PROFITABILITY AND COMMERCIALIZATION OF INDIGENOUS CHICKEN PRODUCTION IN OMORO AND OYAM DISTRICTS, NORTHERN UGANDA

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DECLARATION

I ARYEMO IRENE PENNINAH declare that this research dissertation is my own original work and has not been submitted wholly or in part for any award in this or any other institution of learning.

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To my parents, Godfrey and Rose Oboni, my dear husband Stephen Ouma Lajul.

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LIST OF ABBREVIATIONS

$	U S Dollars
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GH¢	Ghana Series
GM	Gross Margin
IC	Indigenous Chickens
KGS	Kilograms
KMS	Kilometers
M.\AIF	Ministry of Agriculture, Animal industry and Fisheries
MI	Market Index
MML	Method of Maximum Likelihood
OLS	Ordinary Least Squares
SPSS	Statistical Package for Social Scientists
SSA	Sub-Saharan Africa
UBOS	Uganda Bureau of Statistics
UShs	Uganda Shillings

ABSTRACT

Indigenous chicken production has been recognized as an avenue to improve livelihoods of rural households in northern Uganda, where they provide meat, eggs and income. Venturing into commercial indigenous chicken production and marketing is a pathway to meeting the current unmet market demand for indigenous chickens and their products. Although indigenous chicken production is a promising enterprise, factors that drive farmers to change from subsistence to commercial indigenous chicken production are not clearly known. This study was conducted to assess drivers of profitability and commercialization among smallholder farmers of indigenous chickens in northern Uganda. A multi-stage sampling procedure was used to select districts, sub-counties, parishes, villages and indigenous chicken households to interview. A total of 180 indigenous chicken farming households were randomly selected to participate from Bobi and Lalogi sub-counties in Omoro district and Minakulu and Loro sub-counties in Oyam district. The study adopted a cross sectional study design which enabled collection of data using pre-tested researcher administered questionnaires. Data entry, coding, cleaning and transformation were done using SPSS version 20 and data analysis and regressions were done using STATA version 13. A Market index was constructed to measure proportion of indigenous chickens marketed as a proxy for commercialization. A Tobit regression model was fitted using Maximum Likelihood Estimation techniques to determine drivers of commercialization level. Gross margin analysis was conducted to measure annual profits from indigenous chicken production and a multi-linear regression was estimated using Ordinary Least Squares method to ascertain determinants of profitability. Overall, level of commercialization of indigenous chickens was found to be low as 31.2%. This level was affected by: number of cattle owned, indigenous chicken flock size, group membership and poultry extension services. Commercial indigenous chicken production was found to be profitable with average gross margins of

UGX 118,704 equivalent to ($34) per annum. Results further revealed that profitability in indigenous chicken production and marketing was affected by sex of respondent, age of household head, bicycle access, group farming involvement, number of extension visits and family ownership of chickens. Results imply that indigenous chicken producers need to target marketing indigenous chickens to particular market segments. It can also be recommended that implementation of strategies to increase flock size like disease management, provision of targeted extension services and increased group involvement in chicken production and marketing should be done.

Key words: Indigenous chickens, commercialization, profitability, Northern Uganda

CHAPTER ONE

1.0. INTRODUCTION

1.1. Background

1.1.1. Production and consumption of indigenous chickens

Agriculture plays a vital role in African economic growth and social improvement. It has the highest percentage of the working population (about 65%). It also contributes about 30% of the GDP in most countries. It is critical to economic growth, generating incomes and creating jobs (AGRA, 2015). In Uganda, it contributes about 23% to GDP and livestock production contributes about 4% of this GDP (UBOS, 2015). Currently, Ugandan livestock population is estimated at 13.6 million cattle, 14.0 million goats, 3.8 million sheep, 3.5 million pigs and 44.7 million units of poultry (UBOS, 2015).

Of all the livestock species reared, chickens constitute the most widely spread (Perry *et al.*, 2002; Moreki *et al.*, 2010) with the highest proportion (71.6%) of the world's chicken population (16.2 billion) being found in developing countries (Bushra, 2012). In Uganda, indigenous chickens (*Gallus domesticus L)* are found in almost all rural households and are kept mainly for subsistence purposes while the exotic breeds are reared by few market oriented households basically for commercial purposes. Over the past five years, there has been a rise in poultry production. The national poultry flock which includes both indigenous and exotic breeds has been able to increase from 42.7 million birds in 2010 to 44.7 million in 2014. The egg production has also been able to increase from 761.3 million units in 2010 to 856 million units in 2014 (UBOS, 2015) (Table 1). With increased domestic poultry

production, the country will be able to limit importation of poultry birds and products thus saving millions of dollars.

Table 1: Poultry population and egg production in Uganda, 2010-2014

Year	Indigenous (millions)	Exotic (millions)	Eggs (millions)
2010	40.4	2.9	761.3
2011	35.9	5.0	784.1
2012	36.9	5.2	807.6
2013	38.1	5.3	831.9
2014	39.2	5.5	856.8

Source: Uganda Bureau of Statistics (UBOS, 2015)

Currently, the poultry industry consists of 44.7 million birds (UBOS, 2015). Of these birds, chickens dominate the industry and 86% of the chickens being indigenous chickens thus still showing its dominance in the sector (UBOS, 2015). This continued dominance of indigenous chickens despite the introduction of exotic breeds can be attributed to their traits such as high resistance to diseases, high tolerance to heat and cold, better scavenging abilities, good mothering ability and defense of the young ones against predators (Bushra, 2012; King'ori *et al*., 2010). Additionally, indigenous chickens are often associated with good quality eggs and meat flavor, hard egg shells, high dressing percentages and low production costs (Gueye, 1998). Therefore, due to their dominance, indigenous chickens have the capacity to form the basis for improved rural poultry production and attain a commercial status thus increasing food security and income in the poor rural homes (Kyarisiima *et al*., 2004).

So far, poultry production is the fastest growing component of global meat production, with developing countries taking the lead role (Assa, 2012). This could be attributed to the fact that poultry possess greater efficiency in converting feed into egg and meat compared to other livestock enterprises. The poultry industry in Uganda is important for employment generation, source of income and regular supply of protein for human consumption. The main poultry production system in Uganda is free-range indigenous chicken production (Mukiibi, 2001). Chickens make a major contribution to rural livelihoods. The indigenous chickens

immensely contribute to household nutrition and welfare through provision of high quality protein to the increasing human population and additional income to poor farmers especially women through sale of the chickens (Guèye, 2009). According to Ahlers *et al.* (2009) and Roothaert *et al.* (2011), indigenous chickens in Sub- Saharan Africa are mainly owned and managed by women making it an essential part of female-headed households. In Uganda, indigenous chickens are an important animal resource in most rural areas. They are easy to acquire and, under improved management, their reproduction and production is high enough to realize faster income generation due to the minimal initial investment (FAO, 2009). In rural communities, free range chickens contribute significantly to the livelihoods of farmers and are often the only source of animal protein for resource poor households (Kirunda and Mukiibi-Muka, 2003). The farmers also use it to obtain quick funds in times of emergencies. Indigenous chicken meat is served in many restaurants and they fetch high prices and it is consumed by many Ugandans due to its tastiness (Emuron *et al.*, 2008).

High population and income growth, accompanied by increasing urbanization, has been raising the domestic demand for poultry products, a trend that is expected to continue. Demand has been high for poultry products in hotels, schools, and other large institutions, and Uganda's poultry products are being exported to neighboring countries even though it is a net importer (Foy and Kezala, 2017). Projections to 2030 suggest that consumption of poultry products will continue growing at 4.6 percent per year (FAO, 2011). Over the years, consumption of chickens has been on the rise with consumption of indigenous chickens being higher (FAO, 2017). In the table below, percentage of indigenous chicken consumed was computed out of the total chicken consumed and it can be seen that the highest percentage of chicken consumed is indigenous chicken throughout all the three years. This emphasizes the importance of indigenous chicken products in consumption of poultry products (Table 2).

Table 2: Consumption of chicken in Uganda, 2010-2013

Year	Chicken (Tonnes)	Indigenous chicken (Tonnes)	Percentage of indigenous chicken
2010	62300	56357	90.46
2011	62150	60149	96.78
2012	63000	60076	95.36
2013	64500	61595	95.50

Source: FAOSTAT (2017)

1.1.2. Transition from subsistence to commercial production of indigenous chickens

Pingali and Rosegrant (1995) pointed out that agricultural commercialization is a transformation process from subsistence to semi-commercial and then to a fully commercialized agriculture. Transition from subsistence to commercial agriculture is a necessary pathway towards economic growth and development for many agriculture dependent developing countries (World Bank, 2008). Among livestock-based enterprises, poultry production has assumed an important role as a commercial activity with enormous potential for rapid economic growth (Ekunwe *et al.*, 2006).

Commercialization entails both market orientation and market participation. Market orientation refers to the degree of allocation of resources (land, labor and capital) to the production of agricultural produce that are meant for exchange or sale (Immink and Alarcon, 1993). This means decisions regarding production are based on market signals. Meanwhile, market participation refers to produce offered for sale and use of purchased inputs (Gebremedhin and Jaleta, 2010). In the context of this study; commercialization was specifically looked at in terms of level of market participation. This implies sale of the agricultural produce or livestock to earn income. Thus commercialization in this study looked at proportion of indigenous chickens taken to the market for sale out of the total number of indigenous chickens produced by an individual household. Sustainable household food

security and welfare also requires commercial transformation of subsistence agriculture (Gebremedhin and Jaleta, 2010). Additionally, commercialization of indigenous poultry production could meet the unmet market demand (Ondwasy *et al.*, 2006). The level of commercialization of indigenous chicken production is dependent on various factors including socioeconomic factors such as age, experience in indigenous chicken production, education level; institutional factors such as availability of markets, access to extension services, belonging to a group, road infrastructures; and market related factors such as access to markets, and distance to the nearest markets. All these affect a farmer's level of commercialization. The more sales of chickens a farmer makes (the more commercialized), the more profits he or she is likely to make keeping other factors constant (Ayieko *et al.*, 2014).

In terms of market, there are various types of markets where indigenous chickens are usually sold. These include; i) informal markets mainly found in rural settings where households occasionally sell their indigenous chickens to meet immediate needs such as medical fees and school fees; ii) primary markets which consist of a collection of indigenous chicken traders who gather at trading centres of small towns. This may also consist of traders who stand at the road sides of major highways to sell their indigenous chickens; iii) secondary markets are mainly located in market centres and consists of large scale traders; iv) urban markets are in central markets of major cities and towns such as Gulu and Lira. Traders in this market sell to hotels, restaurants and consumers (Foy and Kezala, 2017). In all these markets, indigenous chickens are favored because they are believed to be tastier and free of antibiotics, hormones and other harmful chemicals when compared with the exotic chickens (Mlozi *et al.*, 2003). In addition, their meat and eggs are generally preferred to those from commercial birds, by both rural and urban communities because of their taste, leanness, pigmentation and suitability for special dishes (Ssewanyana *et al.*, 2001; FAO, 2010). These varied benefits of indigenous

chickens offer it a huge market in both rural and urban markets. Traditionally indigenous chickens were occasionally sold when there was need for money by a farmer although currently, it is gaining a commercial status. The economic strength of the indigenous chickens lies in the low cost of production when compared to the value of the outputs. The low cost is due to use of family labor and free-range system. For this reason, Mlozi *et al.* (2003), assumed that almost all revenue obtained from indigenous chicken sales were profits. There is however a possibility that commercialization of indigenous chickens could be a viable and profitable agri-enterprise for a number of small holder farmers (Natukunda *et al.*, 2011).

According to (Rhodes, 2008), profitability is a fundamental factor contributing to the successful operation of a farm business. A commercial enterprise that is not profitable cannot survive in market-oriented production. Higher profits result in increasing income for the farmers. Indigenous chickens have been reported to be very profitable compared to their counterparts, the exotic chickens (Mlozi *et al.*, 2003). This is attributed to their low costs of production and the high demand for their products (Okeno *et al.*, 2011). However, there are various socioeconomic factors that also affect profitability of indigenous chickens and these include age, experience, education level, total average costs, distance to the market and access to extension services (Natukunda *et al.*, 2011; Ayieko *et al.*, 2014).

Although the poultry industry in Uganda is growing, it was not certain to what extent the indigenous chicken industry has been able to grow in terms of its commercial aspects. This study aimed at filling the commercialization gap by providing information regarding the extent to which indigenous chicken has been commercialized and to what extent it is profitable.

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1.2. Problem statement

There has been recognition of indigenous chicken production as an avenue to improve livelihoods and eradicate poverty in the rural households of Northern Uganda, where they provide meat, eggs and income (Nakkazi *et al.*, 2014). Small scale indigenous chicken rearing exhibits low production cost per bird and supports the landless due to low costs and minimal skills required (Okeno *et al.*, 2011). Transforming its production from subsistence to commercial levels will improve food security and income in poor rural households (Kyarisiima *et al.*, 2004). Additionally, it will meet unmet market demand for poultry and poultry products (Ondwasy *et al.*, 2006). However, few studies show the driving factors for smallholder farmers to commercialize their production. Although studies from elsewhere show that commercial indigenous chicken production is profitable (Ayieko *et al.*, 2014; Oladeebo and Ojo, 2012; Natukunda *et al.*, 2011; Menge *et al.*, 2005), it's profitability in Omoro and Oyam districts of Northern Uganda have not been explicitly demonstrated. Currently, limited information exists on the characteristics of indigenous chicken farmers and current level of commercialization of indigenous chickens in Omoro and Oyam districts of Northern Uganda. This study provided evidence regarding profitability, farmer characteristics and level of indigenous chicken commercialization in Oyam and Omoro districts of Northern Uganda. Information can be used by farmers and other key stakeholders to make informed decisions regarding commercial indigenous chicken production. This will enable farmers within the region fully exploit the huge business potential in the indigenous chicken enterprise thereby increasing household income and reducing poverty.

1.3. Main objective of the study

The study sought to assess the extent of commercialization and profitability of indigenous chicken production in Omoro and Oyam districts of Northern Uganda.

1.4. Specific objectives of the study

The specific objectives of the study were:

i. To characterize indigenous chicken farmers in Omoro and Oyam districts, Northern Uganda.

ii. To determine the drivers of the level of commercialization of indigenous chicken production in Omoro and Oyam districts, Northern Uganda.

iii. To ascertain the factors of profitability for smallholder indigenous chicken producers in Omoro and Oyam districts, Northern Uganda.

1.5. Research questions

The research questions for the study were:

i. What are the characteristics of indigenous chicken farmers in Omoro and Oyam districts, Northern Uganda?

ii. What are the drivers of the level of commercialization of indigenous chicken production in Omoro and Oyam districts, Northern Uganda?

iii. What are the factors influencing the profitability of indigenous chicken producers in Omoro and Oyam districts, Northern Uganda?

1.6. Significance of the study

For Northern Uganda to effectively benefit from indigenous chicken commercialization, it is vital that farmers understand its commercial trend and profitability (Natukunda *et al.*, 2011). The essence of this study was to popularize the indigenous chicken enterprise for income generation in smallholder households for improved livelihoods. Therefore, the results of the study can help indigenous chicken farmers to make informed decisions regarding transformation of subsistence indigenous chicken production to commercial indigenous chicken production. Sharing this knowledge can result in scaling up of commercial

production of indigenous chickens hence resulting in increased household incomes and standards of living for the rural farmers in Northern Uganda. The findings of this study offer substantial information on current level of commercial indigenous chicken production so that the right kind of interventions can be taken up by the government and other interested stakeholders in the indigenous chicken value chain. The results of the study can also be used by students on attachment to give the right information on economics of indigenous chicken production to farmers they are attached to. The summation of these can enable the commercial small scale indigenous chicken farmers exploit the recent geo-political changes in Southern Sudan which have opened up a potentially huge market for chicken meat and eggs. Besides, the study has contributed to the existing literature on indigenous chicken production as well as provided pointers to areas of further research.

1.7. Scope of the study

The study involved indigenous chicken farmers in Oyam and Omoro districts only. The study focused on two major issues; commercialization and profitability of indigenous chicken production. This involved characterization of the indigenous chicken farmers, analyzing the status and determining factors of commercial indigenous chicken production and determining profitability and its influencing factors for commercializing indigenous chicken producers. Commercialization was expressed in terms of the proportion of indigenous chickens taken to the markets for sale and profitability in terms of the gross margins obtained from sale of these indigenous chickens.

