 4.3, women made up the majority of respondents (56.1%) while men made up 43.9%. Due to the fact that women are traditionally expected to manage domestic-related tasks and businesses, religion and custom may be the source of the study area's slightly greater female to male ratio. The gender imbalance in commercial poultry keeping may also mean that increased production is anticipated because women tend to be more labor-efficient in the area. In the community under study, gender roles have a cultural component.

4.4.2 Education Level

The study also aimed to determine the respondents' highest level of education. Table 4.4 provides the findings.

Table 4.4

Education Level

		Frequency	Percent
Valid	Primary Level	244	70.9
	Secondary Level	72	20.9
	Tertiary Level	28	8.2
	Total	344	100.0

The findings indicate that 20.9% of respondents had secondary school level of education, 8.2% had tertiary education while the majority at 70.9% had primary school level of education. This demonstrates that the vast majority of respondents were semi-illiterate.

4.4.3 Current Marital Status

Marital status of the respondents was also sought. Table 4.5 represents the findings.

Table 4.5

Current Marital Status

	Frequency	Percent
Married	151	43.9
Widowed	82	23.8
Divorced	46	13.5
Single parent	28	8.2
Never married	37	10.7
Total	344	100.0

The findings showed that 43.9% of respondents were married, 23.8% were widowed, 13.5% were divorced, 8.2% were single parents, and 10.7% had never been married. The findings suggested that most of the respondents in the study were married, and as a result, the husband and wife in the household were mostly responsible for making decisions about chicken farming.

4.4.4 Age Brackets

The study sought to establish age disaggregation of respondents in terms of range of ages. The findings are presented in Table 4.6.

Table 4.6

Age of the Respondents

		Frequency	Percent
Valid	Below 30 years	90	26.2
	31 to 40 years	63	18.4
	41 to 50 years	147	42.6
	Above 50 years	44	12.7
	Total	344	100.0

According to Table 4.6, 26.2% of respondents were under the age of 30 years, 18.4% were between the ages of 31 and 40, 42.6% were between the ages of 41 and 50, and 12.5% were age 50 or above. This demonstrates that the bulk of respondents fell between the 41–50 age bracket. The implication of this finding is that the majority of poultry farmers were middle-aged, within the economic productive age, and able to take risks in the hope of making a profit. They may have also had previous agricultural experience and tried poultry farming on a small scale before moving on to commercial production.

4.5 Descriptive Statistics Results

The findings were discussed under each objective, interview and focus group discussion results. The study utilized two main indicators; the mean score and standard deviation. The mean scores ranged from 1 to 5 corresponding to the 5 scores on the Likert Scale. With; 0-1.00 strongly disagree, 2 to 2.6 disagree, close to 3 moderate/neutral and close to 4 agree, and a score 4.5-5.00 strongly agree.

4.5.1. Poultry Feeding

The study sought to establish the level of commercial poultry feeding in Mandera County. The finding are presented in Table 4.7.

Table 4.7

Supplementary Feeding

	SD F,%	D F,%	M F,%	A F,%	SA F,%	Mean	Std. Dev
In our local town we can access the commercial supplement poultry feeds	234 68%	75 22%	7 2%	10 3%	18 5%	2.06	1.15
There are variety of commercial poultry feeds in the local markets	193 56%	62 18%	34 10%	34 10%	21 6%	2.15	1.17
The poultry commercial feeds are sold at affordable prices	189 55%	55 16%	31 9%	48 14%	21 6%	2.17	1.20
The distance from the farm to the feeds access point is close	158 46%	76 22%	55 16%	21 6%	34 10%	2.15	1.19
The poultry feeds available in the local market are of the good quality	210 61%	52 15%	52 15%	14 4%	16 5%	2.11	1.17
Aggregate Score						2.13	1.18

The finding presented in Table 4.7 indicates that the aggregate mean was 2.13 and aggregate standard deviation was 1.18. The mean corresponds to “disagree” in the Likert scale and the standard deviation with a value of less than 2 indicates that there was low variation in responses from the mean. The results imply that most farmers could not access commercial supplementary poultry feeds in the local town (M=2.06, SD=1.15). Additionally, the study indicated that variety of commercial poultry feeds were not available in the local markets (M=2.15, SD=1.20), the poultry commercial feeds were not sold at affordable prices (M =2.17, SD =1.20), and the distance from the farm to the poultry access point was not close (M=2.15, SD =1.19). Moreover, the study results in Table 4.7 indicated that poultry feeds available in the local market were not of the good quality (M=2.11, SD =1.17).

The results from the majority of the officers interviewed indicated that poultry feeds accessibility in the local town was very low and that the few varieties available were

either of low quality or sold at affordably prices. They indicated that some of commonly available local commercial poultry feeds were crumble and pellet form. The majority in the interview agreed that commercial feeds were important for egg production and quality of meat but the majority of the farmers had shifted to locally or homemade feeds which were cheaper though ineffective. The majority of the respondents argued that despite most of the farmers being enthusiastic at increasing the number of indigenous commercial poultry keeping, the level of production had remained low or constant. They indicated that there was need for both county and national government to improve on accessibility and prices of the poultry feeds in Mandera County. All the respondents interviewed agreed that the poultry feeding was key to their commercial production and that they were ready to partner with various suppliers in ensuring accessibility and stable prices of feeds. Extension agents stated that feed millers should utilize local feed components rather than importing, confirming that feed cost was dependent on the cost of the ingredients while the choice of feed ingredients was dependent on the formulation's goals. Sourcing of feed components locally would also encourage farmers to venture into production of the crops and diversify their food and income security. Feeding program had experienced huge problems characterized by scavenging for feed, limited bio-security, and high death rates (Agriculture Extension Officers, Mandera County, 2023).

The study results were supported by Kariuki et al. (2022) that the production strategy used in a specific region or farm often relied on the breeds retained as well as the resources and technology available. Kariuki et al. (2022) further found that, in a typical intensive production system, more than or equal to ten thousand birds were

housed inside with a medium to high degree of biosecurity. Further, Magothe et al. (2012) posited that poultry production was entirely market-driven to meet the high demand for chicken in large cities, with feed, dwellings, health, and an advanced management structure being characterized by a better degree of productivity. It was also evident that the bulk of small-scale chicken farms were located close to towns and markets, had limited biosecurity, and required only moderate expenditures for feed, water, and veterinarians.

4.5.2. Disease Control

The study sought to establish the disease control measures and its effects on poultry production. The results were presented in Table 4.8. The study results presented in Table 4.8 indicates that the aggregate mean was 2.11 and aggregate standard deviation was 1.18. The mean corresponds to "disagree" in the Likert scale and the standard deviation with a value of less than 2 indicates that there was low variation in responses from the mean. The statements on disease control clearly indicated that vaccines and drug accessibility was low, vaccines variety low and affordably while drugs prices were high and veterinary care was rarely available in Mandera County, Kenya. The interview results supported the fact that officers in the Mandera County do not support farmers to access vaccines in the market.

One respondent said *"here we do not get any veterinary care and even if we needed some, we have to go to town further away from here and many times we find the veterinary officers out of their offices. We have learnt to survive on our own".*

Table 4.8

Disease Control

	SD F,%	D F,%	M F,%	A F,%	SA F,%	Mean	Std. Dev
We are able to access the poultry vaccines in the local market	203 59%	100 29%	10 3%	24 7%	7 2%	2.06	1.15
The vaccines are of different varieties for the farmers to choose	175 51%	55 16%	52 15%	34 10%	28 8%	2.11	1.18
The poultry vaccines are sold at affordable prices	172 50%	72 21%	24 7%	55 16%	21 6%	2.15	1.20
We are able to access the poultry drugs in the local market	151 44%	83 24%	41 12%	38 11%	31 9%	2.10	1.18
The price for each drug is affordable by the local poultry commercial farmers	189 55%	72 21%	34 10%	32 9%	17 5%	2.06	1.15
Veterinary care within the villages is readily available	168 49%	65 19%	62 18%	28 8%	21 6%	2.10	1.16
Aggregate Score						2.11	1.18

The majority of the County agriculture extension officers opined that accessing poultry vaccines and drugs in the county was hard and most large-scale farmers sourced most of their vaccines from Nairobi. The officers indicated that farmers in Mandera County continued to face fluctuating retail prices for vaccine which limited their ability to produce. The government continued to regulate vaccine and drug prices by issuing licenses to companies that made chicken drugs. One of the most significant infectious diseases affecting chickens and responsible for numerous deaths was the Newcastle disease. In addition, they claimed that the cost of medications on the local market was too high.

One county officer said "*here we rarely do administer vaccinations against diseases like Gumboro, Newcastle, and Infectious Bronchitis to all day-old chicks. Also, most of the farmers hatch their chicks from their homes leading to increased home production. When there is an outbreak, we usually find it hard to assist these farmers. However, there are a few farmers who buy day old indigenous chicks which are already vaccinated and hence they are likely to be more resistance to diseases".*

According to the study's findings, disease-related mortality had a negative influence on poultry output. Farmers who used at least two control actions, such as prevention and treatment, considerably lessened the effects of disease-related mortality on chicken. The chicken produced by poor people were especially susceptible to disease due to the cost, lack of, or inappropriateness of animal health and agricultural inputs (Blake et al., 2020). Animal diseases constituted a significant limitation in this. The three main ailments were Newcastle, chicken pox, and chicken typhoid. Inadequate operating funding, a lack of transportation and veterinary supplies, poor infrastructure, and a staffing shortfall had all conspired to hinder the delivery of veterinary services throughout Mandera County. Furthermore, Mutambo et al. (2015) discovered a high negative correlation between disease/predators and keeping poultry. Financial loss was also exacerbated by chicken parasite infestation. Endo- and ecto-parasites were said to have severely reduced chicken output in Tanzania (Rukambile et al., 2020).

4.5.3. Technical Knowledge

The study sought to establish the availability of technical knowledge in form of advisory services and its effects on poultry production. The results were presented in Table 4.9.

Table 4.9

Technical Knowledge

	SD F,%	D F,%	M F,%	A F,%	SA F,%	Mean	Std. Dev
We are able to access technical advisory services from national and county governments	203 59%	100 29%	10 3%	24 7%	7 2%	2.14	1.18
The technical training services are offered frequently in a year	175 51%	55 16%	52 15%	34 10%	28 8%	2.05	1.14
Technical training services offered by the governments are free/affordable	172 50%	72 21%	24 7%	55 16%	21 6%	2.06	1.15
The centres offering technical training services are within the reach of many farmers	151 44%	83 24%	41 12%	38 11%	31 9%	2.10	1.17
There is availability of commercial technical training services within our locality	189 55%	72 21%	34 10%	31 9%	18 5%	2.09	1.17
The commercial technical advisory services are relevant in that they train us on poultry husbandry, disease control, storage, marketing as well as business management	169 49%	65 19%	62 18%	27 8%	21 6%	2.11	1.17
Aggregate Score						2.09	1.16

According to the research results shown in Table 4.9, the overall mean was 2.09, and the overall standard deviation was 1.16. The standard deviation, which measures how widely responses varied from the mean, was less than 2, meaning low variability. The mean of 2.09 which corresponds to the Likert scale response "disagree" meant that respondents did not access technical advisory services easily. The farmers

indicated they were unable to access technical advisory services from national and county governments (M=2.14, SD=1.18). Technical training services were not offered frequently in a year (M=2.05, SD=1.14). Technical training services offered by the government were not affordable (M=2.06, SD=1.15). The centres offering technical training services were not within the reach of many farmers. There was availability of commercial technical training services within the locality. The commercial technical advisory services were not relevant in that they did not train on poultry husbandry, disease control, storage, marketing as well as business management.

The findings were supported by the opinion of interviewees that the prices of drugs were not affordable by the local poultry commercial farmers and technical advisory services to poultry farmers were not consistently given through-out the years. The officers opined that low financing and personnel levels hindered the generation and transmission of knowledge on livestock productivity and disease control methods to livestock producers throughout the years in Mandera County. Important poultry knowledge such as feeding, vaccine and setting prices was not well addressed. It was essential to educate farmers about animal health and nutrition in order to increase livestock output. The findings were supported by Okitoi et al. (2016) who reported that despite farmer's efforts, they continued to earn minimal wages resulting in substandard living conditions. Trainings on disease management, credit access, market infrastructure, and skills development were key to the growth of the indigenous poultry production. One officer said; *"Here, the technical services are not affordable, accessible, or available and the little training offered did not boost the productivity of poultry".* Another officer said that "*Here, farmers do not contact*

a veterinarian because they are too costly. Policy makers should develop laws to address livestock breeding and livestock disease prevention in order to protect farmers from the high cost of private practitioners"

4.5.4. Market Availability

Market availability is key in determining commercial production of chicken. This study aimed to determine how market availability influenced poultry production in Mandera County. Table 4.10 presents the study results. The results indicates that the aggregate mean was 2.46 and aggregate standard deviation was 1.15. The mean corresponds to "disagree" in the Likert scale and the standard deviation with a value of less than 2 indicates that there was low variation in responses from the mean. The evidently low mean for individual statement scores indicated that the majority of the respondents disagreed with the statements presented in Table 4.10. The result indicated that buyer availability in the local market within Mandera County was a big problem. The prices set according to the results, do not guarantee them profit from sale of indigenous chicken (M=2.13, SD=1.17), the poultry were rarely transported directly to the market from the farm (M=2.03, SD= 1.13).

One of the farmers in a group venture said that "*we have insufficient poultry storage facilities at our homes, storage facilities are also not available in the market and market is not available for all the poultry products"*

The interview results with the government officers indicated that they were unable to create markets for poultry farmers most of the time. The officers opined that the process of improving market access for the poultry products in Mandera County was a tedious activity that needed thorough stakeholders' engagement.

Table 4.10

Market Availability

	SD F,%	D F,%	M F,%	A F,%	SA F,%	Mean	Std. Dev
I have readily available buyers from the local markets	200 58%	103 30%	21 6%	14 4%	6 2%	2.07	1.17
I have readily available poultry buyers in urban areas	34 10%	48 14%	58 17%	179 52%	25 7%	3.49	1.16
I get good prices that result to profit from sale of indigenous chicken	175 51%	69 20%	45 13%	45 13%	10 3%	2.13	1.17
The poultry are transported directly to the market from the farm	159 46%	69 20%	48 14%	34 10%	34 10%	2.03	1.13
We have sufficient poultry storage facilities at our homes	172 50%	65 19%	38 11%	52 15%	17 5%	2.02	1.13
The poultry storage facilities are also available in the market and of good quality	237 69%	72 21%	17 5%	10 3%	8 2%	1.99	1.12
The market is available for all the poultry products and sizes	179 52%	62 18%	58 17%	10 3%	34 10%	2.05	1.15
Aggregate Score						2.46	1.15

However, they argued that they encouraged poultry farmers to form Savings and Credit Cooperative Societies (SACCOs) or community groups which would help them easily access government and non-government services. Theft was cited by farmers as one of the most significant obstacles to commercial indigenous chicken production although it was not a variable in this study. Due to inadequate farm buildings, it resulted in the loss of adult indigenous fowl at the selling stage as well as eggs through stealing. The officers indicated that the farmers had experienced security challenges, poor transport system, insufficient capital and low literacy levels

in their bid to expand their market. It was evident that most farmers who raised indigenous poultry lacked or had poorly constructed housing for their chicken.

The study results corroborated the findings of Adoligbe et al. (2020) that trainings on indigenous poultry management methods, illness and cock management had a substantial impact on indigenous poultry output. According to the study, farmers who did not have poultry houses had been at risk of losing their flocks to thieves and incurring losses because they had small flocks and households, lacked building supplies, and were unaware of the importance of real estate hens (Kugonza et al., 2008). The basic requirements for housing chickens were enough space, appropriate airflow, sufficient illumination, and protection (from the elements and predators), and these had to be supplied in the design of poultry houses. It was evident that constructing adequate housing for indigenous chicken aided in reducing theft (Kugonza et al., 2008). one of the officers said that "*here the market prices for poultry products in the local market is too low and the majority of the farmers are forced to transport their produce to buyers at the local markets, and have readily moderately available poultry buyers in urban areas"*

4.5.5. Credit Access

Credit access is critical to any business enterprise all over the world. The study aimed to determine how access to loans by farmers influenced their businesses and commercial indigenous poultry production. The results were submitted in Table 4.11.

Table 4.11

Credit Access

	SD F,%	D F,%	M F,%	A F,%	SA F,%	Mean	Std. Dev
I can easily access formal and informal credit facilities	213 62%	89 26%	34 10%	4 1%	4 1%	2.14	1.20
I can easily access informal credit facilities from local lenders	197 57%	58 17%	55 16%	10 3%	24 7%	2.09	1.19
The credit available is sufficient for investments in farm infrastructure	193 56%	52 15%	65 19%	17 5%	17 5%	2.14	1.20
The informal sources of funds are mostly affordable to most poultry keepers	200 58%	41 12%	52 15%	17 5%	34 10%	2.09	1.19
Most indigenous poultry keepers are able to repay their loans in time hence smooth flow of credit	203 59%	63 18%	34 10%	34 10%	10 3%	2.09	1.18
Aggregate Score						2.11	1.19

The results on credit access as shown in the Table 4.11 indicates that the majority of the respondents disagreed with the statements presented relating to access of credit as represented by a low mean of 2.11 and a low Std Dev. of 1.19. Additionally, the results indicated that farmers in Mandera were not able to easily access formal and informal credit facilities (M=2.14, SD=1.20). Further, the results indicated that the formal credit facilities were not affordable, accessible or sufficient for investments in farm infrastructure to the majority of the farmers. The informal sources of funds were also mostly not affordable to most poultry keepers who were not able to repay their small loans accessed on time. These findings were supported by low means of 2.09, 2.14, 2.09 and 2.09 on the constructs for these variables corresponding to “disagree” in the Likert scale.

The government officers opined that the more the farmer produced the more the credit would be available to them. This was due to the fact that having access to credit made it possible to fund the purchase of feed, adding of more birds, and extension of farmland, all of which improved production. They argued that due to poor infrastructural development and increased conditions for access to credit, the farmers were not able to access formal finances with ease. Some ended up accessing funds from Village Savings and Loan Association (VSLAs) and shylocks whose interests and penalties were huge. Since 2006, the Youth Enterprise Development Fund (YEDF) in Kenya had provided financial services to adolescents in the poultry sector as part of the government's goal to generate job opportunities for youth. One of the officers said that "*the Youth Enterprise and Women Enterprise funds would spur growth of the Small and Medium Enterprises (SMEs) in the county but the funds are not sufficient to support all the businesses hence poultry farmers were disadvantaged in access"*

Another officer alluded that "*here, there is a trend of an increasing proportion of women running households, in several sub counties in Mandera, with the tendency being accelerated by males leaving for urban areas and other countries in search of better paying jobs and leaving women to fend for themselves and their children".* Yet another officer said *"Women are left to shoulder the responsibility of supporting their families, and they are severely handicapped not just by lack of money but also by laws and societal structures that do not grant them an autonomous status".* He added that *"Women are not permitted to rent, purchase, or sell the small plots of land that they use to grow food or keep poultry for their family. They lack access to financing, which prevents them from purchasing farm equipment"*

The findings were supported by Mango et al. (2018) in that availability of financing had been recognized as the most essential resource for the development of any enterprise. Sogunle et al. (2022) found that farm revenue, feed costs, and the number of birds impacted the loan use of farmers. Feed cost subsidies, the use of family labor, and the supply of loans with free or low interest rates should be advanced to Small and Medium Enterprises preferably from a government source. The study was further supported by the findings of Okitoi et al. (2016) that access to financing had an impact on how the indigenous poultry value chain developed. In their study on the impact of contract farming on the income of small-holder poultry farmers in Kenya, Wainaina (2017) found that farmers needed access to finance in order to successfully participate in contract farming. According to Odek and Okoth (2019), there was no discernible impact of the Youth Enterprise Development Fund (YEDF) on the expansion of young companies in Kenya. However, further analysis by Makani (2015) realized a favorable impact on firm expansion, revenue growth, turnover, and employment creation.