1.8 Definition of terms

Indigenous Chickens: These are the free range (scavenging) local breeds of chickens. They are majorly kept at subsistence level. Indigenous chickens are often associated with good quality eggs and meat flavor, hard egg shells, high dressing percentages and low production costs. These village flocks are mainly kept for subsistence purpose although they are occasionally sold to obtain income for meeting household needs such as medication and school fees. The average weight of indigenous chickens at the time of sale or consumption ranges between 1 kg to 2 kg.

Chicken: Chicken refers to the meat product of the chickens. In this study, indigenous chicken is the meat of indigenous chickens.

Commercialization: This refers to the sale of indigenous chickens produced and its products such as eggs. Therefore in my study, respondents who sold their indigenous chickens to earn income were considered to be involved in commercial indigenous chicken production.

Commercialization level: This refers to the total number of indigenous chickens taken to the market to be sold out of the total chicken produced expressed as a percentage. For example, if a farmer takes 50 chickens out of 100 chickens produced, the farmer's level of commercialization is 50%.

Gross Margin: This is the difference between total revenue obtained from sale of indigenous chicken and its products and variable costs incurred in the chicken production.

Profitability: This is when the indigenous chicken enterprise is in a state of making profits. A profit is the surplus income obtained after variable costs are deducted from total revenue.

CHAPTER TWO

2.0. LITERATURE REVIEW

2.1. Agricultural commercialization

Agricultural commercialization can be looked at in two ways. The first one is that it implies increased market-oriented production. Market orientation refers to the degree of allocation of resources (land, labor and capital) to the production of agricultural produce that are meant for exchange or sale (Immink and Alarcon, 1993). This means that agricultural production decisions are destined for market basing on market signals. Kohli and Jaworski (1990) defined market orientation as 'the organization-wide generation of market intelligence pertaining to current and future customer needs, dissemination of the intelligence across departments, and organization wide responsiveness to it.' This means that a producer uses knowledge about the market in relation to customers and prices as a basis to make decisions on the three basic economic questions of what to produce, how to produce and how to market (Gebremedhin and Jaleta, 2010).

Commercial orientation of smallholder agriculture leads to a gradual decline in real food prices due to increased competition and lower costs in food marketing and processing (Jayne *et al.*, 1995). These changes improve the welfare of smallholder farmers in two ways: for consumers, low food prices increase the purchasing power for food, while for producers a decline in food prices enables the reallocation of limited household incomes to high-value non-food agribusiness sectors and more profitable non-farm enterprises (Omiti *et al.*, 2009). Promoting investments in agricultural commercialization could reduce poverty (Geda *et al.*, 2001). The potential benefits of higher product prices and lower input prices due to commercialization are effectively transmitted to poor households when market access is guaranteed (IFAD, 2001, Omiti *et al.*, 2009).

A study by Natukunda *et al.* (2011) revealed that there is a great potential for development of indigenous chicken production by focusing on market oriented production. It is influenced both by production conditions and market signals. It is commonly measured as the ratio of the percentage value of marketed output to total farm production (Haddad and Bouis, 1990). As the marketed share of agricultural output increases, input utilization decisions and output combinations are progressively guided by profit maximization objectives. This process leads to the systematic substitution of non-traded inputs with purchased inputs, the gradual decline of integrated farming systems, and the emergence of specialized high-value farm enterprises (Omiti *et al.*, 2006). According to Pingali and Rosengrant (1995), there are three levels of agricultural market orientation: subsistence systems, semi-commercial systems and commercial systems. Under subsistence system, the emphasis of production is for household consumption however, the surplus production may be taken to the market as marketable surpluses. The inputs required for production are generated from within the household. In this system, no or minimal expenditures are incurred. For semi-commercial systems, production is for both sale and consumption. Inputs used are both traded and non-traded inputs. Expenditures are incurred in purchase of some traded inputs. For commercial systems, the production is basically for sale and all inputs used are traded inputs. The farmer's objective under the commercial system is profit maximization.

There are various factors that affect market orientation in farming households. Gebremedhin and Jaleta, (2010) studied factors that affect market orientation in Ethiopia and found that household size, labor supply of household, ownership of equine, access to all-weather road, involvement in extension the previous year, rainfall, altitude, and land fragmentation significantly affected market orientation. Household size negatively affected household market orientation due to its effect on increasing household domestic consumption needs. Household labor supply was associated positively with market orientation. Ownership of

equines and proximity to all-weather road encouraged market orientation due to their effect of reducing marketing costs, thus improving profitability. While higher rainfall was associated with higher market orientation.

The second aspect of agricultural commercialization can be looked at in terms of market participation. Market participation refers to produce offered for sale and use of purchased inputs (Gebremedhin and Jaleta, 2010). Better output price and market information are key incentives for increased market participation (Alene *et al.*, 2008). As smallholder farmers transition from subsistence production to varying levels of commercialization, there are various factors that influence commercialization and these could enhance commercial smallholder poultry production such as distance to nearest market place and value of production. The potential benefits of higher product prices and lower input prices due to commercialization are effectively transmitted to poor households when market access is guaranteed (IFAD, 2001). Improving market infrastructure by providing more and better markets and making it easier for farmers to access them is also deemed necessary for increasing the level of commercialization, especially in developing countries (Shilpi and Umali-Deininger, 2008). In terms of level of market participation (level of commercialization), for subsistence farmers, the proportion of output sold is less than 25%, for transition (commercializing) farmers, the proportion of output sold is between 25% and 50%. For commercial farmers, the proportion of output sold is above 50% (Demeke and Haji, 2017).

In this study, commercialization was looked at in terms of market participation which is the proportion of indigenous chickens taken to the market to be sold. The level of commercialization is measured as a proportion, which ranges from zero to one. Zero if the farmer does not sell any chickens in the market and one if the farmer sells all the chickens in the market (Von Braun and Kennedy, 1994). The proportion is turned into an index when

multiplied by 100. According to the 2008 World Development Report, if producers sell more than 50 per cent of their agricultural production on the market, they are market-oriented; otherwise they are considered subsistence farmers (World Bank, 2008). Commercialization has been linked to improvement in people's income and welfare (Von Braun and Kennedy, 1994). The process of agricultural commercialization has generally led to an increase in per capita household incomes in some African countries like Malawi, although the greatest benefits have been felt by the better-off households (Omiti *et al.*, 2009). Poor households often sell early in the season when the prices are at their lowest, and buy in the deficit season from the markets when prices are highest. Smallholder farmers in many countries are also experiencing similar price fluctuations including Uganda. Weak institutional frameworks discourage effective involvement in commercial agriculture.

2.2. Determinants of level of commercialization of indigenous chicken production

Level of commercialization refers to the proportion of indigenous chickens taken to the market for sale out of the total indigenous chickens produced by a farmer. Level of commercialization of indigenous chicken production is affected by numerous factors, including socioeconomic factors, institutional factors, market factors and external factors such as political stability of the nation, natural disaster and calamities (Sigei *et al.*, 2014). These factors could have negative and positive effects, which could either improve or cause a decline in the welfare of the actors. Social-economic factors include: age, gender, education, experience, household size. These factors could influence decisions on level of commercialization of indigenous chicken production.

According to Ahlers *et al.* (2009) and Roothaert *et al.* (2011), indigenous chickens in Sub-Saharan Africa are mainly owned and managed by women making it an essential part of female-headed households. Guèye (2003) in Botswana also found out that majority of women had their main occupation as rearing and trade of live chickens and their eggs. Thus being

female could have a significant and positive effect on level of commercialization of indigenous chickens. However, being male could also have a positive effect on level of commercialization since men are more market oriented than women (Sigei *et al.*, 2014).

On the other hand, male headed households are also expected to have a positive impact on level of commercialization because they are more resource endowed than their counterpart females. Jagwe *et al.* (2010) found that, female headed households are more negatively affected by the transaction costs of searching for buyers, contracting and enforcing a sale transaction as opposed to the male headed households. Likewise, female headed households are more likely to be resource constrained hence affecting production of marketable surplus (Guiterrez, 2003).

Ojo (2003) reported that skills acquired in any business are depicted by the number of years of the farmers' experience. This implies that indigenous chicken farmers with longer years in poultry business could be better able to increase their level of commercialization since they have gained some skills and understand the dynamics in the enterprise thus know how to minimize costs and maximize revenue. On the other hand, experience could also have a negative effect on level of commercialization since more experienced farmers think of indigenous chickens on consumption basis and not commercial (Mukiibi-Muka, 1992).

Education is known to play a key role in the adoption of new technologies (Ojo and Ajibefun 2000). This is because it provides necessary managerial skills, strengthens the aptitude to make rational decisions and also widens the scope. Thus education may positively affect level of commercialization because it enhances the skill and ability to utilize market information, which may in turn reduce marketing costs and make it more profitable to participate in the market. Mandal *et al.* (2006) observed that education among farmers is one of the important factors which accelerates growth and development of any enterprise in India. According to Natukunda *et al.* (2011), an educated farmer is more organized and understands better the

production practices in use. Therefore, they are capable of minimizing costs and increasing levels of commercial production hence more profits. On the other hand, being educated may lower level of commercialization since majority of educated people want white collar jobs and are not willing to take up indigenous chicken enterprise as a serious business enterprise.

Age of the household head may have a negative or positive impact on level of commercialization of indigenous chicken production. The positive impact may result from older household heads having accumulated capital and preferential access to credit due to their age and availability of land (Adegbola and Gardebroek, 2007). However, this interpretation is made considering the law of diminishing returns after the mid forties (Luong and Hèbert, 2009). On the other hand, the age impact may be negative in that older households tend to have more dependants causing more consumption, hence lowering proportion of indigenous chickens taken to the market (Ehui *et al.*, 2009). For younger household heads, the age impact may be negative in that young people might have a longer planning horizon and it may be positive because they are more willing to take risks hence they can easily venture in to commercial indigenous chicken production (Zegeye *et al.*, 2001)

Household size of the farming household may also affect level of commercialization. The household size explains the family labor supply for production and household consumption levels (Alene *et al.*, 2008). Positive sign may imply that a larger household provides cheaper labor and produce more output in absolute terms such that the proportion sold remains higher than the proportion consumed. A negative sign on the other hand means that a larger household is likely to consume more output, leaving smaller and decreasing proportion for sale.

Physical resource endowments like ownership of transport and communication equipments have an impact on level of commercialization. Ownership of communication equipments such as mobiles, radios and televisions have a positive impact on the level of commercialization by facilitating marketing information to the farmers. The farmers are able to contact many customers and supply high number of chickens to them thus increasing sales. Ownership of transport equipment such as bicycles, motorcycles and trucks have a positive impact on level of commercialization by reducing the cost of transporting output from the farm to the market (Key *et al.*, 2000). Therefore, farmers are able to transport high number of indigenous chickens with ease to the markets.

Institutional factors like membership in the group, extension service, and infrastructure have an influence on level of commercialization. Poor infrastructure has a negative effect on level of commercialization because the majority of smallholder farmers in developing countries are located in remote areas with poor infrastructure and often fail to participate in the market due to the high transaction costs involved (Goetz, 1992; Makhura *et al.*, 2001; Key *et al.*, 2002). Membership to a group has both positive and negative impacts on level of commercialization. It positively impacts on level of commercialization because it increases household's access to information vital to production and marketing decisions (Olwande and Mathenge, 2012). Poulton *et al.* (2006) argued that belonging to a group, empowers farmers to bargain and negotiate for better trading terms. Additionally, the farmers are able to learn certain vital farming practices such as record keeping that are helpful in analyzing the enterprises. On the other hand, it can negatively impact market participation in case disagreement emerges among group members, distorting marketing decision (Sigei *et al.*, 2014). Extension service is expected to impact positively on level of commercialization because it is through extension services that farmers are able to acquire better skills and knowledge on production and

marketing. Certain services like vaccination and treatment of the chickens are also provided during extension visits which limit mortalities thus farmers are able to have more chickens at the time of sale thus able to sell more.

Market factors such as distance to market, price of chicken, market structures and availability of market information have been found to have mixed effects on level of commercialization of indigenous chickens. Sigei *et al.* (2014) stated that availability of market information like price information enables a farmer decide on proportion of chickens to sell. Poor access to market information results in information-related problem thus farmers make decisions regarding proportion of chickens to sell without prior information hence affecting level of commercialization. Distance from the farm to point of sale has been found in several studies to be a major constraint to level of commercialization. Level of commercialization was found to decrease with increase in the distance between farms and points of sale (Omiti *et al.*, 2009; Sigei *et al.*, 2014). Having looked at how these factors affect level of commercialization elsewhere, this study aims to give effects of certain factors on level of commercialization of indigenous chicken production in Omoro and Oyam districts, Northern Uganda.

2.3. Determinants of profitability of commercial indigenous chicken production

The word profitability has two words embedded in, namely, profit and ability. Profit is the financial benefit realized when the amount of revenue gained from the enterprise exceeds the overall expenses needed to sustain the enterprise. Ability refers to the power of a business entity to earn profits. Therefore, profitability may be defined as the ability of a given investment to earn a return from its use (Tulsian, 2014).

To measure the productivity of capital employed and to measure operational efficiency, profitability analysis is considered as one of the best techniques. Profitability analysis is measured using various methods but in this study, it will be measured using gross margin analysis.

According to a study conducted by (Mlozi *et al.*, 2003; Emuron *et al.*, 2008) majority of chicken traders considered indigenous chickens as most profitable of all the other types of chicken. This is because the consumers were willing to pay more money for the indigenous chickens due to their attributes such as tastiness, being drug free and having vital roles in social-cultural functions, which is not the case with exotic chickens. The basic criterion applied in economics for selecting the level of output that maximizes profit is that marginal cost should be equal to the marginal revenue (Alders, 2004).

A study by Menge *et al.* (2005) used a bio economic model to assess indigenous chicken breeding under different production systems. The results showed that free range system was most profitable, while the confined system was the least profitable. Free range system was more profitable due to the low capital costs such as cheap housing, limited feed expense since chickens scavenged for their own feeds and use of family labor.

Anang *et al.* (2013) also conducted a study on comparing profitability of broiler and layer production and identified constraints to their production in Ghana. Profitability analysis was carried out using the cost, revenue and profit functions to derive total cost, total revenue and total profit respectively. The results showed that both broiler and layer production were profitable in spite of some constraints facing their production. For 1000 layer birds, the average profit per farm was GH¢ 5,928 while for 1000 broiler birds, the average profit per farm was GH¢ 1,053. Although costs incurred in layer production were higher than costs incurred in broiler production, profits obtained from broiler production were also higher than profits from broiler production. Since all these studies show that poultry production is profitable, there could be a high possibility that indigenous chicken production in Omoro and Oyam districts could be profitable.

Natukunda *et al.* (2011) estimated the significance of the factors affecting profitability using a Multiple Linear Regressing Model with the method of Ordinary Least Squares (OLS). The level of significance of the variables was tested using a t-test at 5% level of significance with gross margin per bird being the dependent variable. They found out that profits were affected by total average costs, distance to the nearest market (km), and access to extension services, education level and experience. Higher average costs result in lower profits obtained since most of the revenue is to pay back expenses incurred in the production. The further the distance is to the market from farm, the lesser the profits obtained since costs are increased due to higher transport costs. Access to extension services increased profitability since farmers that received extension services had more knowledge regarding the enterprise and had gained skills like record keeping. Farmers that had more experience in indigenous chicken production had obtained higher profits. This is because their experiences helped them gain more knowledge and skills in regard to the enterprise and thus were able to manage the enterprise profitably.

Oladeebo and Ojo (2012) assessed the profitability of poultry production in Nigeria using a budgetary analysis and ordinary Least squares regression. They found that profit depended on the scale of production in terms of small and medium scale poultry farms and was significantly affected by veterinary costs. The medium scale poultry egg farmers had higher return on investment (ROI) than their small scale counterparts due to economies of scale and minimized operating costs.

Another study done by Ayieko *et al.* (2014) on profitability of indigenous chickens in Makueni County, Kenya found out that indigenous chickens are profitable and socioeconomic factors such as age, education, flock size and experience do affect the amount of profits obtained. The age of the household head had a positive significant effect on profitability, an increase in the age of household head by one year increased profit by 17%.

The Education level of the household head had a positive significant effect on the profitability of indigenous chickens. The increase in profit may have been due to the ability of educated house hold heads to interpret and use cost effective production techniques. The flock size had a positive and significant effect on the profitability of indigenous chickens. The increase in flock size may have led to an increase in profit due to economies of scale. Therefore, profitability of indigenous chickens may be affected by factors such as age, flock size, proportion of chickens sold, group involvement, marital status and access to chicken related information.