4.5.6. Indigenous Poultry Production in Mandera County

The study sought to determine the level of poultry production in Mandera County. The results were presented in Table 4.12.

Table 4.12

Indigenous Poultry Production

	SD	D	M	A	SA	Mean	Std.Dev
We produce high quality poultry meat	34 10%	55 16%	203 59%	38 11%	14 4%	3.09	1.19
Our poultry and poultry products are readily acceptable in the local markets	24 7%	93 27%	193 56%	24 7%	10 3%	3.09	1.18
The prices we charge are affordable to all the markets in the county and beyond hence increasing demand for our products.	7 2%	17 5%	224 65%	86 25%	10 3%	3.10	1.20
We have managed to generate constant and high income from indigenous poultry production through-out the years	14 4%	62 18%	203 59%	31 9%	34 10%	3.11	1.18
The poultry production has really positively impacted on the farmers livelihoods	7 2%	34 10%	224 65%	38 11%	41 12%	3.09	1.17
Aggregate Score						3.10	1.18

The study results presented in Table 4.12 indicates that the aggregate mean was 3.10 and aggregate standard deviation was 1.18. The mean corresponds to “moderate” in the Likert scale and the standard deviation with a value of less than 2 indicates that there was low variation in responses from the mean. The study results further indicated that the poultry meat was of medium quality (M=3.09, SD=1.19). The poultry and poultry products were moderately available in the local markets (M=3.09, SD=1.18). The prices which Mandera farmers charged were moderately affordable to the markets in the county (M=3.10, SD=1.20). The farmers had managed to generate constant and moderate income from indigenous poultry production through-out the years (Mean=3.11, SD=1.18). The poultry production had moderately impacted on farmer’s livelihoods positively (Mean=3.09, SD=1.17). The results implied that the

indigenous poultry production systems in Mandera County either in form of small semi- or fully scavenging household poultry or slightly larger, more intensive units had developed to support livelihood for the rural poor. However, the 'moderate' nature of responses meant that more could be done, more could be achieved, and livelihoods would be made better if constraining factors to commercial indigenous poultry production were addressed by relevant authorities. One Officer said that "*here, the community has become more aware of the significance of commercial chicken farming in expediting poverty reduction and reaching the poorest of the poor"* The second officer said that "*there is mounting evidence that small-scale chicken production improved the food and nutrition security of the poorest families and promoted gender equality"* A third officer interviewed said that "*to some of the locals in Mandera county, chicken farming was the main system of poultry production and crucial source of revenue and nourishment for disadvantaged people"* The results were supported by Attia et al. (2022) that the fraction of the overall chicken population that consists of birds raised under small-scale family production methods in several African nations improved the livelihood of the citizens. In Ethiopia, almost all chickens (99%) were indigenous, although in other nations, native chicken made for at least 70% of the entire chicken population (Bushra et al., 2019). Royal Tropical Institute (KIT) and International Institute for Rural Reconstruction (IIRR, 2008) argued that expanding the indigenous chicken value chain enhanced the standard of living of Africans. Further, Mottet and Tempio (2017) argued that poultry keeping contributed significantly to family food security in developing countries. It offered an alternate source of income, high-quality food,

energy, and manure to more than 80 percent of rural families and was a valuable asset (Arbani et al., 2022).

4.6 Qualitative Analysis Results

The researcher collected qualitative data through focus group discussions and interview schedules. The groups were coded as FGD1, FGD2 and FGD3 representing the three sub counties targeted in the study (Mandera North, Banissa and Mandera West sub counties respectively). The study results were collected from group of producers and traders who were registered as self-help groups in Mandera County. All the three self-help groups conducted had been in operation for more than 6 years and therefore had the relevant information which helped the research achieve its target.

The focus group; FGD1, FGD2 and FGD3, existed to help farmers in production and trade related to poultry keeping. It was established from the FGD's that the group leadership was arrived at through secret ballot voting where members were allowed to elect their leaders freely. The members in the group agreed that being a member of a certain group had helped them to source for farm inputs at subsidized prices, being able to negotiate for prices in the urban market, sharing on the cost of transporting their produce, being able to learn from each other and most importantly, to penetrate in the market easily. The three groups visited had similar objectives and their operations were not unique. However, different sub-counties/ groups had different challenges. The sub counties located in the outskirts of Mandera East where the county offices were located enjoyed better transport system, security and training services. The FGD3 had experienced huge challenges relating to theft, poor transport system and communication system. One of the leaders in the Mandera North region

said that they only relied on one bus from Moyale which was available once a day to transport goods to Mandera East and Nairobi County. The cost of transport and the risk of transporting eggs and chicken using buses and Lorries were huge. Many of the FGD leaders said that loses experienced when transporting their produce were unimaginable. They suggested that roads be improved significantly to attract many transport investors in the county which could ease the cost of transporting goods and services. A member said that "*the roads are impassable especially during the rainy season; the rains washed a huge section of the road this season"*

Many of the members in the FGD indicated that being a member of a certain group led to challenges relating to meeting the standards set by group members such as prices, quality of eggs and the weight of the chicken. The three groups FGD1, FGD2 and FGD3 intervened by lobbying the county government and other well-wishers to handle their transport system, security and marketing problems. The groups had tried to lobby for training services, feeds, feeding and security systems from the county government. However, they concurred that they had benefitted from subsidized poultry feeds and poultry vaccines from NGOs and County government sometimes but the prices set for the poultry feeds and vaccines were still unaffordable by many farmers.

The group leaders argued that they focused on creating harmony between the county government and non-government organizations in ensuring that farmers accessed market with ease. The leaders and members of the various groups suggested increased engagement through seminars and workshops to increase their skills and knowledge on handling their animals. Government should provide subsidies to poultry producers for their inputs to lower the high cost of inputs. The government

would also explore ways of establishing a feed manufacturing plant in the locality or assist private developers to do so. Group members suggested that farmers should also be encouraged to establish cooperative societies so they could pool their resources and take care of themselves. The groups indicated that trainings on indigenous poultry management practices and disease management should be a major focus from the government and non-governmental organizations.

4.7 Inferential Analysis

4.7.1 Correlations

Correlation analysis presented the association between variables used in the study. The results were presented in Table 4.13. The correlation results in Table 4.13 were based on Pearson's correlation coefficient that ranged from -1 to +1. The correlation value of -1 indicates perfect negative correlation and +1 indicates perfect positive correlations while a value 0 indicated no correlation at all.

Table 4.13

Correlations

		Supplementary Feeding	Disease Control	Technical Knowledge	Market Availability	Credit Availability	Poultry Production
Supplementary Feeding	Pearson Correlation	1					
	Sig. (2-tailed)						
	N	344					
Disease Control	Pearson Correlation	.273	1				
	Sig. (2-tailed)	.502					
	N	344	344				
Technical Knowledge	Pearson Correlation	.555	.509	1			
	Sig. (2-tailed)	.600	.500				
	N	344	344	344			
Market Availability	Pearson Correlation	.203	-.074	.397tw	1		
	Sig. (2-tailed)	.201	.253	.400			
	N	344	344	344	344		

Credit Availability	Pearson Correlation	-.116	-.008	.071	-.089	1	
	Sig. (2-tailed)	.170	.895	.270	.167		
	N	344	344	344	344	344	
Poultry Production	Pearson Correlation	.584**	.612**	.827**	.661**	.796**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	344	344	344	344	344	344

**. Correlation is significant at the 0.01 level (2-tailed).

The correlation coefficients in Table 4.13 provide insights into the relationships between independent variables (supplementary feeding, disease control, technical knowledge, market availability, and credit availability) and the dependent variable (poultry production). Firstly, the correlation between supplementary feeding and poultry production is notably strong (Pearson Correlation = 0.584, $p < 0.01$), suggesting that increased supplementary feeding tends to lead to higher levels of poultry production. This implies that ensuring adequate feeding practices positively impacted poultry production outcomes. Secondly, disease control also shows a strong positive correlation with poultry production (Pearson Correlation = 0.612, $p < 0.01$), indicating that effective disease control measures are associated with increased poultry production. This highlights the importance of implementing strategies to mitigate disease risks in poultry farming. Thirdly, technical knowledge demonstrates the strongest positive correlation with poultry production (Pearson Correlation = 0.827, $p < 0.01$), indicating that a higher level of technical knowledge in poultry farming is strongly linked to greater poultry production. This underscores the significance of expertise and skill in optimizing production outcomes. Additionally, market availability exhibits a moderate positive correlation with poultry production (Pearson Correlation = 0.661, $p < 0.01$), suggesting that better market access contributes to higher levels of poultry production. Credit availability shows a high positive correlation with poultry production (Pearson Correlation = 0.796, $p < 0.01$), implying that improved access to credit facilities can positively influence poultry

production. Overall, these findings highlight the multifaceted nature of factors influencing poultry production, emphasizing the importance of addressing various aspects such as feeding practices, disease control, technical knowledge, market access, and credit availability to optimize production outcomes in poultry farming.