The proportion of livestock including indigenous chickens taken for sale has positive effects on profitability of indigenous chickens. This could be due to economies of scale enjoyed in transporting and selling larger numbers of chickens (Bongani, 2013; Ayieko *et al.*, 2014; Nabikyu and Kugonza, 2016). Being married has both positive and negative effects on profitability of indigenous chickens. According to Oladeebo and Ambe-Lamidi, (2007), being married positively affects profitability since farmers would be more relatively stable in their places of agricultural production than their single counterparts and this stability can enhance poultry production hence profits. On the other hand, it could negatively affect profitability since being married also comes with a host of responsibility of looking after the family hence increased consumption of chickens produced.

Involvement in a group like farmer group, savings group may be positively related to profitability of indigenous chickens. This could be explained by benefits that accrue through group involvement like lessons learnt from experienced group members on production, collective marketing and how to increase profits. Additionally, these saving groups are taught basic economic principles such as record keeping, minimizing expenses and maximizing profits in different enterprises. Ayieko *et al.* (2014) found that number of years spent in a group by a farmer increases profitability of indigenous chickens. Group membership also

positively impacts profitability because it increases a household's access to information vital to production and marketing decisions which in turn affects profits obtained (Sigei *et al.*, 2014).

Market proximity or nearness was found by several studies (Omiti *et al.*, 2009; Natukunda *et al.*, 2011; Sigei *et al.*, 2014) to have positive impact on profitability of indigenous chicken production due to the fact that transport costs are minimized which is a huge cost that affects profits. Transport of live chickens to distant markets is expensive due to costs incurred in transportation therefore, the nearer the market from farm, the higher the profits obtained due to the reduced transportation costs.

Access to information by farmers in regard to indigenous chicken production, disease management and marketing was found to be positively and significantly affecting profitability of indigenous chickens. Information such as pricing information plays a crucial role of informing farmers on pricing conditions (Sigei *et al.*, 2014). Therefore, farmers with this information are likely to sell their chickens when prices are higher enabling them obtain higher profits thus positively affecting profitability.

Access to extension services may positively affect profits from sales of indigenous chickens. This is because the more farmers access the extension services such as training, the more knowledge he acquires regarding better methods of production. Hence fewer errors are made in production compared to a farmer who does not get extension services (Natukunda *et al.*, 2011, Sigei *et al.*, 2014). Additionally, extension services such as vaccination and treatment of the chickens ensures reduced mortality hence high numbers of chickens are taken for sales which increases profitability.

Education level may also positively affect profitability of indigenous chickens. This is plausible because an educated farmer is more organized and understands better the

production practices in use. They are capable of minimizing costs and increasing levels of production, thus more profits (Natukunda *et al.*, 2011).

Conclusively, there seems to be no consensus on what influences commercialization and profitability of indigenous chicken production particularly within Northern Uganda. The factors seem to vary from region to region, sometimes with mixed effects. Therefore, this research sought to give clarity to these specific factors.

2.4. Conceptual framework

The conceptual framework in Figure 1 illustrates the interrelationships in the study, the key variables involved and how they are interrelated. The direction of the arrows illustrates the cause-effect relationship. Socioeconomic characteristics are the background factors like (age, education level, experience, gender, household income, occupation, and household income), institutional factors like (group marketing, access to extension service, and road infrastructure) and market factors like (prices of output, price information, marketing experience, and distance to the market) have an influence on profitability and level of commercialization. Level of profitability in turn determines the level of commercialization. Both profitability and extent of commercialization are affected by factors such as socioeconomic, institutional and market factors. Higher profits result in increasing incomes and thereby lead to a sustainable improvement in the livelihoods of the farmers. An enterprise that is not profitable cannot survive in market-oriented production.

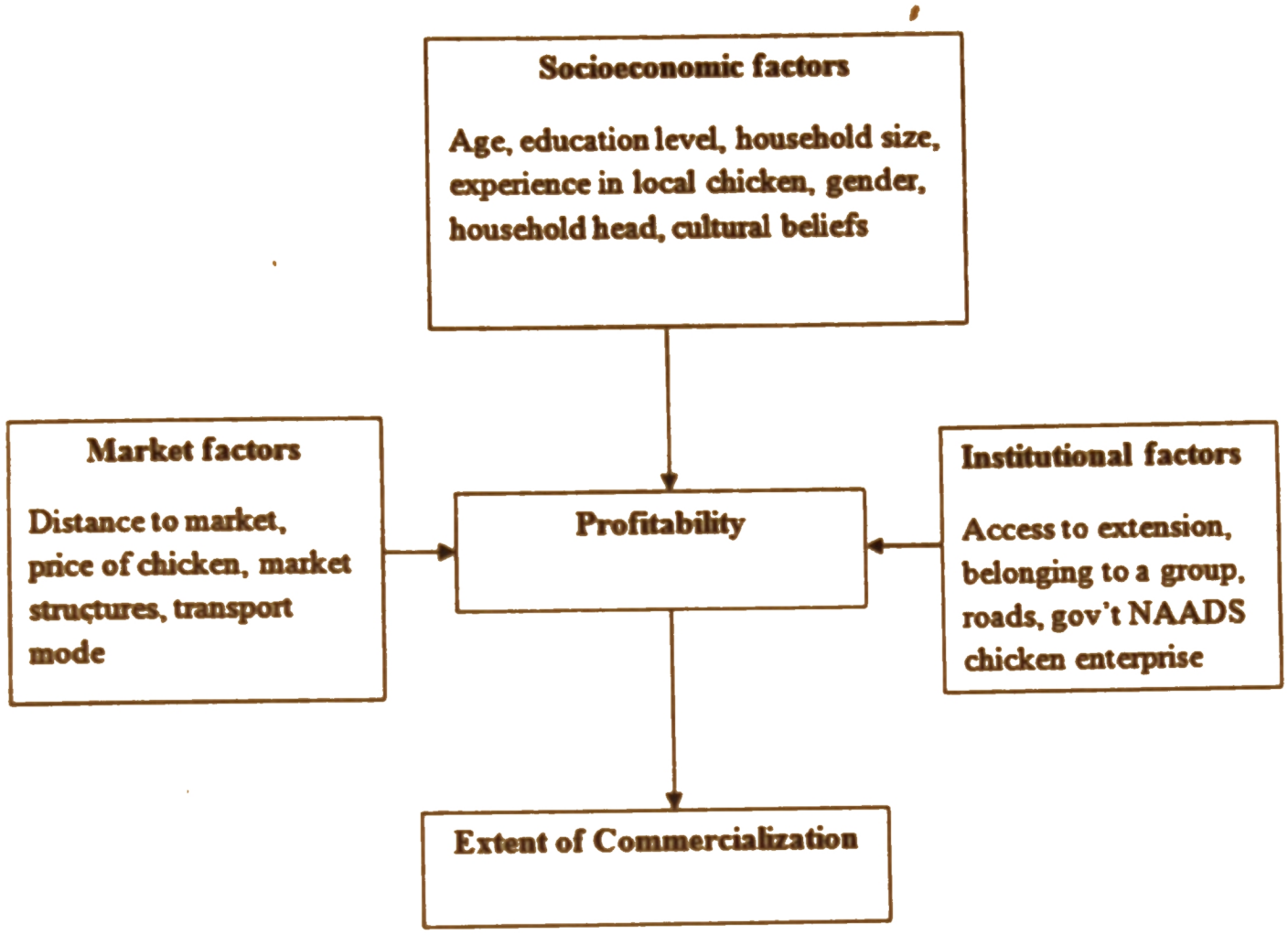

Figure 1: A conceptual framework of the linkage among market, socioeconomic and institutional factors and profitability and level of commercialization. Adapted from Sigei *et al.* (2014)

CHAPTER THREE

3.0. METHODOLOGY

3.1. Study areas

This study was conducted in Omoro (Bobi and Lalogi sub-counties) and Oyam (Loro and Minakulu sub-counties) districts of Northern Uganda. The two districts are ECOPROMALI (Enhancing Commercial Production and Marketing of Local Chickens in Northern Uganda through Innovation Platforms) project areas. Major reasons for the choice of these districts are the fact that they possess vast numbers of indigenous chickens and the potential to exploit the current South Sudan market (Nakazzi *et al.*, 2014).

Omoro district is a newly created district but initially, it was a county in Gulu district. The district headquarter is located in Omoro town council. Omoro district is bordered by Gulu district to the north, Oyam district to the south, Pader district to the east and Nwoya District to the west. The district consists of six sub-counties: Odek, Lalogi, Lakwana, Bobi, Koro and Ongako sub-counties and one town council which is Omoro town council. Omoro district has a total land area of 1,581 km^2 and a total population of 165,642 people in 2014 with an annual growth rate of 3.3 percent and population density is at 105 persons per Km^2. The average total rainfall received is 1,500 mm per annum with the monthly average rainfall varying between 1.4 mm in January and 230 mm in August. The climate consists of dry and wet seasons. Normally the wet season extends from April to November with the highest peaks during May, August and October, while the dry season begins in November up to March. The average maximum temperature is $30^{O}C$ and the average minimum temperature is $18^{O}C$. Relative humidity is high during the wet season and low in the dry season. The major activity in the rural areas is production of crops and livestock (UNFPA and UBOS, 2013) (Appendix 1).

Oyam District is located in Northern Uganda, situated between latitudes 2° N and 2°7' N and longitudes 32°2' E and 32°10' E. The district covers a total area of approximately 2,207 km. The district is made up of seven sub-counties comprised of 39 parishes and 810 villages and one town council. The climate consists of wet and dry seasons. The annual rainfall ranges from 1200-1600mm. The average minimum and maximum temperatures are 17°C and 29°C, respectively (Oyam, 2008).The total number of households is 77435 as of 2014 with average household size of 5.0 and current population growth rate of 3.07% (UBOS 2014) (Appendix 2).

3.2. Research Design

A cross-sectional research design using household survey was carried out to collect both qualitative and quantitative data. This research design was chosen because it required going to the households for the interview only once during the entire study. Therefore, there was no follow up study that was done hence it was time saving and inexpensive in terms of resources yet the design allowed collection of large amounts of data at one point in time (Odiya, 2009).

3.3. Study population

Because the study focused on characterizing indigenous chicken farmers, level and profitability of commercial indigenous chicken production, the main target population of the study constituted indigenous chicken farmers in the study areas. The unit of analysis for the study was the household since it enabled capturing a range of socio-economic characteristics at that level.

The study sample was obtained from the purposively selected sub-counties; Bobi and Lalogi in Omoro district and Loro and Minakulu in Oyam district. The sub-counties were chosen because they ranked highest in terms of number of indigenous chickens. On this basis therefore, the respondents were randomly selected from a sample frame of indigenous

chicken farming households that sell their chickens at least once a year regardless of the number sold and at least have a one year experience in indigenous chicken production.

3.4. Sampling techniques

3.4.1. Sampling procedure

Purposive and random sampling techniques were used. Since indigenous chicken production was the main criteria for selection of farmers, purposive sampling was used to select sub-counties with high indigenous chickens reared. Therefore, two sub-counties were purposively chosen per district. The sub-counties were chosen basing on the high number of indigenous chickens in each. In Omoro district, Bobi and Lalogi sub-counties had the highest number of indigenous chickens compared to the other sub-counties. In Oyam district, Loro and Minakulu sub-counties had the highest number of indigenous chickens compared to the other sub-counties (Table 3).

Table 3: Number of indigenous chickens in Omoro and Oyam districts in 2015

District	Sub-county	2015
Omoro	Bobi	85,615
Omoro	Lalogi	93,146
Oyam	Loro	129,256
Oyam	Minakulu	89,130

Source: Database of District Veterinary Offices of Omoro and Oyam districts (2015)

A multi-stage sampling procedure was used to select the respondents. From each sub-county, two parishes were randomly selected for the study to give a total of eight parishes. A village was randomly chosen from each parish giving a total of eight villages. The indigenous chicken households were randomly selected from the selected villages. From each village, 23 indigenous chicken households were randomly selected for the study. This gave a total of 180 respondents that were included in the study (Figure 2 and 3).

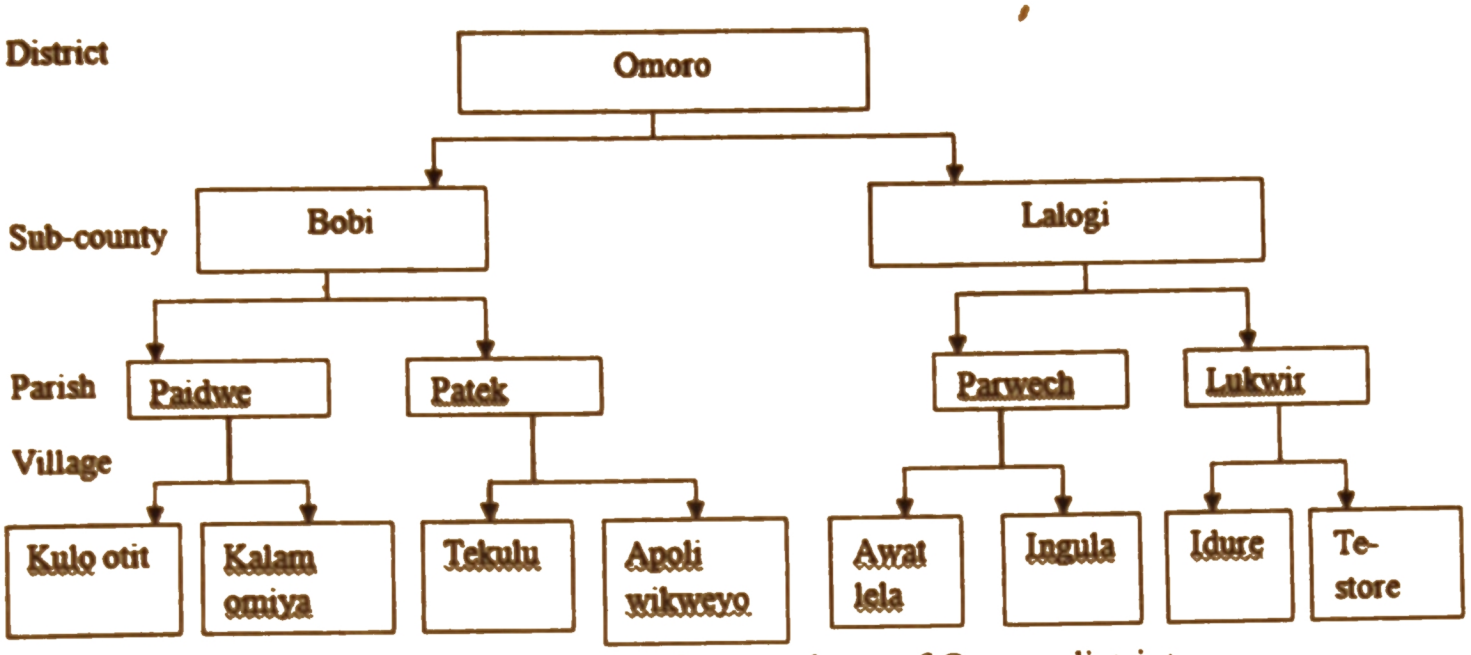

Figure 2: Multi-stage sampling procedure of respondents of Omoro district

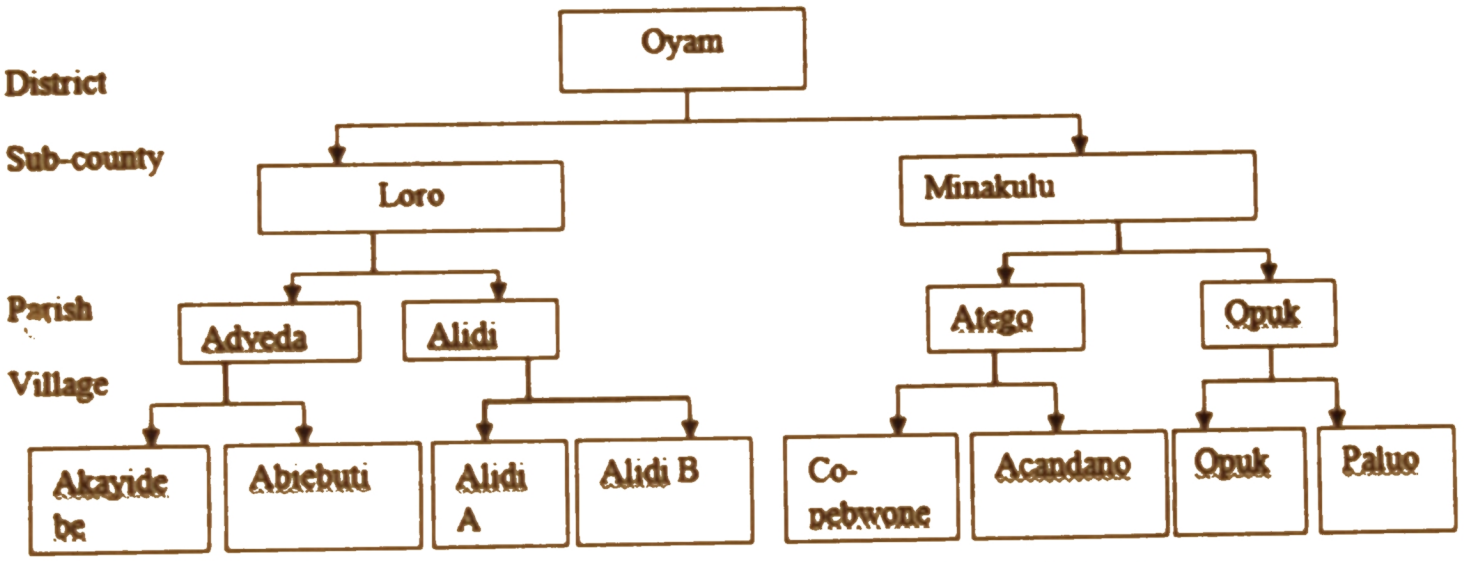

Figure 3: Multi-stage sampling procedure of respondents of Oyam district

3.4.2. Sample size determination

The sample size for this study was determined using the formula by Krejcie and Morgan (1970)

$$s = x^2NP(1-P) \div d^2(N-1) + x^2P(1-P)$$

Where:

s = required sample size

X^2 = table value of Chi-square (0.05 = 3.84)

N = Population size

P = Population proportion (assumed to be 0.50)

d = Degree of accuracy (expressed as a proportion of farmers keeping indigenous chickens),

Basing on the Krejcie and Morgan table of sample size, from a sampling frame of 340 farming households keeping and selling indigenous chickens, a sample size of 181 was obtained. However in this study, a sample size of 180 was used in order to have equal numbers of respondents from the two study areas, Omoro and Oyam districts. The sampling frame was obtained from the local council leaders of the study areas **(Krejcie and Morgan table is found in appendix 15).**

3.5. Data collection techniques

Researcher administered pre-tested questionnaires were used to collect primary data from farmers. Secondary data were obtained from District Agricultural and Veterinary Offices and Uganda Bureau of Statistics (UBOS). Data were collected on the respondent's background, local poultry enterprise, and indigenous chickens, level of commercialization and profitability of commercial indigenous chicken production.