Analysis of the correlations indicates several noteworthy patterns. For instance, there exists a positive correlation between supplementary feeding, disease control, technical knowledge, market availability, with poultry production, suggesting that higher levels of the independent variables tended to coincide with higher levels of poultry production. Similarly, technical knowledge exhibited positive correlations with all other variables, indicating its broad association with the examined factors. However, the interrelationship amongst the independent variables were not significant at 5% significance level and therefore changes in any of the independent variables could not influence the changes of the other independent variables at 95% confidence interval.

4.8 Regressions Analysis

Regression analysis was done to understand the linear relationship between variables. The interpretation of the results was based on regression coefficients, coefficient of determination, ANOVA, and model summaries. The results were presented in Table 4.14, Table 4.15 and Table 4.16.

Table 4.14

Model Summary

Model	R	R Square	Adjusted Square	RStd. Error of the Estimate
1	.971[a]	.942	.941	2.81585

a. Predictors: (Constant), Credit Availability, Disease Control, Market Availability, supplementary Feeding, Technical Knowledge

The results in Table 4.14 indicated that there was a strong correlation between the factors considered (credit availability, disease control, market availability, poultry feeding, technical knowledge) and poultry production (adjusted R^2 = 0.941). This implied that 94.1 percentage changes in poultry production would be explained by credit availability, disease control, and market availability, poultry feeding and technical knowledge. Analysis of variance results are presented in Table 4.15.

Table 4.15

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	41706.071	4	10426.518	736.785	.000[b]
	Residual	4797.313	339	14.151		
	Total	46503.384	343			

a. Dependent Variable: Poultry Production

b. Predictors: (Constant), supplementary feeding, Credit Availability, Disease Control, Market Availability, Technical Knowledge

The results of the ANOVA reveal an F calculated value of 736.785, while F critical was 2.76, at a 5% level of significance. Since F computed was greater than F critical, it meant that the full regression model was significant in predicting the correlation between the research variables. According to the P value of 0.000, which was less

than 0.05, the research's predictor factors had a statistically significant impact on the output of poultry. Table 4.16 shows the overall model summary.

Table 4.16

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.091	1.296		5.469	.000
	Supplementary Feeding	1.108	.074	.287	14.973	.000
	Disease Control	1.006	.053	.370	18.988	.000
	Technical Knowledge	1.130	.076	.361	14.833	.000
	Market Availability	.700	.058	.224	12.161	.000
	Credit Availability	1.201	.046	.427	26.365	.000

a. Dependent Variable: Poultry Production

When the five independent variables (credit availability, disease control, market availability, poultry feeding, and technical knowledge) were regressed together in a multivariate regression, the results are as shown in Table 4.16. Each of the five independent variables was related to poultry production in a way that was statistically significant (sig 0.05).

4.8.1 Poultry Feeding

Table 4.16 showed that poultry feeding had a positive and significant effect on poultry production (β=1.108, p=0.000). P-value= 0.000 which is lower than 0.05 shows that the relationship between poultry feeding and poultry production is significant. Ensuring that poultry has the right nutrients is important to enable them to increase production (Food and Agriculture Organization of the United Nations, 2024). Farmers should know how to feed their poultry on a balanced diet. Indigenous farmers are not keen on this since most of them leave their poultry to roam. Farmers nonetheless are improving day by day as they learn the benefit of feeding their

poultry well (Food and Agriculture Organization of the United Nations, 2024). Biological and chemical contamination, however, remains a challenge when it comes to poultry feeds.

4.8.2 Disease Control

Disease control had a positive and significant effect on poultry production (β=1.006, p=0.000). P-value= 0.000 which is lower than 0.05 consequently shows that the relationship between disease control and poultry production is significant. Diseases hurt the growth of poultry farming (Hafez & Attia, 2020). Foodborne and zoonotic diseases are common in poultry. Poultry also may consume feed with high antibiotic residues and this posses a big challenge to their survival. Ensuring that there is proper disease control is key to growth of the poultry farming (Hafez & Attia, 2020). Farmers need to have the correct skills and knowledge to effectively and efficiently control diseases which is important for the growth of their poultry.

4.8.3 Technical Knowledge

Technical knowledge had a positive and significant effect on poultry production (β=1.130, p=0.000). P-value= 0.000 which is lower than 0.05 showed that the relationship between poultry feeding and poultry production was significant. Poultry farming is becoming competitive day by day which makes technical knowledge important (Thakur et al., 2021). Technical knowledge enables the farmer to make informed decisions in a current dynamic business environment. It enables the farmer to know the technologies that can be adopted to increase production and remain competitive (Thakur et al., 2021). Farmers should be trained to enable them to acquire technical knowledge that is important to enable them to improve poultry farming.

4.8.4 Market Availability

Market availability had a positive and significant effect on poultry production (β=0.700, p=0.000). P-value= 0.000 which is lower than 0.05 showed that the relationship between poultry feeding and poultry production was significant. Market availability is important in poultry farming (Hafez & Attia, 2020). Availability of market motivates a farm to produce more. It challenges a farmer to adopt practices and strategies that will enable them to meet the demands of the market (Hafez & Attia, 2020). Having knowledge about market is important to enable the farmer to make informed decisions as far as market is concerned.

4.8.5 Credit Availability

Credit availability had a positive and significant effect on poultry production (β=1.201, p=0.000). P-value= 0.000 which less than 0.05 showed that the relationship between poultry feeding and poultry production was significant. Availability of credit is important as it enables farmers to get money to boost their poultry business (Shuaibu & Nchake, 2021). Credit conditions should be convenient for farmers to enable them access it. Better credit conditions are good for the growth and development of poultry farming (Shuaibu & Nchake, 2021). It motivates farmers to focus on expanding poultry farming which is good for growth and development of the county.

The findings reveal that all predictor variables had a positive and significant influence on the dependent variable. These factors were critical in determining the success of commercial indigenous poultry production in Mandera County, Kenya.

4.9 Tests of Hypotheses

The researcher tested the hypotheses at 5% significance level. The first hypothesis, H_{01}: There is no relationship between supplementary feed availability and feeding on commercial indigenous poultry production in Mandera County, Kenya. The study findings rejected the null hypothesis H_{01} since the p-value was significance (p=0.000) which was less than 0.05.

The second hypothesis H_{02}: There is no relationship between disease control and commercial indigenous poultry production in Mandera County, Kenya. The study rejected the null hypothesis $H_{02,}$ since there was a significant relationship between disease control and commercial indigenous poultry production in Mandera county, Kenya (p=0.000; <0.05).

The third null hypothesis, $H_{03:,}$ was that 'there is no significant relationship between farmers' technical advisory services (expertise) and commercial production of indigenous chicken in Mandera County, Kenya' The study found that there was a significant relationship between technical advisory services (expertise) and commercial indigenous poultry production in Mandera county, Kenya (p=0.000), hence rejecting the null hypothesis $H_{03.}$

The fourth hypothesis was that H_{o4}: 'There is no relationship between market availability and market infrastructure on commercial indigenous poultry production in Mandera County, Kenya'. The study rejected the null hypothesis $H_{04,}$ since there was a significant relationship between market availability and commercial indigenous poultry production in Mandera county, Kenya (p=0.000 ;< 0.05).

The fifth null hypothesis (H_{o5}) was; 'There is no effect of credit availability to farmers on commercial indigenous poultry production in Mandera County, Kenya. The study rejected the null hypothesis $H_{05,}$ since there was a significant relationship between credit availability and commercial indigenous poultry production in Mandera county, Kenya ($p=0.000<0.05$).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter presents summarized results related to factors affecting poultry production in Mandera County, Kenya. The results were guided by research objects.

5.2 Summary

5.2.1 Effects of supplementary feeds on commercial indigenous poultry production

The study results indicated that most farmers could not access commercial supplementary poultry feeds in the local town. Additionally, the study indicated that variety of commercial poultry feeds were not available in the local markets, and, when available, the poultry commercial feeds were not sold at affordable prices and the distances from the farm to the access points for feeds was normally long. Moreover, the study results indicated that the poultry feeds available in the local market were not of the right quality. The majority of the respondents agreed that commercial feeds were important for egg production and quality of meat but most of the farmers had shifted to locally or homemade feeds which were a cheaper alternative. The respondents argued that despite the majority of the farmers being enthusiastic in increasing the number of indigenous commercial poultry birds, the level of production had remained low or constant due to external factors and challenges. Regression analysis confirmed a significant relationship between availability of commercial poultry feeds and poultry production in Mandera County ($p=0.000$). Furthermore, there was a highly positive and significant correlation between the dependent and the particular independent variable on commercial

poultry feeding (r=.584**) confirming the critical role of availability of feeds in the right quantity, quality and price to commercial poultry production.

5.2.2 Effects of Disease Control on Commercial Indigenous Poultry Production

The study results on disease control clearly indicated that vaccines and drug accessibility was low, vaccines variety was low and unaffordable, and drugs prices were prohibitively high while veterinary care was rarely available in Mandera County, Kenya. Accessing poultry vaccines and drugs in the county was hard and the majority of large-scale farmers sourced most of their vaccines from Nairobi. Government officers indicated that farmers in Mandera County continued to face fluctuating retail vaccine prices which hindered vaccination and predisposed their chicken to preventable diseases with catastrophic effects of loss of entire flocks sometimes. Regression analysis confirmed that there was a significant relationship between disease control and commercial indigenous poultry production in Mandera County (p=0.000). Further analysis revealed a highly positive and significant correlation between disease control and commercial indigenous poultry production at r= .612** meaning incidences of diseases and pests highly influenced commercialization of indigenous poultry ventures in the county. The government continued to regulate vaccine and drug prices by issuing licenses to companies that made poultry drugs.

5.2.3 Effects of Technical Knowledge on Commercial Indigenous Poultry Production

The farmers indicated that technical advisory services were not affordable, accessible, or available and the little training offered did not translate into boosting the productivity of poultry. The majority of officers indicated that farmers did not contact a veterinarian because they were too costly or unavailable. Regression

analysis revealed a significant relationship between technical advisory (knowledge or expertise) and commercial indigenous poultry production in Mandera County (p=0.000). Correlation between the dependent and predictor variable was highly positive and significant as per Pearsons Correlation Coefficient r=.827**. Government officers proposed that policymakers develop laws to address livestock breeding and livestock disease prevention in order to protect farmers from the high cost of private practitioners. This was further corroborated by poultry producers through the focused group discussions.

5.2.4 Effects of Market availability on commercial indigenous poultry production

The study results showed that market prices in the local market were too low and the majority of the farmers were forced to transport their available produce to buyers in markets further away. The prices set according to the results did not guarantee them profit from sale of indigenous chicken. The farmers indicated that they had insufficient poultry storage facilities at their homes or at the market place while market was not available for all the poultry products and sizes. Further, government officers were most of the time unable to find alternative markets for poultry farmers. They opined that the process of improving market access for the poultry products in Mandera county were tedious and needed thorough stakeholder engagement. Regression results confirmed a significant relationship between market availability and commercial indigenous poultry production (p=0.000) and correlation results confirmed a highly significant positive correlation between the dependent and this predictor variable (r=.661**).

5.2.5 Effects of Credit Access on Commercial Indigenous Poultry Production

The results on credit access indicated that farmers in Mandera County were not able to access formal and informal credit facilities. Further, the results indicated that the formal credit facilities were not affordable, accessible or sufficient for investments in farm infrastructure by the farmers. The informal sources of funds were also mostly not affordable to most poultry keepers and were not able to repay their small loans accessed on time. Some ended up accessing funds from VSLAs and shylocks whose interests and penalties were huge militating against commercialization of the poultry enterprise. Regression analysis results confirmed existence of a significant relationship between credit access and commercial poultry production in Mandera County ($p=0.000$). A highly positive and significant correlation was also established ($r= 0.796^{**}$) between the dependent and this predictor variable. The findings suggested that the poultry production systems in Mandera County had evolved to support the livelihood of the rural poor, but most were in the process of being commercialized to the point of becoming big businesses. These systems could have taken the form of small, fully or partially scavenging household poultry or slightly larger, more intensive units.

5.3 Conclusions

Indigenous fowl production commercialization in Mandera County was affected by all the predictor variables of; credit availability, disease control, market availability, poultry feeding and technical knowledge. According to the regression analysis results, all these independent variables positively and significantly influenced the dependent variable and had positive and significant correlation with it. It was concluded that for commercial indigenous poultry production to thrive in Mandera County, Kenya, provision of these essential services by the County or even the National government

as well as creation of an enabling environment by provision of public goods and encouraging private sector investment in the county would greatly and positively impact the indigenous poultry farming venture and have profound effect on food security, employment creation especially among the many unemployed youth and income generation for the families. It would be fully and properly commercialized.

5.4 Recommendations

On provision of supplementary feeding to enable commercialization of indigenous poultry, the government, at both county and national levels need to provide an enabling environment for private sector to thrive so that more players can enter the input markets at profitable level. Infrastructural development in this front require more elaborate and motorable roads and initiation of local processing capacity by providing public goods like electricity, water and raw materials.

On disease control in poultry commercialization, there is a role for both farmers and government. The farmers, using group dynamics to leverage on economies of scale may pool together to attract veterinary officers and pay then from a centralized kitty which would be more affordable than by individual farmers. For government, provision of adequate and qualified staff, especially with the ability to resonate with the local population, would be a great positive step to poultry commercialization. Employment in public sector is highly constrained but for a county with limited alternative livelihood sources like Mandera, investment in more lucrative and simple enterprises like commercial indigenous poultry production would greatly impact the livelihoods and food security of the county and hence a necessary investment.

Alongside disease control, technical advisory services are critical aspect in support to farming activities. Due to the long duration without recruitment of extension officers,

there has been a gap in technical advisory services especially on specialized areas like poultry farming. This is the more reason that the county government would invest in employment of qualified agricultural extension officers.

Market availability is a matter of demand and supply of goods and services. However, market infrastructure can provide an enabling environment for trade to flourish. The county government of Mandera County should invest in providing market infrastructure like cold chains for poultry products to be sold to far flung markets. Other necessary market support should also be provided by the government.

Credit access is a willing buyer, willing seller bargain. Most lenders are skeptical at lending to agriculture due to its unpredictable nature. However, use of group dynamics is recommended in pooling resources to access bargaining power and leverage on economies of scale. The government should also establish mechanisms of group lending through farmer cooperatives or small, micro and medium enterprises to enable commercial poultry enterprise to grow in Mandera County.

5.5 Suggestion for Further Study

Further research could investigate the effectiveness of existing government policies and interventions aimed at supporting indigenous poultry production. This could involve assessing the implementation of policies related to credit access, disease control measures, market development initiatives, and technical knowledge dissemination.

A study could be conducted to analyze the involvement of the private sector in providing essential services such as veterinary care, access to quality feeds, and credit facilities. This research could explore the impact of private sector initiatives on

improving the commercial viability of indigenous poultry farming and identify opportunities for further collaboration.

Given the indication that women are more likely to own native fowl and participate in livestock-based activities, further research could delve into the gender dynamics within the indigenous poultry production sector. This could involve examining the roles and contributions of women in poultry farming, as well as identifying any gender-specific challenges and opportunities for empowerment.

A study could focus on evaluating the impact of infrastructure development, particularly road networks, on the accessibility of inputs and markets for poultry farmers in Mandera County. This research could assess how improvements in infrastructure influence production costs, market access, and overall profitability of indigenous poultry farming enterprises.

Further investigation could explore alternative financing mechanisms for poultry farmers, beyond formal and informal credit facilities. This could include examining the feasibility of community-based financing models, microfinance initiatives tailored to the needs of small-scale poultry producers, or innovative crowdfunding platforms. Longitudinal studies could be undertaken to track changes and trends in indigenous poultry production over time. This would allow for the monitoring of progress in addressing key challenges identified in the current study and evaluating the effectiveness of interventions implemented to support the sector.

REFERENCES

Adoligbe, C., Fernandes, A., Osei-Amponsah, R., Adje, N. D., Gbedevi, R., Fonton, M. C., & Souaibou, F. S. (2020). Native chicken farming: A tool for wealth creation and food security in Benin. *International Journal of Livestock Production, 11*(4), 146-162. https://doi.org/10.5897/IJLP2020.0716

Afroze, D., & Rista, F. I. (2022). Mobile financial services (MFS) and digital inclusion–a study on customers' retention and perceptions. *Qualitative Research in Financial Markets, 14*(5), 768-785. https://doi.org/10.1108/QRFM-06-2021-0095

Alders, R. G., Dumas, S. E., Rukambile, E., Magoke, G., Maulaga, W., Jong, J., & Costa, R. (2018). Family poultry: M ultiple roles, systems, challenges, and options for sustainable contributions to household nutrition security through a planetary health lens. *Maternal and child nutrition, 14*, e12668. https://doi.org/10.1111/mcn.12668

Al-Tabbaa, O., & Ankrah, S. (2016). Social capital to facilitate 'engineered'university–industry collaboration for technology transfer: A dynamic perspective. *Technological Forecasting and Social Change, 104*, 1-15. https://doi.org/10.1016/j.techfore.2015.11.027

Alves, V. V., Arantes, L. C. R. V., de Barros Moreira Filho, A. L., da Silva Teixeira, M., Da Silva, E. F. A., de Mesquita Souza Saraiva, M., & de Freitas Neto, O. C. (2023). Effect of diets containing commercial bioactive compounds on Salmonella Heidelberg infection in broiler chicks. *Brazilian Journal of Microbiology, 54*(1), 571-577. https://link.springer.com/article/10.1007/s42770-022-00899-8

Arbani, O., Ducatez, M., El Houadfi, M., & Fellahi, S. (2022). *Low Pathogenic Avian Influenza: A Permanent Threat to Poultry Farming in Africa. In Broiler Industry.* IntechOpen. https://10.5772/intechopen.104480

Attia, Y. A., Al-Khalaifah, H. S., Alqhtani, A. H., Abd El-Hamid, H. S., Alyileili, S. R., El-Hamid, A. E. H. E. A., & El-Shafey, A. A. (2022). The impact of multi-enzyme fortification on growth performance, intestinal morphology, nutrient digestibility, and meat quality of broiler chickens fed a standard or low-density diet. *Frontiers in Veterinary Science, 9*(1), 1012462. https://doi.org/10.3389/fvets.2022.1012462

Bakari, M., & Yusuf, H. O. (2018). Utilization of locally available binders for densification of rice husk for biofuel production. *Banat's Journal of Biotechnology, 9*(18), 47-55. https://10.7904/2068–4738–IX(19)–47