3.6. Data quality control

3.6.1. Validity

This study used content validity which is the degree to which data collected using particular instruments represents content of a particular concept. Content validity is determined primarily by judgment and intuition. It is determined using a panel of persons which in this study were my supervisors. To ensure content validity of the research instruments, the researcher constructed the instruments with all the items that measure variables of the study.

The researcher also consulted supervisors for proper guidance after which the researcher pre-tested the instruments and then removed ambiguous questions and made them simpler (Odiya, 2009).

3.7. Ethical consideration

The study first of all obtained ethical clearance from the ethics committee of Gulu University before conducting the survey. Permission to gain entry to the study areas was also asked from the local area leaders within. The consent of individual households expected to participate in the study was also sought before they were interviewed. The researcher also ensured that the identity of the respondents was kept confidential and the information obtained was used specifically for study purpose only.

3.8. Data analysis methods

Data from the farmer survey were entered, coded, cleaned and transformed using statistical package for social Sciences (SPSS) version 20 and analyzed using STATA version 13. The STATA version was used to do the descriptive and regression analyses.

3.8.1. Characterization of commercial indigenous chicken producers in Omoro and Oyam districts

For objective one, descriptive analyses consisting of frequency distributions and summary statistics (means, Chi square and t-tests) were generated using STATA. This enabled describing the characteristics of the indigenous chicken farmers. Comparison of categorical variables such as sex, household head, marital status and access to extension and information was done across districts using chi square test. Comparison of numerical variables such as age, level of education in years, household size, flock size and experience in indigenous chicken production was performed across districts using independent t-tests. Levels of

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commercialization were compared with characteristics such as household size, group membership involvement, land sizes and flock sizes.

3.8.2. Analysis on level of commercialization of indigenous chicken production

Theoretical model:

In order to achieve objective two, level of commercialization was measured using Market Index (MI) which looks at the proportion of indigenous chickens sold out of the total indigenous chickens produced by a given household in one year (Osmani *et al.*, 2014).

There are diverse methods for estimating the level of commercialization and indicators that are also used for measuring the level of commercialization (Randolph, 1992). Majority of earlier studies of smallholder commercialization measure the level of commercialization in terms of the proportion of output sold in markets (Osmani *et al.*, 2014). A value of zero would imply a totally subsistence oriented household and the value of the index closer to 100 means the higher degree of commercialization (Leavy and Poulton, 2007). Also the degree of farmers' participation in output markets could be measured either in terms of the proportion of output sold by the market index or the total value of output sold (Gebreselassie and Sharp, 2008, Osmani *et al.*, 2014). In measuring household-specific level of commercialization, Govereh *et al.* (1999), Strasberg *et al.* (1999) and Osmani *et al.* (2014) used a household commercialization index (HCI), which is a ratio of the gross value of all output sales per household per year to the gross value of all output.

Thus, in measuring the levels of commercialization for indigenous chicken farmers in Omoro and Oyam districts, a market index was used as per Govereh *et al.* (1999), Strasberg *et al.* (1999) and Osmani *et al.* (2014). The market index (MI) was formulated in the following way:

$$MI_i = \frac{\textit{Gross value of indigenous chicken sales by ith household in year j}}{\textit{Gross value of all indigenous chickens produced by ith household in year j}} X\ 100\% \ldots\ldots 1$$

Where, MI_i refers to the extent of ith household's commercialization level. This index measures the ratio of the gross value of indigenous chicken sales by ith household in year j to the gross value of all indigenous chickens produced by the same household in the same year. That is, it measures the degree to which a household sells its indigenous chickens to the market. If the index is zero, it would signify a totally subsistence oriented household and if the index is 100, it would signify the higher degree of commercialization.

Farmer participation in the output or input market (commercialization) is to a great extent estimated by the Tobit regression method (Strasberg *et al.*, 1999). The Tobit model is used in analysis when data for the dependent variable is censored at lower and upper limits (Gujarati and Porter, 2008). The Tobit model is used to quantify the magnitude and direction of effects of factors influencing level of commercialization (Martey *et al.*, 2012).

The study used a Tobit regression model to analyze factors affecting the level of commercialization. This model was used due to the fact that commercialization level has both lower and upper limits (commercialization level values range from 0-1) and using the probit model would limit detailed measure of level of commercialization since only two binary variables are used. The level of commercialization per household was measured as a proportion of the number of indigenous chickens marketed to the total annual production. Scholars that have used the Tobit model on commercialization studies include (Gebremedhin and Jaleta, 2010; Martey *et al.*, 2012).

Following Wooldridge (2003) and Cameron and Trivedi (2005), the Tobit regression was specified as below:

$$Y^* = x_i \beta + \mu_i \ldots\ldots\ldots\ldots\ldots 2$$

Where:

Y^* is the dependent variable which is the level of commercialization. It is a continuous variable with normal distribution over strictly positive values.

X_i is a vector of independent variables that have potential influence on the dependent variable;

β is a vector of parameters to be estimated by the Tobit model, while μ_i is an error term which is assumed to be independent and identically distributed.

Empirical model:

The model was modified for analysis of level of commercialization as below:

$$C_{ij}^{*} = X_{ij}\beta + \mu_i \ldots\ldots\ldots\ldots\ldots\ldots 3$$

Where:

$C_{ij} = 0$ if $C_{ij} < 0$

$C_{ij} = C^{*}_{ij}$ if $0 \leq C^{*}_{ij} \leq 1$

$C_{ij} = 1$ if $C_{ij} > 1$

C_{ij} is a latent variable representing commercialization level scores of households keeping j^{th} number of chickens. These commercialization scores take on a minimum number of zero and a maximum number of one. X_{ij} is a vector of explanatory variables which affect level of commercialization of indigenous chickens for the i^{th} indigenous chicken farmer. These include age, number of school going children, access to poultry extension services, number of cattle owned, belonging to a group, transport hire, sale at market place, husband's decision to sell indigenous chickens and indigenous chicken flock size. β is a vector of parameters to be

estimated associated with commercial indigenous chicken production. These parameters of the Tobit model were estimated using the method of maximum likelihood (MML) in STATA version 13 (Table 4).

Multicollinearity, omitted variable test, covariance matrix of coefficients and variance inflationary factor were performed on the model. The results of these tests turned out negative for multicollinearity, omitted variables and variance inflationary factor implying that the model and variables chosen were adequate.

Table 4: Description of variables in the Tobit model

Variable	Description	Apriori signs	Citations
(X_1)	Age of respondent in years	+/-	Sigei *et al.* (2014); Martey *et al.* (2012), Omiti *et al.* (2009)
(X_2)	Number of school going children	+	Cassian, (2013)
(X_3)	Number of cattle owned by household	+	Kugonza *et al.* (2008)
(X_4)	Indigenous chicken flock size	+	Omiti *et al.* (2009), Lubungu *et al.* (2012)
(X_5)	Husband's decision to sell indigenous chickens	+/-	Omiti *et al.* (2009)
(X_6)	Dummy variable with 1 for group involvement and 0 for otherwise	+	Sigei *et al.* (2014), Martey *et al.* (2012)
(X_7)	Dummy variable with 1 for farmer receiving poultry extension service and 0 for otherwise.	+	Sigei *et al.* (2014)
(X_8)	Dummy variable with 1 for sale of chickens at the market and 0 for otherwise	+	Foy and Kezala, (2017)
(X_9)	Dummy variable with 1 for transport hire and 0 for otherwise	-	Omiti *et al.* (2009)

3.8.3. Analysis of profitability and its determinants

For objective three, gross margin analysis was used to determine profits obtained from indigenous chicken sales. The profit function gives the profit (π) when cost is deducted from revenue. The profit, cost and revenue functions are related by the formula

$$\pi_i = R_i - C_i \ldots\ldots\ldots\ldots\ldots 4$$

Where π_i is the profit per farmer per year for the i^{th} household, R_i is the revenue per farmer per year for the i^{th} household and C_i is the cost per farmer per year for the i^{th} household.

The revenues (R) were calculated using the equation:

$$R_i = R_{eggs} + R_{pullets} + R_{cockerels} + R_{cocks} + R_{hens} \ldots\ldots\ldots\ldots 5$$

Where;

Reggs is the revenue from the sale of eggs.

Rpullets is revenue from the sale of pullets.

Rcockerels is the revenue from the sale of cockerels

Rcocks is revenue from the sale of cocks and

R hens is the revenue from the sale of hens.

The revenue function gives the total revenue from the sale of X birds/eggs. Revenue was computed as

$$R_i = PX \ldots\ldots\ldots\ldots\ldots 6$$

Where R is revenue. P is price per bird/egg and X is the number of birds/eggs.

Costs (C) were derived from the following equation:

$$C_i = C_F + C_V + C_M \ldots\ldots\ldots\ldots 7$$

Where;

C_F is the total cost of feeds for the entire flock,

C_F is the total cost of feeds for the entire flock,

C_V is the veterinary costs of vaccination,

C_M is the marketing costs involving transport and market levy costs,

Theoretical formula:

In a multiple linear regression model, the regressand which is the dependent variable depends on two or more explanatory variables known as the regressors (Gujarati & Porter, 2008).

$$Y_i = \alpha + \beta_1 X_1 + \ldots\ldots + \beta_n X_n + U_i \ldots\ldots 8$$

Where;

Y_i is the dependent variable; profitability which was measured in terms of gross margin for the i^{th} household, X_1 to X_n are the explanatory variables (factors affecting profitability), u the Stochastic disturbance term. α is the intercept term and it gives the mean or average effect on Y when all the variables are excluded from the model. The coefficients β_1 and β_n are called the partial regression coefficients.

Empirical formula:

To estimate the significance of determinants of profitability, a multiple linear regressing model was applied using the method of Ordinary Least Squares (OLS). In this study, OLS was adopted since gross margins are continuous (Wooldridge, 2003)). Gross margin per farmer was the dependent variable. The annual gross margin per farmer was obtained by subtracting annual variable costs from annual revenue in Uganda shillings. Independent variables included sex of respondent, age of household head, bicycle access, group farming, number of extension visits, and family ownership of chickens. A constant, α indicates the profit or loss a farmer would make holding other factors constant. The error term, μ was

included in the model to account for other determinants that were not included in the model but could affect the level of profits (Table 5).

The key assumptions that were to be met before use of OLS were; the regression model should be linear in the parameters, the values of the regressors are independent of the error term; for given values of regressors, the mean value of the disturbance u_i is zero, the variance of u_i is constant or homoscedastic and there is no exact collinearity between independent variables.

Multicollinearity, variance inflationary factor and heteroscedasticity tests were performed on the model. The results of the tests turned out negative for multicollinearity and variance inflationary factor implying that the model and variables chosen were adequate. However, heteroscedasticity was positive but corrected using robust regression.

A multiple Linear Regression Model of the determinants of profitability was specified as below:

$$GM = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \mu \ldots 9$$

Where:

GM = Gross margin per farmer (Uganda Shillings)

α = Constant (intercept)

Gross margin was expected to change by a certain factor, β (coefficient) if any of the above variables increased by one unit.

Table 5: Description of variables in the OLS Regression model

Variable	Description	Apriori signs	Citations
(X_1)	Dummy variable with 1 for male and 0 for female	+/-	Dorward *et al.*, (2004); Martey *et al.*, (2012); Sigei *et al.*, (2014)
(X_2)	Age of household head	+/-	Barret *et al.*, (2007)
(X_3)	Dummy variable with 1 for bicycle access and 0 for otherwise	+	Ayieko *et al.*, (2014); Sigei *et al.*, (2014)
(X_4)	Dummy variable with 1 for motorcycle access and 0 for otherwise	+	Ayieko *et al.*, (2014); Sigei *et al.*, (2014)
(X_5)	Dummy variable with 1 for information access and 0 for otherwise	+	Ayieko *et al.*, (2014); Sigei *et al.*, (2014)
X_6)	Dummy variable with 1 for group farming and 0 for otherwise	+	Martey *et al.*, (2012); Sigei *et al.*, (2014)
(X_7)	Number of extension visits	+	Natukunda *et al.*, (2011); Sigei *et al.*, (2014)
(X_8)	Market distance	-	Omiti *et al.*, (2009); Sigei *et al.*, (2014)
(X_9)	Quantity of sunflower sold	+	Omiti *et al.*, (2009)
(X_{10})	Family ownership of chickens	+	Lubungu *et al.*, (2012)

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Socio-economic characteristics of indigenous chicken farmers in Oyam and Omoro districts of northern Uganda

In Table 6, numerical variables that describe the social economic characteristics of the indigenous chicken farmers were compared across districts using independent t-tests. In Table 7, categorical variables used to describe socio economic characteristics of the indigenous chicken farmers were compared across the study districts using chi-square test.

Table 6: *t*-test of socio-economic characteristics of indigenous chicken farmers in Omoro and Oyam districts

Variable	Overall mean N=180	Mean Oyam n=84	Mean Omoro n=96	Mean difference
Household Size	6.84(0.208)	6.29(0.258)	7.31(0.312)	1.015(0.412)***
Number of school going children	3.15(0.178)	2.79(0.223)	3.46(0.268)	0.661(0.354)**
Education(years)	7.97(0.244)	8.56(0.375)	7.47(0.313)	-1.079(0.485)**
Age	42.4(0.990)	40.56(1.315)	44.052(1.443)	3.493(1.973)**
Land size	7.314(0.699)	5.667(0.459)	8.755(1.232)	3.089(1.386)**
Age HH	42.42(0.990)	40.559(1.315)	44.052(1.443)	3.493(1.973)**
Chicken experience	13.54(0.813)	12.44(1.108)	14.51(1.173)	2.082(1.627)

***, ** and * imply coefficients statistically significant at 1, 5 and 10 per cent respectively.

Figures in parentheses are standard errors

Source: Survey data (2017)

Table 7: Chi square of socio-economic characteristics of indigénous chicken farmers in Omoro and Oyam districts, Northern Uganda

Variable	Category	Overall N=180	Omoro n=96	Oyam n=84	Chi-square	p-value
Sex	Female	31.67	33.33	29.76	0.2641	0.607
	Male	68.33	66.67	70.24		
Marital Status	Married	85.0	83.33	86.90	0.9467	0.814
	Unmarried	15.0	16.67	13.10		
Sex HH	Female	13.33	14.58	11.90	0.2782	0.598
	Male	86.67	85.42	88.10		
Group membership	No	27.22	22.92	32.14	1.9249	0.165
	Yes	72.78	77.08	67.86		
Group Savings	No	33.33	27.08	40.48	3.6161*	0.057
	Yes	66.67	72.92	59.52		
Extension Service	No	80	71.87	89.29	8.4877***	0.004
	Yes	20	28.13	10.71		

***, ** and * imply coefficients statistically significant at 1, 5 and 10 per cent respectively.

Source: Survey data (2017)

Majority of the respondents were males accounting for 68.33% of all the respondents. However, there was no significant difference in sex between Omoro and Oyam districts (χ^2=0.2641, p-value=0.607). High percent (86.67%) of the households visited were headed by males. There was also no significant association between household head and district (χ^2 =0.2782, p-value=0.598). This result corresponds to the finding of Njuguna *et al.* (2017) who found that majority of indigenous chicken households in Makueni and Kakamega counties in Kenya were male headed households.