Bakari, S. (2018). The impact of domestic investment on economic growth new policy analysis from Algeria. *Bulletin of Economic Theory and Analysis, 3*(1), 35-51. https://doi.org/10.25229/beta.337367

Banda, M., & Mutambo, P. P. (2015). The role of the teacher: Philosophical perspectives. *International Journal of Humanities Social Sciences and Education, 2(*10), 111-124. https://www.arcjournals.org

Begeç, S., & Arun, K. (2021). The bottleneck of intrapreneurship: are social positions and held expectations constraints in organizations' entrepreneur process? A conceptual view. *Journal of Entrepreneurship in Emerging Economies, 13*(1), 131-151. https://doi.org/10.1108/JEEE-08-2019-0120

Blake, D. P., Knox, J., Dehaeck, B., Huntington, B., Rathinam, T., Ravipati, V., & Tomley, F. M. (2020). Re-calculating the cost of coccidiosis in

chickens. *Veterinary Research, 51,* 1-14. https://doi.org/10.1186/s13567-020-00837-2

Bushra, S. R., Basil, M. I., & Saja, T. O. (2019). Effect of adding different levels of tamarind pulp on bod weight and conformation for carcasses of broiler chicken. *Biochemical & Cellular Archives, 19*(1), 1327-1331. https://10.35124/bca.2019.19.1.1327

Caine, R. S., Yin, X., Sloan, J., Harrison, E. L., Mohammed, U., Fulton, T., & Gray, J. E. (2019). Rice with reduced stomatal density conserves water and has improved drought tolerance under future climate conditions. *New Phytologist, 221*(1), 371-384. https://doi.org/10.1111/nph.15344

Chatterjee, R. N., Rajkumar, U., & Prince, L. L. L. (2022). Revolutionizing Impact of Poultry Resources in Food Security and Rural Economy. In *Agriculture, Livestock Production and Aquaculture: Advances for Smallholder Farming Systems Volume 1* (pp. 205-215). Cham: Springer International Publishing. https://link.springer.com/chapter/10.1007/978-3-030-93258-9_12

Chilala, A. (2019). *Diffusion of the orange fleshed sweet potatoes (OFSP) and its impact on household food security and livelihoods in Petauke district, Zambia* [Doctoral dissertation, University of Zambia]. Zambia. http://dspace.unza.zm/handle/123456789/6269

Christakis, N., Fowler, J., Imbens, G. W., & Kalyanaraman, K. (2020). *An empirical model for strategic network formation. In The Econometric Analysis of Network Data (123-148).* Academic Press. https://doi.org/10.1016/B978-0-12-811771-2.00012-2

Deshmukh, V. L., Yelikar, K. A., & Waso, V. (2013). Comparative study of efficacy and safety of oral versus vaginal misoprostol for induction or labour. *The Journal of Obstetrics and Gynecology of India, 63*, 321-324. https://doi.org/10.1007/s13224-012-0337-3

Dhakshana, A., & Rajandran, K. V. R. (2018). Challenges and problems on farmers' access to agricultural credit facilities in Cauvery Delta, Thanjavur District. *St. Theresa Journal of Humanities and Social Sciences, 4*(1), 50-62. https://www.researchgate.net/profile/Aarthi-Jd/publication/326412711_Challenges_and_Problems_on_Farmers'_Access_to_Agricultural_Credit_Facilities_in_Cauvery_Delta_Thanjavur_District/links/5b4c2140aca272c60946fea8/Challenges-and-Problems-on-Farmers-Access-to-Agricultural-Credit-Facilities-in-Cauvery-Delta-Thanjavur-District.pdf

Dhakshana, A., & Rajandran, K. V. R. (2018). Challenges and problems on farmers' access to agricultural credit facilities in Cauvery Delta, Thanjavur District. *St. Theresa Journal of Humanities and Social Sciences, 4*(1), 50-62. https://www.researchgate.net/profile/Aarthi-Jd/publication/326412711

El Jeni, R., Villot, C., Koyun, O. Y., Osorio-Doblado, A., Baloyi, J. J., Lourenco, J. M., & Callaway, T. R. (2023). Invited Review:"Probiotic" approaches to improving dairy production: reassessing "magic foo-foo dust". *Journal of Dairy Science, 107*(4), 1832-1856. https://doi.org/10.3168/jds.2023-23831

Fekadu, T., Berhane, G., Mengesha, M., & Alewi, M. (2022). Effect of Dietary Metabolizable Energy and Crude Protein on the Laying Performance, Egg Quality, Hatchability, and Fertility of DZ-White Chickens. *Journal of Livestock Research, 12*(7), 37-47. https://creativecommons.org/licenses/by/4.0/

Freudenreich, B., Müller, O., & Steininger, M. (2019). *Business Economics*. Springer.

Gueye, O. K., Tchouakui, M., Dia, A. K., Faye, M. B., Ahmed, A. A., Wondji, M. J., & S. Wondji, C. (2020). Insecticide resistance profiling of Anopheles coluzzii and Anopheles gambiae populations in the southern Senegal: role of target sites and metabolic resistance mechanisms. *Genes*, *11*(12), 1403. https://doi.org/10.3390/genes11121403

Gueye, R., Sandefo, V. C., Beye, B., Faye, E. O., Diop, A., Sarr, S. O., ... & Diop, Y. M. (2022). Assessment of poultry feed contamination level by aflatoxin B1: Quantification by two chromatographic analysis methods. *Food and Nutrition Sciences,* *13*(11), 950-961. https://www.scirp.org/journal/paperinformation?paperid=121587

Hafez, H. M., & Attia, Y. A. (2020). Challenges to the poultry industry: current perspectives and strategic future after the COVID-19 outbreak. *Frontiers in veterinary science, 7*(1), 516. https://doi.org/10.3389/fvets.2020.00516

Hedman, H. D., Vasco, K. A., & Zhang, L. (2020). A review of antimicrobial resistance in poultry farming within low-resource settings. *Animals, 10*(8), 1264. https://doi.org/10.3390/ani10081264

Ipara, B. O., Otieno, D. J., Nyikal, R., & Makokha, N. S. (2021). The contribution of extensive chicken production systems and practices to Newcastle disease outbreaks in Kenya. *Tropical Animal Health and Production, 53*, 1-13. https://doi.org/10.1007/s11250-020-02550-w

Kariuki, I., Hong, S., Kang, S., Ngae, G., Kim, K. J., Nyaga, S., & Nyaga, M. (2021). Increase in Egg Production in Households using Low Cost Rations as Feeds for Indigenous Chickens in Kenya. *The Journal of the Korean Society of*

International Agriculture, 33(3), 240-246. https://doi.org/10.12719/KSIA.2021.33.3.240

Kariuki, J., Galie, A., Birner, R., Oyieng, E., Chagunda, M. G., Jakinda, S., & Ojango, J. M. (2022). Does the gender of farmers matter for improving small ruminant productivity? A Kenyan case study. *Small Ruminant Research, 206,* 106574. https://doi.org/10.1016/j.smallrumres.2021.106574

Kirkpinar, F., & Atan, H. L. (2022). *Sustainability strategies in poultry nutrition*. https://dergipark.org.tr/en/download/article-file/2345644

Kitalyi, A. J., Kizima, J., Nzogela, B., Njuguna, C., Notenbaert, A. M. O., Paul, B. K., & Omore, A. O. (2021). *Policy Actions for Climate Smart Dairy Development in Tanzania: Policy Briefing report (10 August 2021).* https://cgspace.cgiar.org/server/api/core/bitstreams/aca700bc-7aeb-4cc5-85f1-dd0ba48e84ae/content

Kohls, R. L., & Uhl, J. N. (2002). *Marketing of agricultural products* (9th Ed.). Prentice-Hall Inc.

Kugonza, D. (2018). Analysis of the indigenous chicken value chain in Uganda. *African Journal of Rural Development, 3*(3), 895-912. https://afjrdev.org/index.php/jos/article/view/213

Kuria, P., Gitari, J., Mkomwa, S., & Waweru, P. (2022). Effect of Conservation Agriculture on Soil Properties and Maize Grain Yield in the Semi-arid Laikipia County, Kenya. In *Conservation Agriculture in Africa: Climate Smart Agricultural Development* (pp. 256-269). GB: CABI. https://www.cabidigitallibrary.org/doi/abs/10.1079/9781789245745.0015

Lamidi, W. A., & Osunade, J. A. (2023). Broilers' performance in deep litter house at different floor geometries and stocking densities in humid tropics. *West African Journal of Applied Ecology, 31*(1), 75-84. https://www.ajol.info/index.php/wajae/article/view/249487

Lüdeke-Freund, F. (2020). Sustainable entrepreneurship, innovation, and business models: Integrative framework and propositions for future research. *Business Strategy and the Environment, 29*(2), 665-681. https://doi.org/10.1002/bse.2396

Macharia, J. K., Ogolah, E. O., & Munyaneza, J. P. (2022). Indigenous Chicken Farming in Kenya: A Minireview of Genetic Resource, Production Systems, Constraints, and Opportunities. *Journal of Animal Breeding and Genomic, 6*(4), 183-193. https://doi.org/10.12972/jabng.20220020

Madeira, R. N., Santos, P. A., Java, O., Priebe, T., Graça, E., Sárközi, E., & Gómez, R. P. B. (2022). Towards digital twins for multi-sensor land and plant monitoring. *Procedia Computer Science, 210,* 45-52. https://doi.org/10.1016/j.procs.2022.10.118

Magothe, T. M., Okeno, T. O., Muhuyi, W. B., & Kahi, A. K. (2012). Indigenous chicken production in Kenya: I. Current status. *World's Poultry Science Journal, 68*(1), 119-132. https://10.1017/S0043933912000128

Magothe, T. M., Okeno, T. O., Muhuyi, W. B., & Kahi, A. K. (2012). Indigenous chicken production in Kenya: I. Current status. *World's Poultry Science Journal, 68*(1), 119-132. http://10.1017/S0043933912000128

Mailu, S. (2022). *Biodigester attribute tradeoffs among farmers in Kiambu and Machakos Counties, Kenya. Kenya (April 9, 2022).* https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4079623

Makani, F. L. (2016). *Strategies small restaurant owners use to reduce food waste and increase profits.* Walden University.

Makini, F., Mose, L., & Kamau, G. (2019). *Innovation Opportunities in Dairy Livestock in Kenya.* Forum for Agricultural Research in Africa. https://research4agrinnovation.org/app/uploads/2019/06/FARA-Innovation-Opportunities-in-Diary-Livestock-in-Kenya_FINAL_-APRIL-11-1.pdf

Marchewka, J. T. (2016). *Information technology project management.* John Wiley and Sons.

Mathiu, E. M. (2021). *Technology Adoption, Production and Market Participation among Smallholder Indigenous Chicken Farmers in Tigania West Sub-County, Meru County* [Doctoral dissertation, University of Embu]. http://41.89.240.73/handle/embuni/3885

Mirzazadeh, A., Grafl, B., Abbasnia, M., Emadi-Jamali, S., Abdi-Hachesoo, B., Schachner, A., & Hess, M. (2021). Reduced performance due to adenoviral gizzard erosion in 16-day-old commercial broiler chickens in Iran, confirmed experimentally. *Frontiers in veterinary science, 8*, 635186. https://connectjournals.com/pages/articledetails/toc032705

Mohammed, R. J., & Al-Hassani, D. H. (2020). Comparison of in ovo injection at 18 days of incubation and feeding in the hatchery and their interaction in influencing on some of hatching and productive traits in broiler chickens. *Biochem. Cell. Arch, 20*(2), 6617-6621. https://connectjournals.com/03896.2020.20.661

Mottet, A., & Tempio, G. (2017). Global poultry production: current state and future outlook and challenges. *World's poultry science journal, 73*(2), 245-256. https://doi.org/10.1017/S0043933917000071

Mugenda, O. M., & Mugenda, A. G. (2003). *Research methods: Quantitative & qualitative approaches.* Acts press.

Mugo, J. N., Karanja, N. N., Gachene, C. K., Dittert, K., Nyawade, S. O., & Schulte-Geldermann, E. (2020). Assessment of soil fertility and potato crop nutrient status in central and eastern highlands of Kenya. *Scientific Reports, 10*(1), 1-11. https://doi.org/10.1038/s41598-020-64036-x

Mutombo, P. K. (2022). *An analysis of economic efficiency among indigenous chicken farms in Kitui County, Kenya* [Master's Thesis, South Eastern University]. Kenya. http://repository.seku.ac.ke/handle/123456789/6859

Mutua, B. M. (2018). *Challenges facing indigenous chicken production and adoption levels of Biosecurity measures in selected areas of Makueni County, Kenya* [Master's Thesis, South Eastern University]. Kenya. http://repository.seku.ac.ke/handle/123456789/4126

Ndegwa, J. M., Mead, R., Norrish, P., Shephered, D. D., Kimani, C. W., Wachira, A. M., & Siamba, D. N. (2014). Investigating eggs hatchability in indigenous chicken system with smallholder farms in Kenya in a participatory research using analysis of variation. *Journal of Applied Biosciences, 80,* 7000-7013. https://10.4314/jab.v80i1.6

Ndoro, M. (2019). *Farmer group approach to commercialization of smallholder agriculture. Do social capital and collective action arrangements matter? The case of indigenous chicken farmer groups in Mutare district, Zimbabwe.*

[Master's Thesis, Lund University]. Sweden. https://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=8976028&fileOId=8976043

Ngongolo, K., Mmbaga, N., & Chota, A. (2023). Productivity and growth performance of chickens from small holder farmers in Dodoma, Tanzania. *Animal Research International, 20*(3), 1-9. https://doi.org/10.1016/j.psj.2022.101785

Nishi, A., Alexander, M., Fowler, J. H., & Christakis, N. A. (2020). Assortative mating at loci under recent natural selection in humans. Biosystems, *187*, 104040. https://doi.org/10.1016/j.biosystems.2019.104040

Njeru, J., Wareth, G., Melzer, F., Henning, K., Pletz, M. W., Heller, R., & Neubauer, H. (2016). Systematic review of brucellosis in Kenya: disease frequency in humans and animals and risk factors for human infection. *BMC public health, 16*(1) 1-15. https://doi.org/10.1186/s12889-016-3532-9

Odek, R., & Okoth, E. (2019). *Effect of internal control systems on financial performance of distribution companies in Kenya.* https://repository.maseno.ac.ke/handle/123456789/3525

Odhiambo, N. M. (2021). Health expenditure and economic growth in sub-Saharan Africa: an empirical investigation. *Development Studies Research, 8*(1), 73-81. https://doi.org/10.1080/21665095.2021.1892500

Ogendi, M. N., Mukundi, J. B., & Githiri, S. M. Occurrence level of urban and peri-urban farming activities across major network links of Nairobi County, Kenya. *International Journal of Agronomy and Agricultural Research (IJAAR), 18*(4), 25-37. http://www.innspub.net

Okello, D. M., Odongo, W., Aliro, T., & Ndyomugyenyi, E. (2021). An assessment of pig feed diversity amongst smallholder pig farmers in Northern Uganda. *Cogent Food & Agriculture, 7*(1), 1937867. https://doi.org/10.1080/23311932.2021.1937867

Okitoi, L. O., Ondway, H. O., Obali, M. P., Murekefu, F., Ramatu, M., Larvoe, N., & Adaku, A. A. (2016). 1, 2 livestock keepers in Isiolo County, embrace new adaptive strategies as mitigation measures against the effects of drought. In *2nd Biennial International Conference On Enhancing Sustainable Agricultural Production And Marketing Systems* (Vol. 25). http://www.ir-library.ku.ac.ke

Pettit, T. J., Croxton, K. L., & Fiksel, J. (2019). The evolution of resilience in supply chain management: a retrospective on ensuring supply chain resilience. *Journal of business logistics, 40*(1), 56-65. https://doi.org/10.1111/jbl.12202

Rukambile, E. J., Chengula, A., Swai, E. S., & Jongejan, F. (2020). Poultry ecto-, endo-and haemoparasites in Tanzania: a review. *Austin Journal of Veterinary Science and Animal Husbandry, 7*(1), 1066-1075. https://www.researchgate.net/profile/Elpidius-Rukambile/publication/339238056_Poultry_Ecto-_Endo-_and_Haemoparasites_in_Tanzania_A_Review/links/5e4566efa6fdccd965a221db/Poultry-Ecto-Endo-and-Haemoparasites-in-Tanzania-A-Review.pdf

Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., & Jinks, C. (2018). Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & quantity, 52*(1), 1893-1907. https://doi.org/10.1007/s11135-017-0574-8

Schechner, R., & Hess, L. (1977). The Ramlila of Ramnagar India. *The Drama Review, 21*(3), 51-82. https://doi:10.2307/1145152

Shuaibu, M., & Nchake, M. (2021). Impact of credit market conditions on agriculture productivity in Sub-Saharan Africa. *Agricultural Finance Review, 81*(4), 520-534. https://doi.org/10.1108/AFR-05-2020-0063

Sogunle, O. M., Olatunbosun, O. B., Adetola, O. O., Odutayo, O. J., Ayodeji, T. M., Ayoola, A. A., & Abiona, J. A. (2022). In ovo feeding of organic salts of zinc and copper: effects on growth performance and health status of two strains of broiler chickens. *Tropical Agriculture, 99*(2), 20-20. https://journals.sta.uwi.edu/ojs/index.php/ta/article/view/8272

Suarez, D. L., Pantin-Jackwood, M. J., Swayne, D. E., Lee, S. A., DeBlois, S. M., & Spackman, E. (2020). Lack of susceptibility to SARS-CoV-2 and MERS-CoV in poultry. *Emerging infectious diseases, 26*(12), 3074. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7706925/

Teece, D. J. (2017). *Dynamic capabilities and (digital) platform lifecycles. In Entrepreneurship, innovation, and platforms (*Vol. 37, pp. 211-225). Emerald Publishing Limited. https://doi.org/10.1108/S0742-332220170000037008

Thapliyal, K., & Joshi, M. (2022). *Cross-Cultural Management: Opportunities and Challenges. Integrating New Technologies in International Business, 31-53.* Apple Academic Press. https://10.1201/9781003130352-3

Wainaina, E. W. (2017). *Computational Analysis of Signatures of Selection in Genes for Egg Production and Growth in Poultry* [Master's Thesis, JKUAT] Kenya. http://hdl.handle.net/123456789/3490

Walker, D. I. (2022). The economic (in) significance of executive pay ESG incentives. *Standard Journal Business and Finance, 27*(1) 318-340 .https://heinonline.org/HOL/LandingPage?handle=hein.journals/stabf27&div=12&id=&page=

Wambua, S., Macharia, I., & Mwenjeri, G. (2022). Challenges and Opportunities in Improved Indigenous Chicken Production in Kenya. *East African Agricultural and Forestry Journal, 86*(4), 10-10. https://www.kalro.org/www.eaafj.or.ke/index.php/path/article/view/574