Average age of household head was 42.4 years and there was a significant difference in age of household head between the two districts with household heads in Omoro (44.1years) being significantly ($p<0.05$) older than their counterparts in Oyam (40.6years). This showed that majority of indigenous chicken farming household heads were within the country's economically active age bracket of 20 to 59 years as specified by UBOS (2015). This average

age of household head was slightly lower than the age of household heads (44 years) of indigenous chicken farmers in Makueni County in Kenya (Ayieko *et al.*, 2014).

The mean household size in the study areas was 6.8. Household size was significantly different between the two districts ($p<0.01$) with households in Omoro being larger than those in Oyam. This mean is higher than the Ugandan average (4.7) and the district averages for Oyam (5.0) and Omoro (5.0) (UBOS 2014). This is attributed to the fact that the study concentrated in the rural areas of the two districts where household sizes are usually large. Large household sizes may signify availability of free family labor to be involved in production and marketing of indigenous chickens (Martey *et al.*, 2012).

Average education level was 8.0 years. This implies that majority of the respondents had completed primary level education which takes 7.0 years within the Ugandan Education system (UBOS, 2015). Education level was significantly ($p<0.05$) different between the two districts with farmers in Oyam district being more educated than their counterparts in Omoro district. This result could be attributed to age effect since indigenous chicken farmers in Oyam district were younger than their counterparts in Omoro district implying that the younger generation is more educated than the older generation. The low level of education in rural areas could be attributed to the fact that after primary education, many people resort to agriculture which is the main source of livelihoods in rural areas (Cassian, 2013). On average, three members of each household go to school.

Most of the farmers that participated in the study were married (85.0%) although there was no significant difference in marital status between Omoro and Oyam districts (χ^2 =0.9467, p-value=0.814). This implies that most of the indigenous chicken farmers were relatively stable in their places of residence and would be in better positions to invest in enterprises such as

commercial indigenous chicken production than their single counterparts (Oladeebo and Ambe-Lamidi, (2007).

Mean experience in indigenous chicken production was 13.4 years. There was no significant difference in experience between the two districts however Omoro farmers had more experience than their counterparts in Oyam. This could have been an effect of age given that farmers in Omoro were much older than their counterparts in Oyam since age can be used as a proxy for experience (Martey *et al.*, 2012; Sigei *et al.*, 2014). Therefore older farmers could be having more experience in indigenous chicken production compared to younger farmers.

The mean land size owned by these farmers was 7.31 acres and there was a significant difference ($p<0.05\%$) in land sizes between the two districts whereby land sizes in Omoro district were higher than land sizes in Oyam district. Majority of the land in northern Uganda is customarily owned (Nakazzi *et al.*, 2014). The abundance of land could be due to the low population densities in the districts and inheritance of huge land sizes from ancestors. These large land sizes imply that farmers are able to invest in both crop and livestock production and be able to have surplus production for sales (Martey *et al.*, 2012)

In regard to group involvement, 72.78% of the respondents belonged to a group. There was no significant difference in group involvement between Omoro and Oyam districts (χ^2 =1.9249, p-value=0.165). However, there was significant difference in savings group involvement between Omoro and Oyam districts (χ^2 =3.6161, p-value=0.057). More farmers in Omoro were participating in savings group than those in Oyam. Group involvement enables farmers have access to information vital to production and marketing decisions (Martey *et al.*, 2012, Sigei *et al.*, 2014).

Only 20% of the farmers had received extension services in regard to chicken production. There was a significant difference in receipt of extension services between Omoro and Oyam districts (χ^2 =8.4877, p-value=0.004). There were more farmers in Omoro who had received extension services compared to those in Oyam. This finding is similar to that of Ayieko *et al.* (2014) who found that only 31% of the indigenous chicken farmers had received extension services in Kenya (Table 6 and table 7).

4.1.1. Comparison of level of indigenous chicken commercialization with farmer characteristics

In table 8, indigenous chicken farmers were grouped depending on individual proportion of indigenous chickens taken to the market for sale out of the total number of indigenous chickens produced per year.

Table 8: Level of commercialization of indigenous chicken farmers in Omoro and Oyam districts

	Percent		
Level of commercialization	**Overall**	**Omoro**	**Oyam**
Less than 50%	85	86.46	83.33
Above 50%	15	13.54	16.67

Source: Survey data (2017)

Majority (85%) of the indigenous chicken farmers had less than 50% level of commercialization implying that they sold less than 50% of the total indigenous chickens they produced in a year. Only 15% of the indigenous chicken farmers sold over 50% of the total indigenous chickens they produced. Comparing by district, Omoro district had more farmers selling less than 50% of their indigenous chickens produced compared to their counterparts in Oyam. More farmers in Oyam district were selling more than 50% of their indigenous chickens produced than their counterparts in Omoro district. This means that farmers in Oyam were more commercialized than farmers in Omoro district. Perhaps this

could be explained by many farmers in Oyam taking commercial indigenous chicken production as an important source of income. Overall, this emphasizes the low level of commercialization of indigenous chickens in northern Uganda (Demeke and Haji, 2017) (Table 8).

Table 9 gives the level of commercialization compared with the various farmer characteristics to understand behaviors of farmers in regard to their proportion of indigenous chickens taken to the market. To compare these characteristics with level of commercialization, *t*-tests were done with specific characteristics such as land size, flock size, age of household head and number of school going children.

Table 9: *t*-test to compare level of commercialization and farmer characteristics in Omoro and Oyam districts

Variable	Overall mean (N=180)	Less than 50% (n=153)	Above 50% (n=27)	Mean difference
Number of school going children	3.150(0.178)	3.2418(0.1801)	2.6296(0.4978)	0.6122(0.4978)
Flock size	83.1833(6.0460)	75.3137(5.0726)	127.7778(27.1166)	-52.4641(16.5179)***
Age of household head	42.4222(0.9904)	42.0719(1.315)	44.4074(3.0580)	-2.3355(2.7758)
Land size	7.3139(0.6989)	6.7778(0.4852)	10.3519(3.7688)	-3.5741(1.9444)**

***, ** and * imply coefficients statistically significant at 1, 5 and 10 per cent respectively.

Figures in parentheses are standard errors

Source: Survey data (2017)

Results show that indigenous chicken flock size of a household was found to be significantly ($p<0.05$) higher in households that sold more than 50% of their indigenous chickens compared to households that sold less than 50% of their indigenous chickens. This shows that higher indigenous chicken flock size results in higher level of commercialization. This result is similar to the findings of (Omiti *et al.*, 2009) who found that the quantity of output

produced has a positive significant effect on the proportion of the output sold. This finding also resonates with the findings of (Lubungu *et al.*, 2012) among small holder livestock farmers in Zambia. They found that as livestock size of a household increases, the proportion taken to the market also increases.

Land sizes were significantly ($p<0.01$) larger in farming households that sold more than 50% of their indigenous chickens compared to households that sold less than 50% of the total indigenous chickens produced. This implies that these households have larger land areas to accommodate higher numbers of indigenous chickens. This corresponds to the finding of Gobena *et al.* (2012) who reported that larger land sizes were responsible for larger output produced by farming households. Additionally, land is an asset which can be used to grow supplementary feeds to feed increasing numbers of indigenous chickens to be taken to the market (Nakazzi *et al.*, 2014). The land can also be used to obtain credit to expand commercial indigenous chicken production (Sigei *et al.*, 2014) (Table 9).

4.2. Agricultural production and indigenous chicken flock size

4.2.1. Agricultural production

All the households interviewed were farmers growing crops and keeping livestock. All the crops grown and livestock kept were mainly for consumption and sale. All the farmers were peasant farmers growing little acreage of crops and keeping livestock although they have relatively large acres of land (7.31 acres). Crops grown mainly for consumption were maize, beans, cassava and millet while crops grown mainly for sale were soybeans and sunflower. Majority of the livestock kept were cattle, goats, pigs, sheep and chickens.

The indigenous chickens are kept in a free-range production system. In this system, the chickens are kept in a small-scale and they scavenge for their own feeds with minimal feed supplementation. There is increased risk of exposure of birds to diseases and predators, and

reproduction is entirely based on uncontrolled natural mating and hatching of eggs using broody hens, where there is no or minimum intervention to maximize their production and reproductive performance.

4.2.2. Indigenous chicken flock sizes

Table 10 gives the average annual household flock sizes of indigenous chickens compared across the two study districts.

Table 10: *t*-test of annual flock size of indigenous chickens in Omoro and Oyam districts

Variable	Overall N=180	Omoro n=96	Oyam n=84	Mean diff	p-value
Chicks	35.989(3.356)	41.083(5.709)	30.167(2.950)	10.917(6.697)*	0.0524
Cockerels	14.589(1.171)	15.260(1.812)	13.821(1.424)	1.439(2.351)	0.2706
Pullets	15.206(1.370)	16.594(2.337)	13.619(1.216)	2.975(2.746)	0.1400
Hens	10.017(1.130)	11.365(1.983)	8.476(0.837)	2.888(2.261)	0.1015
Cocks	7.383(0.722)	8.448(1.244)	6.167(0.593)	2.281(1.440)*	0.0577
Overall	83.183(6.046)	92.750(10.230)	75.250(5.412)	20.50(12.055)**	0.0454)

***, ** and * imply coefficients statistically significant at 1, 5 and 10 per cent respectively.

Figures in parentheses are standard errors

Source: Survey data (2017)

Average annual household flock sizes were 83 chickens consisting of 36 chicks, 15 cockerels, 15 pullets, 10 hens and 7 cocks. In Oyam, the average annual flock size was 72 chickens consisting of 30 chicks, 14 cockerels, 14 pullets, 8 hens and 6 cocks while in Omoro, average annual flock size was 93 chickens consisting of 41 chicks, 15 cockerels, 17 pullets, 11 hens and 8 cocks. Flock sizes were significantly ($p<0.05$) different between the two districts with Omoro flock sizes being higher than Oyam flock sizes. These flock sizes are within the flock size range of 3-113 reported by (Ssewanyana *et al.*, 2006). However, they are higher than Ugandan flock size range of 5–40 reported by (Kyarisiima, 2004) and flock size of 32±2 birds per household reported by (Nakazzi *et al.*, 2014) within the same region (Table 10).

4.3. Determinants of level of Commercialization of indigenous chicken production in Omoro and Oyam districts, Northern Uganda

Level of commercialization was determined using market Index (MI) which measures the proportion of indigenous chickens taken to the market for sale and the Tobit model was used to determine factors influencing level of commercialization of indigenous chickens. The variables included in the model were age of respondent, number of school going children, number of cattle owned by household, indigenous chicken flock size, husband's decision to sell indigenous chickens, group involvement, poultry extension service provision, sale of chicken at market places and transport hire.

Multicollinearity, omitted variable test, variance inflationary factor and heteroscedasticity tests were performed on the model. The results of the tests turned out negative implying that the model and variables chosen were adequate. However, heteroscedasticity turned positive implying that the variables do not meet a criteria for normal distribution hence a robust regression was run to correct for it.

4.3.1. Level of commercialization of indigenous chickens and its products

Table 11 gives the level of commercialization as measured by the market index.

Table 11: *t*-tests of levels of commercialization of indigenous chickens and products in Omoro and Oyam districts, northern Uganda

Variable	Overall N=180	Omoro n=96	Oyam n=84	Mean diff.	p-value
Annual egg sales	14.022	4.104	25.357	-21.253*	0.0538
	(6.585)	(3.385)	(13.510)	(13.141)	
Chick proportion sold	0.005	0.009	0	0.009	0.1658
	(0.004)	(0.008)	(0)	(0.009)	
Cockerel proportion sold	0.383	0.361	0.409	-0.049	0.2198
	(0.031)	(0.044)	(0.045)	(0.063)	

Pullet proportion sold	0.352	0.233	0.489	-0.256*	0.0905
	(0.095)	(0.036)	(0.200)	(0.191)	
Hen proportion sold	0.237	0.229	0.247	-0.018	0.3928
	(0.032)	(0.037)	(0.055)	(0.065)	
Cock proportion sold	0.581	0.625	0.530	0.095	0.1762
	(0.051)	(0.077)	(0.064)	(0.102)	
Overall chicken proportion sold	0.312	0.291	0.335	-0.044	0.1878
	(0.025)	(0.024)	(0.045)	(0.049)	

***, ** and * imply coefficients statistically significant at 1, 5 and 10 per cent respectively.

Figures in parentheses are standard errors

Source: Survey data (2017)

Overall annual egg sales on average was 14 eggs with annual egg sales in Oyam district (25 eggs) being significantly higher ($p<0.1$) than annual egg sales in Omoro district (4 eggs). There was very negligible proportion of chicks sold on average (0.5%). Although there were no chick sales in Oyam, there was no significant difference in proportion of chicks sold between Oyam and Omoro districts (0.9%). The chicks are usually left to grow replacing mature chickens sold. The percentage of chickens sold per household was 31.2% on average in Oyam and Omoro districts. In Oyam, the percentage of chickens sold was 33.5% and in Omoro district, the percentage of chickens sold was 29.1%. There was no significant difference in percentage of chickens sold in Omoro and Oyam districts. Average percentage of pullets sold per household was 35.2% of the annual production. However, farmers in Oyam were selling significantly ($p<0.1$) higher numbers of pullets than their counterparts in Omoro. Of the total annual household cockerel production, 38.3% were sold. However, there was no significant difference in cockerel sales between Oyam and Omoro districts. The average percentage of hens sold per household was the least at 23.7% of the total annual production. The level of sale of hens between the two districts was not significantly different. The average percentage of cocks sold per household was the highest at 58.1% of the total annual production. Although households in Omoro were selling more cocks than households in Oyam, this was not significantly different (Table 11).

Majority of indigenous chicken farmers in Omoro and Oyam districts do not sell their indigenous chicken eggs. The eggs are majorly used for reproduction. The trend of chicken sales signifies the importance of cocks and cockerels in generating income. Most farmers prefer selling cocks and cockerels that fetch higher prices as compared to hens and pullets that are preferred for reproduction and household consumption (Mlozi *et al.*, 2003). The level of commercialization (31.2%) reported in this study shows that indigenous chicken farmers in Oyam and Omoro districts are transitioning (commercializing) indigenous chicken farmers (Demeke and Haji, 2017). They are yet to become fully commercialized. This is because this level is below 50% which is the threshold for fully commercialized farmers (World Bank, 2008). The indigenous chicken farmers in Omoro and Oyam districts, northern Uganda are in a transition process from subsistence to commercializing (semi-commercial) which is their current state and then finally to commercial farmers.

4.3.2. Determinants of Commercialization of indigenous chicken production in Omoro and Oyam districts, Northern Uganda

In table 12, a Tobit model was run using the method of Maximum Likelihood to identify factors that significantly affect level of commercialization of indigenous chicken production. The overall model was found to be adequate as shown by the summary statistics. The Prob>F and Prob>chi2 are highly significant. Variables included in the model were age, number of school going children in a household, cattle size, indigenous chicken flock size, group membership, husband's decision to sell chicken, poultry extension services, sale of chicken at markets and transport hire. Six variables (number of school going children in a household, cattle size, flock size, group membership, husband's decision to sell chicken and poultry extension services) were found to significantly affect level of commercialization of indigenous chickens. Multicollinearity, omitted variable test and variance inflationary factor were performed on the model. Post estimation tests were also performed on the model. The

model was controlled for heteroscedasticity using robust standard errors of STATA. Twenty one out of 180 observations were not within the limits specified thus 17 observations were left censored implying that 17 farmers interviewed do not sell their chickens while 4 observations were right censored implying that 4 farmers interviewed sold more chickens than they produced. These observations may have occurred due to failure of farmers to recall their production and marketing statistics.

Table 12: Tobit regression of determinants of indigenous chicken commercialization level

	Tobit		Robust	
Variables	**Coef. (SE)**	**P>|t|**	**Coef. (SE)**	**P>|t|**
Age of respondent	0.0015(0.0013)	0.254	0.0015(0.0017)	0.355
Number of school going children	-0.0153(0.0087)*	0.080	-0.0153(0.0084)*	0.071
Number of cattle owned	0.0112(0.0045)**	0.013	0.0112(0.0044)**	0.012
Indigenous chicken flock size	0.0007(0.0002)***	0.002	0.0007(0.0003)**	0.021
Male's decision to sell chicken	0.0811(0.0446)*	0.070	0.0811(0.0425)*	0.058
Group involvement	0.0734(0.0387)*	0.060	0.0734(0.0398)*	0.067
Poultry extension services	-0.0960(0.0479)**	0.047	-0.0960(0.0479)**	0.046
Selling chicken at markets	0.0279(0.0380)	0.464	0.0279(0.0382)	0.466
Bicycle hire for chicken transport	-0.0660(0.1490)	0.658	-0.0660(0.1256)	0.600
Constant	0.0783(0.0757)	0.302	0.0783(0.0794)	0.325
Log likelihood	-21.5813		-21.5813	
F(9, 171)			2.82	
Prob>F			0.0041	
Prob>chi^2	0.0015			
LR chi^2 (9)	26.78			
Pseudo R_2	0.3829		0.3829	
N	180			
Left censored observations	17			
Uncensored observations	159			
Right censored observations	4			

***, ** and * imply coefficients statistically significant at 1, 5 and 10 per cent respectively.

Figures in parentheses are standard errors

Source: Survey data (2017)

The number of school going children in a household was unexpectedly found to be negatively and significantly ($p<0.1$) affecting level of commercialization of indigenous chicken production. A unit increase in number of school going children in a household decreases level of commercialization by 1.53%. This shows that increase in number of school going children decreases the level of commercialization of indigenous chickens. This negative relationship between number of school going children and level of commercialization was contrary to apriori expectation. Number of school going children was expected to increase level of commercialization. A study conducted by Cassian (2013) in Iringa district, Tanzania showed that many farmers commercialize their food crop production to be able to meet expenditures such as school fees for their children. Thus increase in number of school going children was expected to increase level of commercialization. However, this was not the case in Oyam and Omoro districts as supported by the findings.

The number of cattle possessed by a household was found to be positively and significantly ($p<0.05$) related to indigenous chicken production. A unit increase in number of cattle increases level of commercialization by 1.12%. This could be attributed to barter trade exercised in the Acholi and Lango sub-regions where a bull, cow or heifer can be exchanged with a certain number of chickens. This result is similar to the findings of Kugonza *et al.* (2008) who reported that in Teso sub-region of Uganda, indigenous chickens are usually exchanged for other livestock such as cattle and goats. Thus, increase in number of cattle of a household could be as a result of increase in proportion of indigenous chickens taken to the market for sale. Additionally, FAO, (2009) reported that indigenous chickens are usually exchanged in informal markets for larger animals such as goats and cattle. This also explains why such barter trade results in increased level of indigenous chicken commercialization.

Indigenous chicken flock size of a household was also found to be positively and significantly ($p<0.05$) affecting level of commercialization of indigenous chicken production.

Results show that a unit increase in flock size would result in 0.07% increase in proportion of indigenous chickens marketed. This result is similar to the findings of (Omiti *et al.*, 2009) who found that the quantity of output produced has a positive significant effect on the proportion of the output sold. This finding also resonates with the findings of (Lubungu *et al.*, 2012) among small holder livestock farmers in Zambia. They found that as livestock size of a household increases, the proportion taken to the market also increases. Gebregziabher, (2010) observed a similar effect in market chain analysis in the Tigray region where they found out that flock size positively affected value of poultry sales. This suggests that households with larger indigenous chicken flock sizes are more likely to sell more indigenous chickens than those with smaller flock sizes.

A husband's decision to sell indigenous chickens was found to be positively and significantly ($p<0.05$) associated with level of commercialization of indigenous chicken production. This could be due to the fact that in an African setting, men are usually entitled to ownership of resources in a home so their decisions regarding the resources are always vital and implemented (Omiti *et al.*, 2009). Although women are the ones mainly involved in production, it is predominantly the role of men to decide on sale and other marketing decisions regarding indigenous chickens. This greatly affects the level of commercialization of the indigenous chickens. This could also be attributed to the fact that men are more market oriented compared to women therefore their decisions regarding indigenous chicken production are more likely to favor increase in level of commercialization of indigenous chickens (Martey *et al.*, 2012; Sigei *et al.*, 2014).

Involvement in group activities by farmers such as group marketing, group farming and group savings positively and significantly ($p<0.1$) influenced the level of commercialization of indigenous chickens. The result shows that an increase in group involvement by a farmer increases the level of commercialization of indigenous chickens by 7.34%. Group

involvement such as group marketing enables farmers to pull their resources together and take advantage of economies of scale such as transportation and marketing of larger numbers of chickens as a result of the social capital created. Poulton and Dorward, (2006) argued that belonging to a group empowers farmers to bargain and negotiate for better trading terms thus increasing level of commercialization of indigenous chickens. Additionally, group involvements increases household's access to information vital to production and marketing decisions (Olwande and Mathenge, 2012). Access to reliable information such as market information improves agricultural commercialization (Omiti *et al.*, 2009). This gives farmers a good understanding of market variation in terms of supply, demand and prices hence are able to make informed decisions regarding chicken sales.

Provision of poultry extension services was found to be negatively and significantly ($p<0.05$) affecting level of indigenous chicken commercialization. This negative effect could probably be explained by the fact that in regard to Plan for Modernization of Agriculture (PMA), the focus of agricultural extension has been on training farmers on production and marketing of commercial birds mainly broilers and layers which is an initiative of the government of Uganda. Therefore, extension agents have put major emphasis on commercial birds which has negatively impacted on level of commercialization of indigenous chickens (Table 12).

4.4. Profitability of commercial indigenous chicken production in Omoro and Oyam districts, Northern Uganda

Gross margin analysis was used to determine profits of indigenous chicken sales and OLS regression model was used to analyze factors influencing profitability of indigenous chickens. The variables included in the model were marital status, proportion of indigenous chickens sold, quantity of cereals like millet produced, group savings involvement, access to information on chicken production and marketing and district. Multicollinearity, variance

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inflationary factor and heteroscedasticity tests were performed on the model. The results of the tests turned out negative for multicollinearity and variance inflationary factor implying that the model and variables chosen were adequate. However, heteroscedasticity was positive but corrected using robust regression.

4.4.1 Gross margin, revenues and costs of indigenous chicken production

Table 13 gives the annual gross margins, revenues and costs incurred in indigenous chicken production compared across Omoro and Oyam districts.

Table 13: Comparing annual gross margins, revenues and costs of indigenous chicken production across districts

Variable	Overall mean (N=180)	Mean Oyam (n=84)	Mean Omoro (n=96)	Mean difference
Total revenue	266482.2 (365370)	235511.9 (42231.4)	293581.3 (57760.2)	58069.4 (73313.22)
Variable Cost	144255.8 (37154.7)	199958.4 (77893.1)	95516.2 (13607.5)	-104442.2 (74272.63)*
Gross Margin	118704.2 (45490.5)	31232.1 (78040.9)	195242.2 (50227.9)	164010.1 (90609.49)**

***, ** and * imply coefficients statistically significant at 1, 5 and 10 per cent respectively.

Figures in parentheses are standard errors

Source: Survey data (2017)

On average, the overall total revenue obtained annually by a household was 266,482.2 Uganda shillings (Ugx) ($ 76.14). There was no significant difference between total revenue obtained by farmers in Oyam and those of Omoro. The overall mean variable cost incurred by each household was 144,255.8 Ugx ($ 41.23). Variable cost incurred was significantly ($p<0.1$) different between famers in Oyam and Omoro districts. Average gross margin was 118,704 Ugx ($ 33.92) and was significantly ($p<0.05$) different between Oyam and Omoro districts (Table 13).

Generally, commercial indigenous chicken production was profitable although profits obtained in Omoro district were significantly ($p<0.05$) much higher than profits obtained in Oyam district. This difference could be attributed to the fact that Omoro district is nearer to Gulu town where chicken prices are much higher compared to prices in Omoro and Oyam districts. This is consistent with (Tung and Costales, 2007) who emphasized that geographical location largely affects market access in relation to main market centres. Access to main market centres which offer better and higher prices for indigenous chickens increases the gross margins obtained from sale of the chickens. This finding is also related to the findings of Abeykoon *et al.* (2013) where value of poultry sales differed among villages in Sri Lanka. They argued that high market accessibility might be a reason for more sales in particular villages.

4.4.2 Factors affecting profitability of commercial indigenous chicken production in Omoro and Oyam districts, Northern Uganda

A multi-linear regression was run using the method of Ordinary Least Squares (OLS) to identify factors that significantly affect profitability of commercial indigenous chicken production. The gross margin was transformed using logarithmical transformation for the purpose of normal distribution. The overall model was found to be adequate as shown by the summary statistics. The F statistics were found to be highly significant ($p<0.01$). Six variables (sex, age of household head, bicycle access, group farming involvement, number of extension visits and family ownership of chickens) were found to significantly affect profitability of commercial indigenous chicken production as presented in table 14.

Table 14: OLS regression of determinants of profitability of indigenous chickens

	OLS		Robust	
Variables	**Coef. (SE)**	**P>|t|**	**Coef. (SE)**	**P>|t|**
Sex	1.662(0.795)**	0.038	1.662(0.844)*	0.050
Age of household head squared	-0.001(0.000)*	0.061	-0.001(0.000)*	0.094
Bicycle access	4.920(2.780)*	0.079	4.920(1.262)***	0.000
Motorcycle access	1.934(1.404)	0.170	1.934(1.316)	0.143
Access to chicken information	-2.157(1.444)	0.137	-2.156(1.547)	0.165
Group farming involvement	1.673(0.952)*	0.081	1.673(0.873)*	0.057
Number of extension visits	0.300(0.153)*	0.052	0.300(0.086)***	0.001
Ln_Market distance	-0.091(0.467)	0.846	-0.091(0.446)	0.838
Quantity of sunflower sold	0.003(0.003)	0.287	0.003(0.002)	0.128
Family ownership of chickens	2.325(1.015)**	0.023	2.325(0.841)***	0.006
Constant	7.662(1.062)***	0.000	7.662(1.141)***	0.000
F(10, 169)	2.47		4.12	
Prob>F	0.0086		0.0000	
N	180		180	
R^2	0.1277		0.1277	
Adjusted R^2	0.0761			
Root MSE	4.7208		4.7208	

***, ** and * imply coefficients statistically significant at 1, 5 and 10 per cent respectively. Figures in parentheses are standard errors.

Source: Survey data (2017)

Sex of the respondent significantly ($p<0.1$) and positively influenced profitability of commercial indigenous chicken production. Being male increased the gross margin of indigenous chicken sales by 1.662 keeping all other factors constant. Men are believed to have strong bargaining power which in turn increases the proportion of indigenous chicken sales and gross margin. The result is consistent with that of Cunningham *et al.* (2008) who argued that men are likely to sell more and obtain higher gross margins due to their acumen in bargaining, negotiating and enforcing contracts. This argument was also advanced by Dorward *et al.* (2004) who concluded that the discriminatory tendencies against women tend to weaken their negotiation prowess and therefore making them less influential in agro-commodity trade. Although women are the ones mainly involved in production, it is

predominantly the role of men to market indigenous chickens. This is attributed to the fact that men are more market oriented compared to women hence are able to market more and better resulting in higher gross margins which turn favors profitability (Martey *et al.*, 2012; Sigei *et al.*, 2014).

Age of household head significantly ($p<0.1$) and negatively affected profitability of commercial indigenous chicken production. Increase in age decreased profitability of commercial indigenous chicken production by 0.001 keeping all other factors constant. This implies that younger household heads are more enthusiastic to participate in indigenous chicken sales hence obtain higher gross margins compared to their older counterparts. Barret *et al.* (2007) stated that younger people participated more in the market because they are more receptive to new ideas and are less risk averse than the older people thereby obtaining higher gross margins thus increased profitability.

Access to bicycles for transportation of indigenous chickens for sale was found to significantly ($p<0.01$) and positively influence profitability of commercial indigenous chicken production. This result showed that an increase in bicycle access by one bicycle increases gross margin by 4.920. Bicycle access plays a crucial role in boosting the number of indigenous chickens transported to the market which in turn brings about higher gross margins. Additionally, bicycle access lowers the cost of transportation which would be higher in case vehicles or motorcycles were used for transportation thus minimizing costs hence higher gross margins and profitability. The finding concurs with the study by Jagwe (2010) on the impact of transaction cost on the participation of smallholder farmers and intermediaries in the banana market of Burundi, Rwanda and Democratic Republic of Congo who found the ownership of bicycle to increase the banana sales. Therefore, reduced transport cost minimizes costs incurred and maximizes gross margins hence higher

profitability. This finding is similar to findings elsewhere (Omiti *et al.*, 2009; Natukunda *et al.*, 2011; Ayieko *et al.*, 2014; Sigei *et al.*, 2014).

Involvement in a group especially farming group was found to be positively and significantly ($p<0.1$) related to profitability of indigenous chickens. This could be explained by benefits that accrue through group involvement like lessons learnt from experienced group members on production, collective marketing and how to increase profits. Farming group involvement results in creation of social capital among the farmers which enables them work together in unity to achieve a common goal. Additionally, these groups are taught basic economic principles such as record keeping, minimizing expenses and maximizing profits in different enterprises by certain Non-Governmental Organizations (NGO's). This is consistent with Ayieko *et al.* (2014) who found that number of years spent in a group by a farmer increases profitability of indigenous chicken. Group membership also positively impacts profitability because it increases a household's access to information vital to production and marketing decisions which in turn affects profits obtained (Martey *et al.*, 2012; Sigei *et al.*, 2014).

Numbers of extension visits positively and significantly ($p<0.01$) affected profitability of commercial indigenous chicken production. The higher the number of extension visits per household, the higher the gross margins hence increased profitability. This is because the more farmers access the extension services such as training, the more knowledge he acquires regarding better methods of production. Hence fewer errors are made in production and marketing compared to a farmer who does not get extension services (Natukunda *et al.*, 2011, Sigei *et al.*, 2014). Additionally, extension services such as vaccination and treatment of the chickens ensures reduced mortality hence high numbers of chickens are taken for sales which increases profitability.

Family ownership of indigenous chickens was found to significantly ($p<0.01$) and positively affect profitability of commercial indigenous chicken production. This is because if every

household member is entitled to ownership of a certain number of indigenous chickens, the overall number of indigenous chickens in the household's pool is likely to be high resulting in many indigenous chickens taken to the market for sale hence higher gross margins which translate to high profitability. This finding also resonates with the findings of (Lubungu *et al.*, 2012) among small holder livestock farmers in Zambia. They found that as livestock size of a household increases, the proportion taken to the market also increases which in turn increases the gross margins. Gebregziabher, (2010) observed a similar effect in market chain analysis in the Tigray region where they found out that flock size positively affected value of poultry sales. This suggests that households with larger indigenous chicken flock sizes are more likely to sell more indigenous chickens thereby obtaining higher gross margins hence increasing profitability of commercial indigenous chicken production and marketing (Table 14).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Enhancing commercial indigenous chicken production entails increasing level of commercialization in terms of proportion of indigenous chickens taken to the market for sale as well as finding strategies to maximize profits. However, limited literature was available on extent of indigenous chicken commercialization and its profitability determinants for Oyam and Omoro districts. This study was an attempt to fill this gap of knowledge in the commercialization literature. The main objective of this study was to assess profitability and commercialization of indigenous chicken production in Omoro and Oyam districts of Northern Uganda. This was achieved through the following specific objectives: i) To characterize indigenous chicken farmers in Omoro and Oyam districts, Northern Uganda. ii) To determine the drivers of the level of commercialization of indigenous chicken production in Omoro and Oyam districts, Northern Uganda. iii) To ascertain the factors of profitability for the commercializing smallholder indigenous chicken producers in Omoro and Oyam districts, Northern Uganda.