Wangui, M., Mbugua, J. K., Kiano, E. K., Mbugua, S. N., & Kariuki, J. N. (2015). Micro–Economic Factors Influencing Quantity of Stock Demanded by Retail Investors in the Kenyan Stock Market: A Case of Nyeri District, Central Province: Kenya. *Journal of Economics and Sustainable Development, 6*(15), 9-16. http://ir-library.mmarau.ac.ke:8080/handle/123456789/9749

Yadessa, E., Tulu, D., Bogale, A., Mengistu, G., Aleme, M., Shiferawu, S., & Amare, A. (2017). Characterization of smallholder poultry production systems in Mezhenger, Sheka and Benchi-Maji zones of south western Ethiopia. *Research Journal of Agricultural Science Research, 5*(1), 2360-7874. http://www.academicresearchjournals.org/ARJASR/Index.htm

Yensuk, A. A., Maina, J. G., & Mbugua, P. N. (2022). Farmers' Perception on the Welfare of Broiler Chickens in Smallholder Production Systems in Kiambu County, Kenya. *Advances in Agriculture, 2022*(1), 1-7 .https://doi.org/10.1155/2022/7502751

Zhou, S., Han, L., Huang, G., Yang, Z., & Peng, J. (2018). Pyrolysis characteristics and gaseous product release properties of different livestock and poultry

manures: Comparative study regarding influence of inherent alkali metals. *Journal of analytical and applied pyrolysis, 134,* 343-350. https://doi.org/10.1016/j.jaap.2018.06.024

Zhu, N., Wang, J., Yu, L., Zhang, Q., Chen, K., & Liu, B. (2019). Modulation of growth performance and intestinal microbiota in chickens fed plant extracts or virginiamycin. *Frontiers in Microbiology, 10*(1), 1333. https://doi.org/10.3389/fmicb.2019.01333

APPENDICES

Appendix I: Questionnaire for poultry farmers

Fill in the questionnaire attached as truthfully as possible. The data will be used for academic purposes only.

SECTION A: BACKGROUND INFORMATION

1. Indicate your gender?

Male [ ] Female [ ]

2. Indicate your level of education?

Post Graduate [ ]

Undergraduate [ ]

Diploma [ ]

Certificate [ ]

3. What is your age bracket?

Below 30 years [ ]

31 to 40 Yrs [ ]

41 to 50 Yrs [ ]

Above 50 Yrs [ ]

4. Which of the following best describes your current marital status?

Married [ ]

Widowed [ ]

Divorced [ ]

Single parent [ ]

Never married [ ]

SECTION B: SUPPLEMENTARY FEEDING

The following section relates to supplementary feeding of indigenous poultry in Mandera County, Kenya. Use the key 1=strongly disagree, 2= disagree, 3= moderate, 4=agree and 5= strongly agree.

No.	**Statements**	**1**	**2**	**3**	**4**	**5**
1	Poultry Supplementary feeds are easily accessible in the local shopping centres					
2	There are variety of commercial poultry feeds in the local markets					
3	The poultry commercial feeds are sold at affordable prices					
4	The poultry feeds available in the local market are of the right quality					

5. *Indicate some of the recommendation related to poultry feeds in your local market*

……..

SECTION C: DISEASE CONTROL

The following section relates to disease control of indigenous poultry in Mandera County, Kenya. Use the key 1=strongly disagree, 2= disagree, 3= moderate, 4=agree and 5= strongly agree.

No.	Statements	1	2	3	4	5
1	We are able to access the poultry vaccines in the local market					
2	The vaccines are of different varieties for the farmers to choose					
3	We are able to access the poultry drugs in the local market					
4	The price for treatment drugs is affordable by the local commercial poultry farmers					
5	The veterinary care within the villages are readily available					

6. *What other challenges do you face in controlling the poultry disease in your County?*

Please state……..

SECTION C: TECHNICAL KNOWLEDGE

The following section relates to technical knowledge by farmers of indigenous poultry in Mandera County, Kenya. Use the key 1=strongly disagree, 2= disagree, 3= moderate, 4=agree and 5= strongly agree.

No.	Statements	1	2	3	4	5

1	We are able to access the technical advisory services from national and county governments					
2	The technical training services are offered frequently in a year					
3	The technical training services offered by the governments are free/affordable					
4	The centers offering technical training services are within the reach of many farmers					
5	There is availability of private technical training services within our locality					
6	The private technical advisory services are relevant in that they train us on poultry husbandry, disease control, storage, marketing as well as business management.					

7. *What are some of the recommendations you may make related to technical advisory services in your County?*

……

……

SECTION D: MARKET AVAILABILITY

The following section relates to market availability of indigenous poultry in Mandera County, Kenya. Use the key 1=strongly disagree, 2= disagree, 3= moderate, 4=agree and 5= strongly agree.

No.	**Statements**	**1**	**2**	**3**	**4**	**5**

1	I have readily available buyers from the local markets					
2	I have readily available poultry buyers in urban areas					
3	I get good prices that result to profit from sale of indigenous chicken.					
4	The poultry are transported directly to the market from the farm					
5	We have sufficient poultry storage facilities at our home					
6	The poultry storage facilities are also available in the market and of good quality					
7	The market is available for all the poultry products and sizes					

8. *What are some of the challenges you face in marketing your poultry from this county?* ……

SECTION E: CREDIT ACCESS

The following section relates to credit access on farming of indigenous poultry in Mandera County, Kenya. Use the key 1=strongly disagree, 2= disagree, 3= moderate, 4=agree and 5= strongly agree.

No.	**Statements**	**1**	**2**	**3**	**4**	**5**
1	I can easily access formal and informal the credit facilities					
2	The formal credit facilities are affordable to the majority of the farmers					
3	I can easily access informal credit facilities from local lenders					
4	The funds available are sufficient for investments in farm infrastructure					

5	Most indigenous poultry keepers are able to repay their loans in time hence smooth flow of credit					

5. Kindly indicate any difficulties encountered by borrowers on repayment of loans

SECTION F: INDIGENOUS COMMERCIAL POULTRY PRODUCTION

The following section relates to indigenous commercial poultry production in Mandera County, Kenya. Use the key 1=strongly disagree, 2= disagree, 3= moderate, 4=agree and 5= strongly agree.

No.	Statements	1	2	3	4	5
1	We produce high quality poultry meat					
2	Our poultry and poultry products are readily available in the local markets					
3	The prices we charge are affordable to all the markets in the county and beyond hence increasing demand for our products.					
4	We a have managed to generate constant and high income from indigenous poultry production through-out the years					
5	The poultry production has really positively impacted on the farmers livelihoods					
6	Through indigenous poultry business, I am able to pay school fees for my family, build decent house and feed the family					

7. *Comments on some of the other benefits accrued from indigenous poultry production in your county……*

THANK YOU FOR PARTICIPATING!

Appendix II: Interview Schedule for the County Extension Officer

1. Do the farmers have access to the commercial supplementary poultry feeds?
2. Name some of the feeds available in the local market please?
3. Are poultry commercial feeds sold at affordable prices?
4. Do you think the poultry feeds available in the local market are of the right quality?
5. Indicate some of the recommendation related to poultry feeds in your local market?
6. Do you help poultry keepers access the poultry vaccines?
7. What are some of the accessible vaccines offered?
8. Is the price for each drug affordable by the local poultry commercial farmers?
9. Do you offer technical advisory services to poultry farmers?
10. How frequently do you offer the technical advisory services?
11. Have you assisted in creating markets or improving market access for the poultry products in your county?
12. What help do you give the poultry keepers to access the market?
13. What are some of the challenges faced in marketing the poultry from this county?

14. Do you help farmer's access credit facilities? If Yes How?
15. Are the loans available to poultry keepers in the county?
16. Do you facilitate on the availability of poultry products in the local markets? Kindly indicate…
17. Do you think the poultry production has really positively impacted on the farmers' livelihoods? In which ways?

Appendix III: Focus Group Discussion Guide for poultry group of farmers (For Common Interest Groups)

FOCUS GROUP DISCUSSION GUIDE

County: _____

Name of group: _____

Type of group eg producer, traders, processors, etc: _____

Registration date and number: _____

Group type e.g. Self-help, Community service or cooperative (specify)

Directions:

Any member in the group with knowledge and right answers can volunteer information in a ground Table discussion. All suggestions or contributions or opinions are valid and should be respected by members unless they are contrary to the group norms which should be aptly corrected. No member should vilify another over their contributions.

Guiding questions?

1. What does the group exist to do?
2. How is the group leadership arrived at?

3. What are the major benefits of being in this group?
4. What are the major challenges of being in the group?
5. How does the group lobby and advocate for interventions by relevant bodies e.g. government on its challenges?
6. How effective is the lobby?
7. What tangible benefits has the group gotten from any stakeholder (government or NGO) over the previous three years?
8. What is the future focus of the group in terms of commercial indigenous poultry production and trade?
9. What suggestions do member have on improving their group welfare and indeed commercial indigenous poultry production and trade?
10. What would the group want to be highlighted from this study?
11. What plans does the group have to expand its business of commercial indigenous poultry production?
12. Any other suggestions?

Appendix V: NACOSTI Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **748782**

Date of Issue: **05/April/2023**

RESEARCH LICENSE

This is to Certify that Mr.. MOHAMED MOHAMUD MOHAMED of Kenya Methodist University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Mandera on the topic: FACTORS AFFECTING COMMERCIAL PRODUCTION OF INDIGENOUS POULTRY IN MANDERA COUNTY, KENYA for the period ending : 05/April/2024.

License No: **NACOSTI/P/23/24936**

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Director General
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See overleaf for conditions

Appendix VII: Map of Mandera County