A multi-stage sampling procedure was used to select districts, sub-counties, parishes, villages and indigenous chicken households to interview. A total of 180 indigenous chicken farming households were randomly selected to participate from Bobi and Lalogi sub-counties in Omoro district and Minakulu and Loro sub-counties in Oyam district. These sub-counties and districts were purposively chosen because they ranked highest in terms of the numbers of indigenous chickens. This study adopted a cross sectional study design which enabled collection of large amounts of data at one point in time. Primary data was collected using pre-tested researcher administered questionnaires. Secondary data was obtained from district

veterinary offices. Data entry, coding, cleaning and transformation were done using SPSS version 20 and data analysis and regressions were done using STATA version 13.

Descriptive statistics such as t-tests and chi squares were used to characterize indigenous chicken farmers; market index was used to measure proportion of indigenous chickens taken to the market for sale, a Tobit regression model was run using the method of Maximum Likelihood to determine the drivers of extent of commercialization, gross margin analysis was used to measure annual profits obtained from sales of indigenous chickens and its products and multi-linear regression model was run using the method of Ordinary Least Squares to ascertain determinants of profitability for the commercializing smallholder producers of indigenous chickens.

Results from descriptive statistics show that majority of the indigenous chicken farmers were selling less than 50% of the indigenous chickens produced and only 15% of the farmers sold above 50% of their indigenous chickens produced. The characteristics that significantly varied between farmers with low level of commercialization (selling less than 50% of indigenous chickens produced) and high level of commercialization (selling above 50% of indigenous chickens produced) were land sizes and flock sizes of the indigenous chickens. Farmers selling more than 50% of their indigenous chickens were found to have higher land sizes and indigenous chicken flock sizes compared to their counterparts selling less than 50% of their indigenous chickens.

The study also showed that the average annual household flock sizes were 83 chickens consisting of 36 chicks, 15 cockerels, 15 pullets, 10 hens and 7 cocks. The overall level of commercialization of indigenous chicken production in Omoro and Oyam districts of Northern Uganda was found to be low at 31.2% thus below the threshold level (50%) for fully commercialized farmers according to World Bank report, 2007. This implies that

indigenous chicken farmers in Oyam and Omoro districts are commercializing (semi-commercial) farmers. In Oyam, the level of commercialization of indigenous chicken production was low at 33.5% and in Omoro district; the level of commercialization of indigenous chicken production was also low at 29.1%. From the Tobit model, major factors that significantly affected level of indigenous chicken commercialization were: number of school going children ($p<0.1$), cattle size ($p<0.05$), indigenous chicken flock size ($p<0.05$), husband's decision to sell indigenous chicken ($p<0.1$), group membership ($p<0.1$) and poultry extension services ($p<0.05$). All these factors positively influenced level of commercialization except number of school going children and poultry extension services that negatively influenced level of commercialization.

Generally, commercial indigenous chicken production was found to be profitable. The average gross margin obtained was 118,704 Uganda shillings ($ 34). Over 40% of the total revenue obtained were profits implying that the enterprise is highly profitable. However, profits obtained in Omoro district ($ 56) were significantly ($p<0.05$) much higher than profits obtained in Oyam district ($ 9). Thus measures to increase commercialization would in turn increase profits accruing to the enterprise. From the OLS regression, the factors that had significant impact on profitability were sex of respondent ($p<0.1$), age of household head ($p<0.1$), bicycle access ($p<0.01$), group farming involvement ($p<0.1$), number of extension visits ($p<0.01$) and family ownership of chickens ($p<0.01$). All these factors positively influenced profitability of commercializing smallholder producers of indigenous chickens except age of household head.

5.2 Conclusions

Farmer characteristics that are vital for increasing commercialization and profitability of indigenous chickens include: land sizes which were found to be relatively higher (7.3 acres). These acreages can be used as an asset to obtain credit for commercial indigenous chicken

production, grow supplementary feeds for chickens such as millet and fence it off to allow chickens scavenge freely without straying away. Male headed households are more likely to increase commercialization level and profitability since they are more resource endowed and market oriented. Group involvement which enables obtaining information regarding production and marketing of indigenous chickens is an incentive for increasing commercialization level and profitability.

Average annual household flock size was 83 chickens consisting of 36 chicks, 15 cockerels, 15 pullets, 10 hens and 7 cocks. Chicks were the most predominant in the flock compared to the cockerels, pullets, hens. This is because they are less marketed as they are left to replace sold and growing stock. The overall level of commercialization of indigenous chicken production in Oyam and Omoro districts was found to be low at 31.2%. Of all the flocks, level of commercialization of cocks was the highest and above average at 58.1% of the total annual production. This is because cocks fetch higher prices compared to the other flock composition. This shows the significance of cocks in indigenous chicken commercialization. Level of egg sales was lowest since most of the farmers do not sell their indigenous chicken eggs so that they are mainly kept for reproduction. Yet egg sales can be a potential profitable business basing on the high price charged per egg (300 Uganda shillings per egg) provided there is continuous increase in production. Therefore, the level of commercialization (31.2%) reported in this study shows that indigenous chicken farmers in Northern Uganda are yet to become fully commercialized. This is based on the fact this level is below 50% which is the threshold for fully commercialized farmers (World Bank, 2007). The study found that major factors significantly affecting level of indigenous chicken commercialization were factors such as indigenous chicken flock size, number of cattle owned, number of school going children, husband's decision to sell indigenous chickens, group involvement and provision of poultry extension services. Since indigenous chicken flock sizes, number of cattle owned,

husband's decision to sell indigenous chickens and group involvement positively influenced proportion of indigenous chickens sold, increase in their effect on commercialization results in increased level of commercialization. On the contrary, increase in number of school going children and provision of poultry extension services result in decreased level of commercialization.

Generally, commercial indigenous chicken production in the study areas was found to be profitable. On average, the overall total revenue obtained annually by a household from sale of indigenous chicken was 266,482.2 Uganda shillings (Ugx) ($ 76.14). The overall mean total cost incurred by each household in production of indigenous chicken was 144,255.8 Ugx ($ 41.22). Average gross margin was 118,704 Ugx ($ 33.92) which showed that over 40% of the total revenue obtained were profits implying that the enterprise is highly profitable. Thus measures to increase commercialization would in turn increase profits accruing to the enterprise. The study factors that had significant impact on profitability were sex of respondent, age of household head, bicycle access, group farming involvement, number of extension visits and family ownership of chickens. Sex of respondent was positive and significant. This implies that being male increased gross margins obtained since men are more market oriented than women. Age of household head was negative and significant. This showed that younger household heads obtained higher gross margins compared to their older counterparts. This can be explained by their enthusiasm in participating in the marketing of indigenous chickens hence obtaining higher gross margins. Access to bicycle for transportation was positive and significant. This enabled transportation of higher numbers of indigenous chickens while minimizing transportation costs. Involvement in group farming was positive and significant. This could be explained by benefits that accrue through group involvement like lessons learnt from experienced group members on production, collective marketing and how to increase profits. Number of extension visits was positive and

significant. This shows that increase in extension visits increases profitability of indigenous chickens. This is as a result of increased access to information through trainings and also provision of services such as vaccinations and treatments. Family ownership of indigenous chickens was positive and significant. This is due to the fact that family ownership allows each individual to own a certain number of chickens which contributes to the household's pool of indigenous chickens which are marketed. This results in higher gross margins hence increased profitability.

5.3. Recommendations

5.3.1. Policy recommendations

The study recommends that since increased flock size increases commercialization level, the government and private sectors have to invest in increasing indigenous chicken flock sizes through measures such as vaccinations and disease control strategies.

Since group involvement increases level of commercialization, the government and other policy makers should encourage famers to carry out their production and marketing activities in groups since group involvement which enhances learning, increases their bargaining power and enables them enjoy economies of scale. Additionally, community based officers should continuously provide trainings on group dynamics and ensure that they are continuously active.

The study also recommends provision of poultry extension services by agricultural service providers that specifically targets indigenous chicken enterprises to ensure transformation from subsistence to commercial indigenous chicken production.

It is also recommended that the current savings and farming groups can be used as groups for other purposes such as group marketing to improve the bargaining power of the indigenous

chicken farmers and maximize profits as they minimize certain transaction costs. Training of these groups by extension agents could enhance group activities and encourage more farmers to gain from the group activities. Additionally, a working innovation platform should also be put in place to link all the value chain actors of the indigenous chicken for purposes of networking and finding market for the indigenous chicken along the chain. Having various potential buyers will definitely increase the proportion of indigenous chickens marketed thus increased profits.

Similarly, farmers are also advised to sell their indigenous chickens in competitive places like near urban places. A case in point is that respondents in Omoro had higher gross margins and this could be associated to their close proximity to Gulu which is a major urban area that offers higher prices for the indigenous chickens.

The key implication of this study is that policy, technological, organizational and institutional interventions aimed at enhancing commercial indigenous chicken production should focus on: increasing proportions of indigenous chickens taken to the market and increasing profitability of indigenous chicken production. Higher profits result in increasing incomes and thereby lead to a sustainable improvement in the livelihoods of the farmers.

5.3.2. Recommendations for further study

The main intention of the study was to determine the level and determinants of commercialization of indigenous chicken production in Northern Uganda. It also determined profitability and its determining factors on commercial indigenous chicken production.

However, the study proposes further research on:

1. Comparison of profitability of indigenous chicken production vis a vis kuroiler, broiler or layer production in Northern Uganda. There is need to determine which venture is more profitable in the long run.

2. Since the study looked at level of commercialization and profitability of indigenous chickens in Oyam and Omoro districts only of Northern Uganda, it is necessary to have the study scaled up by looking at level of commercialization in Northern Uganda and the entire country.

3. Since the study found a poultry extension services to negatively influence level of commercialization, a study can be carried out on 'Effect of targeted poultry extension service provision on level of commercialization of indigenous chickens'

4. Demand versus supply analysis to reflect the impact of long term decisions and changes in commercialization and profitability.

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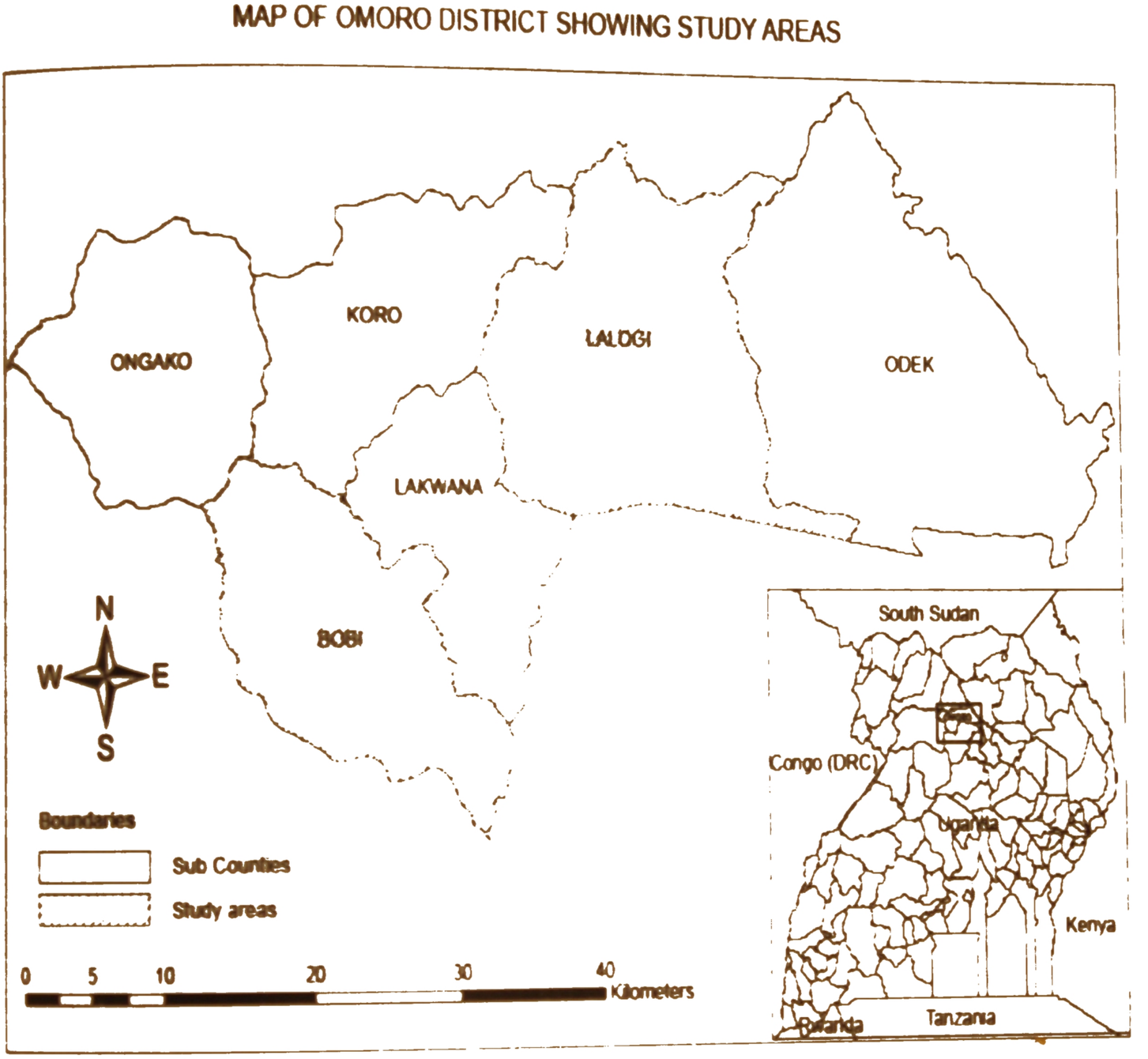
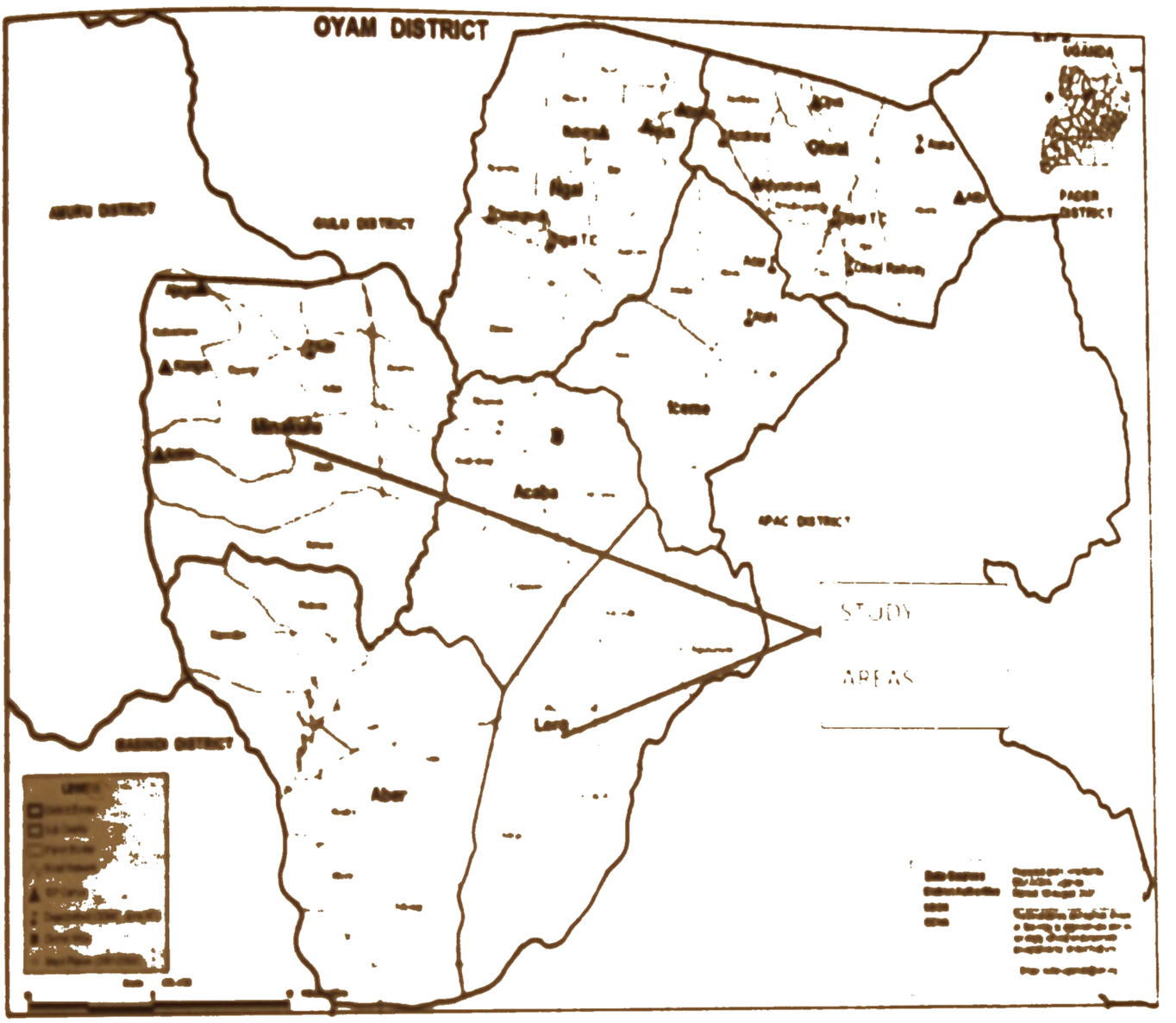
Appendix 1: Map of Omoro District



Appendix 2: Map of Oyam District



Appendix 3: Survey questionnaire

Gulu University

Faculty of Agriculture and Environment

Enhancing Commercial Production and Marketing of Local Chickens in Northern Uganda through Innovation Platforms (ECOPROMALI)

Research survey for ECOPROMALI Project in Gulu and Oyam Districts

We are students from Gulu University conducting a research survey in Gulu and Oyam districts. The study is mainly focusing on characterizing indigenous chicken farmers, extent of commercialization and profitability of the indigenous chicken. The information provided for this study will be used for academic purpose only and will be treated with strict confidentiality. Your participation is highly appreciated.

Name of interviewer ..... Date .....

A. Socio-demographic information

Name of respondent .....

District ..... Sub-county ..... Parish ..... Village .....

Please tick the appropriate option

1. Gender of household head Male Female

2. Sex of household head? Male Female

3. Age of household head .....

4. Level of education of household head in years .....

5. Main occupation

a)Farming b)Teaching c)Civil servant d)Trading e) None

6. Secondary occupation

a)Farming b)Teaching c)Civil servant d)Trading e)None

7. Marital Status

a) Married b) single c) separated d) widowed

8. Household size .....

9. What is your land size (in acres)? .....

10. Experience in local chicken production (in years) .....

11. Do you belong to any group? Yes No

12. If yes what are the activities of the group? a) Marketing b)Savings c)Farming

d)Others specify .....

13. Are you a member of a business association cooperative? Yes No

15. Does the association handle chicken related activities? Yes No

16. If yes, what activities? .....

B: Commercial chicken production

1. What are your reasons for keeping local chicken?

.....

.....

3. What is the annual production of your local chicken flock in the last one year?

Flock type	Flock size
Chicks	
Cockerels	
Pullets	
Hens	
Cocks	

4. Do you sell your local chicken? Yes No

If yes, where do you sell? a) Market b) Home c) Road side

5. What is the distance to the nearest market for chicken (in km)? .....

6. Out of annual production, how many have you sold in the last one year?

Flock type	Number sold	Average price per product
Eggs		
Chicks		
Cockerels		
Pullets		
Hens		
Cocks		

7. If no, why don't you sell your chicken (reasons for not participating in the market)?

.....

.....

C: Annual costs of production and marketing in the last one year

1. **Total number of birds = ...**

Activities	Unit Cost	Quantity	Total Cost
Housing			
Feeders and drinkers			
Feeds			
Vaccination			
Transport to market			
Labor			
Market levy			

N.B: If you don't incur transport, how much would you pay? .....

Annual profits = Annual revenue – Annual costs (Generate from STATA)

2. **What affects the profits you should get from sales of your chicken?**

Total average costs (Uganda Shillings) .....

Distance to the nearest market (Km) .....

Flock size .....

Household size .....

Access to extension services .....

Belonging to a farmers' group .....

Education level .....

Experience in indigenous chicken rearing (years) .....

THANK YOU FOR PARTICIPATING

Appendix 4: Correlation matrix for gross margin analysis

```
corr ln_GM_Y Sex AgeHH2 BicycleBoda MotorcycleBoda ChickenInfo GroupFarm ExtNum ln_marketDist2 SFlowerSold FamMemOwn
(obs=180)
```

	ln_GM_Y	Sex	AgeHH2	Bicycl~a	Motorc~a	Chicke~o	GroupF~m	ExtNum	ln_mar~2	SFlowe~d	FamMem~n
ln_GM_Y	1.0000										
Sex	0.1904	1.0000									
AgeHH2	-0.1357	-0.2404	1.0000								
BicycleBoda	0.0998	-0.0031	0.0399	1.0000							
MotorcycleBoda	0.0898	0.1008	-0.0381	-0.0363	1.0000						
ChickenInfo	0.0172	0.0317	0.0837	0.1013	0.1214	1.0000					
GroupFarm	0.1200	0.0452	0.0714	0.0369	0.0096	0.4091	1.0000				
ExtNum	0.0749	-0.0709	0.2012	0.0053	-0.0024	0.4067	0.0735	1.0000			
ln_marketD~2	0.0300	0.0648	-0.0919	0.0113	0.1568	-0.0340	0.0344	-0.0530	1.0000		
SFlowerSold	0.0943	0.1553	0.0247	-0.0359	-0.0368	-0.0503	0.0564	-0.0468	0.0739	1.0000	
FamMemOwn	0.1363	-0.0887	0.0646	0.0535	0.0536	0.0737	0.0908	0.0147	-0.0199	-0.0188	1.0000

Appendix 5: Robust regression analysis of gross margin analysis

```
reg ln_GM_Y Sex AgeHH2 BicycleBoda MotorcycleBoda ChickenInfo GroupFarm ExtNum ln_marketDist2 SFlowerSold FamMemOwn , robust

Linear regression                               Number of obs     =        180
                                                F(10, 169)        =       4.12
                                                Prob > F          =     0.0000
                                                R-squared         =     0.1277
                                                Root MSE          =     4.7209
```

ln_GM_Y	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
Sex	1.662422	.8438724	1.97	0.050	.0034677	3.321377
AgeHH2	-.0005554	.0063294	-0.09	0.930	-.0130856	.0119749
BicycleBoda	4.919831	1.262197	3.90	0.000	2.428128	7.411534
MotorcycleBoda	1.933991	1.315573	1.47	0.143	-.663082	4.531064
ChickenInfo	-2.156488	1.54698	-1.39	0.165	-5.213382	.9004053
GroupFarm	1.672668	.8729213	1.92	0.057	-.0504441	3.395782
ExtNum	.299586	.0956402	3.13	0.002	.1107236	.4884484
ln_marketDist2	-.0911892	.4457912	-0.20	0.838	-.9712258	.7888475
SFlowerSold	.002873	.0018768	1.53	0.128	-.0008332	.0065791
FamMemOwn	2.324565	.8406218	2.77	0.006	.6650331	3.984097
_cons	7.661821	1.141057	6.71	0.000	5.407259	9.916383

Appendix 6: Regression analysis of gross margin analysis

```
. reg ln_GM_Y Sex AgeHH2 BicycleBoda MotorcycleBoda ChickenInfo GroupFarm ExtNum ln_marketDist2 SFlowerSold FamMemOwn
```

Source	SS	df	MS
Model	581.460386	10	55.1460386
Residual	3766.31338	169	22.2858805
Total	4317.77419	179	24.1216435

Number of obs	= 180
F(10, 169)	= 2.47
Prob > F	= 0.0086
R-squared	= 0.1277
Adj R-squared	= 0.0761
Root MSE	= 4.7209

ln_GM_Y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Sex	1.662422	.7951912	2.09	0.038	.0926346	3.232209
AgeHH2	-.0005584	.0002943	-1.89	0.061	-.0011364	.0000257
BicycleBoda	4.919831	2.780054	1.77	0.079	-.5682751	10.40794
MotorcycleBoda	1.933991	1.403687	1.38	0.170	-.8370292	4.705011
ChickenInfo	-2.156488	1.443937	-1.49	0.137	-5.006965	.6939885
GroupFarm	1.672668	.9517085	1.76	0.081	-.2061	3.551436
ExtNum	.299806	.1529952	1.96	0.052	-.002442	.601614
ln_marketDist2	-.0911892	.4673769	-0.20	0.846	-1.013838	.8314599
SFlowerSold	.002873	.0026804	1.07	0.287	-.0024342	.0081803
FamMemOwn	2.324565	1.015038	2.29	0.023	.3207789	4.328351
_cons	7.661821	1.061573	7.22	0.000	5.56617	9.757471

Appendix 7: Variance inflationary factor of gross margin analysis

```
. vif
```

Variable	VIF	1/VIF
ChickenInfo	1.52	0.659809
ExtNum	1.27	0.787933
GroupFarm	1.24	0.805398
AgeHH2	1.12	0.890441
Sex	1.12	0.896543
Motorcycle~a	1.07	0.937781
SFlowerSold	1.05	0.953753
ln_marketD~2	1.05	0.955210
FamMemOwn	1.03	0.972398
BicycleBoda	1.02	0.977465
Mean VIF	1.15	

Appendix 8: Test for omitted variables in gross margin analysis

```
. ovtest

Ramsey RESET test using powers of the fitted values of ln_GM_Y
       Ho:  model has no omitted variables
                 F(3, 166) =      0.21
                  Prob > F =      0.8864
```

Appendix 9: Correlation matrix for Tobit model

```
. corr overall RespAge HHsizeSchool CattleSize total_chicken HusbDecide GpMembershp ExtChicken mkt_place BicycleBoda
(obs=180)
```

	overall	RespAge	HHsize~l	Cattl~ze	total_~n	HusbDe~e	GpMemb~p	ExtChi~n	mkt_pl~e	Bicycl~a
overall	1.0000									
RespAge	0.0276	1.0000								
HHsizeSchool	-0.0551	0.2913	1.0000							
CattleSize	0.0709	0.1017	0.4014	1.0000						
total_chic~n	0.1430	-0.0685	-0.0219	-0.0239	1.0000					
HusbDecide	0.1546	-0.1451	-0.0993	0.0959	0.0972	1.0000				
GpMembershp	0.1246	0.0507	0.0352	0.0476	0.0264	0.0589	1.0000			
ExtChicken	-0.0626	0.0564	0.1201	0.1418	0.2169	0.0066	0.0646	1.0000		
mkt_place	0.0549	-0.0554	-0.0663	-0.0800	0.0212	0.0439	-0.0780	0.1527	1.0000	
BicycleBoda	-0.0121	0.0529	-0.0446	-0.0133	0.0491	-0.0328	-0.0902	0.0434	0.1576	1.0000

Appendix 10: Omitted variable test for Tobit model

```
. ovtest

Ramsey RESET test using powers of the fitted values of overall
       Ho:  model has no omitted variables
                  F(3, 167) =      1.06
                  Prob > F =      0.3694
```

Appendix 11: Tobit model of commercialization level (Robust regression)

```
. tobit overall RespAge HHsizeSchool CattleSize total_chicken HusbDecide GpMembershp ExtChicken mkt_place BicycleBoda , ll(0
```

```
Tobit regression                                  Number of obs     =        180
                                                  F(  9,    171) =       2.82
                                                  Prob > F          =     0.0041
Log pseudolikelihood = -21.581238                 Pseudo R2         =     0.3829
```

overall	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
RespAge	.0015327	.0021654	0.71	0.480	-.0042321	.0072976
HHsizeSchool	-.0152806	.0084731	-1.80	0.073	-.0319911	.0014299
CattleSize	.0112469	.0046331	2.43	0.016	.0020963	.0203976
total_chicken	.0007208	.0003175	2.27	0.024	.0000933	.0013483
HusbDecide	.0811417	.0475411	1.71	0.089	-.0127317	.1750152
GpMembershp	.0733782	.0307336	2.39	0.018	.0126822	.1340742
ExtChicken	.0960039	.0478631	2.01	0.046	.0015135	.1904944
mkt_place	.0278795	.0381363	0.73	0.466	-.0475755	.1033346
BicycleBoda	.0660041	.1255735	0.53	0.600	-.1818838	.3138921
_cons	.0783322	.0336...	2.33	0.021	.0118331	.1448314
sigma	.2390252	.0178331			.2038139	.2742365

```
Obs. summary:        17  left-censored observations at overall<=0
                    159     uncensored observations
                      4 right-censored observations at overall>=1
```

Appendix 12: Tobit model of commercialization level

```
. tobit overall RespAge HHsizeSchool CattleSize total_chicken HusbDecide GpMembershp ExtChicken mkt_place BicycleBoda , ll(0

Tobit regression                                  Number of obs     =        180
                                                  LR chi2(9)        =      26.78
                                                  Prob > chi2       =     0.0015
Log likelihood = -21.581298                       Pseudo R2         =     0.3829

------------------------------------------------------------------------------
     overall |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     RespAge |   .0015327   .0013403     1.14   0.254    -.001113    .0041784
HHsizeSchool |  -.0152906   .0086833    -1.76   0.080   -.0324307    .0018496
  CattleSize |   .0112469   .0044821     2.51   0.013    .0023996    .0200943
total_chicken |   .0007208    .000232     3.11   0.002    .0002628    .0011787
  HusbDecide |   .0811417   .0445646     1.82   0.070   -.0068826    .1691093
  GpMembershp |   .0733782   .0386972     1.90   0.060   -.0030075     .149764
  ExtChicken |  -.0960039   .0479115    -2.00   0.047   -.1905781   -.0014298
   mkt_place |   .0278795   .0380168     0.73   0.464   -.0471631    .1029221
 BicycleBoda |  -.0660041   .1489875    -0.44   0.658   -.3600956    .2280873
       _cons |   .0783322   .0757291     1.03   0.302    -.071152    .2278163
-------------+----------------------------------------------------------------
       /sigma |   .2390252   .0137981                      .211788    .2662618
------------------------------------------------------------------------------
Obs. summary:         17  left-censored observations at overall<=0
                     159     uncensored observations
                       4 right-censored observations at overall>=1
```

Appendix 13: Variance inflationary factor for Tobit model

```
. vif

    Variable |       VIF       1/VIF
-------------+----------------------
HHsizeSchool |      1.32    0.758902
  CattleSize |      1.25    0.802997
     RespAge |      1.13    0.888821
  ExtChicken |      1.12    0.892988
   mkt_place |      1.07    0.931137
total_chic~n |      1.07    0.932522
  HusbDecide |      1.07    0.938454
 BicycleBoda |      1.04    0.957297
 GpMembershp |      1.03    0.974370
-------------+----------------------
    Mean VIF |      1.12
```

Appendix 14: Covariance matrix of coefficients for Tobit model

. vce

covariance matrix of coefficients of tobit model

e(V)	model RespAge	HHsizeSc~l	Cattlesize	total_ch~n	HusbDecide	GpMember~p	ExtChicken	mkt_place	BicycleB~a
model									
RespAge	1.796e-06								
HHsizeSchool	-2.925e-06	.0000754							
Cattlesize	6.932e-08	-.00001524	.00002009						
total_chic~n	2.192e-08	-1.918e-08	6.925e-08	5.383e-08					
HusbDecide	6.792e-06	.00004666	-.00003095	-8.895e-07	.00198601				
GpMembership	-3.616e-06	-1.224e-06	2.275e-06	-1.414e-07	-.00010307	.0014974			
ExtChicken	-3.092e-06	-.00003015	-.00002656	-2.548e-06	.00004662	-.00010957	.00229551		
mkt_place	2.875e-06	5.679e-06	.00001548	3.254e-07	.00008424	.00010484	.00031683	.00144528	
BicycleBoda	-.00001316	.00008456	-.00001618	2.187e-06	.00013334	.00042068	-.00015423	-.00080256	.02219726
_cons	-.00006685	-.00010998	.0001271	4.312e-06	.00170179	.00078039	.00021646	-.00071962	.00011441
sigma									
_cons	1.182e-07	-2.259e-06	1.898e-06	1.412e-07	-.0000232	.00001166	-.00001163	8.472e-06	-.00005108

e(V)	sigma _cons
sigma	
_cons	.00019039

Appendix 15: Krejcie and Morgan Sample size Table

N	S	N	S	N	S
10	10	130	97	380	191
15	14	140	103	400	196
20	19	150	108	420	201
25	24	160	113	440	205
30	28	170	118	460	210
35	32	180	123	480	214
40	36	190	127	500	217
45	40	200	132	550	226
50	44	210	136	600	234
55	48	220	140	650	242
60	52	230	144	700	248
65	56	240	148	750	254
70	59	250	152		
75	63	260	155		
80	66	270	159		
85	70	280	162		
90	73	290	165		
95	76	300	169		
100	80	320	175		
110	86	340	181		
120	92	360	186		

Note: N is Population size. S is Sample size