A COMPARATIVE ASSESSMENT OF MANAGEMENT PRACTICES AND LIVELIHOOD ROLES OF INDIGENOUS CHICKEN IN PASTORAL AND AGRICULTURAL HOUSEHOLDS OF KENYA

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A thesis submitted to Graduate School in partial fulfillment for the requirements of the Master of Science Degree in Livestock Production Systems of Egerton University

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DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and to the best of my knowledge has not been presented for an award of any degree or diploma in this or any other university.

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Recommendation

This research thesis has been submitted with our approval as the University supervisors.

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DEDICATION

This work is dedicated to the Almighty God and to my loving wife Kamais Ekaran and my children Ekuom, Ewoi, Monti and Eregae.

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God bless you all.

ABSTRACT

Indigenous chicken (IC), which have traditionally been an important component of livelihoods among the agricultural households are being integrated into pastoral livelihoods as a diversification strategy. The goal is to reduce vulnerability of ruminant livestock to recurring drought events. However, sustainable utilization of IC could suffer in the absence of adoption of improved management practices supported with access to inputs and output markets and advisory services which support IC utilization in the agricultural households. This study compared management practices, livelihood roles and needs for inputs and extension services for IC utilization between pastoral and agricultural households. A questionnaire was administered to 256 randomly selected households in a cross sectional survey in Counties where pastoral (Turkana) and agricultural (Trans-Nzoia) households predominated. Data was subjected to chi-square test of independence when data were categorical variables and to independent sample t-tests when data were continuous variables. Compared to agricultural households, the pastoral households keeping IC were of lower literacy levels, younger age and lower income levels. Their foundation stocks were more from gifts (67.2% vs 18.8%) or from Non-Governmental Organization (NGO) (29.7% vs 3.1%) and the flocks were smaller (6.7 vs 26.6) but with more cocks (27.2% vs 10.2%) and fewer growers (40.4% vs 61.2%). Among the pastoral households, the entire total monthly incomes were from IC (100% vs 20%) and more used the income to purchase food (89.1% vs 58.6%), to finance school fees (94.5% vs 39.8%) and to access health care services (95.3% vs 85.9%), but fewer used chicken manure in kitchen gardening (0.8% vs 92.2%). Adoption of improved management practices were on average, lower among the pastoral households, with regard to improved housing (0% vs 28.9%), purchasing supplementary feeds (1.6% vs 28.9%), vaccinating flocks (12.5% vs 88.3%), practicing artificial incubation of eggs (0% vs 14.8%) or artificial brooding (0% vs 45.3%). Similarly, fewer of the pastoral households could access vaccines (22.5% vs 59.4%), drugs for treatment (30.5% vs 93.7%), agro-vet stores (30.5% vs 96.9%), extension advisory services (6.2% vs 27.3%) or credit facilities (2.3% vs 15.6%) that they needed to improve management of their IC flocks. These results suggest that improving input and output markets and service delivery will be critical in enhancing IC contribution to pastoral livelihoods.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ASAL	Arid and Semi-Arid Land
CDLP	County Director of Livestock Production
FAO	Food and Agriculture Organization of the United Nations
FBO	Faith Based Organization
HELB	Higher Education Loans Board
HH	Household
HIV	Human Immunodeficiency Virus
IC	Indigenous Chicken
KALRO	Kenya agriculture and Livestock Research Organization
KES	Kenya Shillings
KG	Kilogram
MFI	Micro Finance Institution
NGO	Non-Governmental Organization
SACCO	Savings and Credit Cooperative Society
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
TV	Television

CHAPTER ONE

INTRODUCTION

1.1 Background information

Pastoralism is a livestock based livelihood characterized by large herds of large and small ruminants that are frequently trekked over vast rangelands in search of water, pasture and security from stock rustling. Worldwide, nearly a billion heads of ruminants contributing about 10% of the world's meat production are managed under pastoralism by about 200 million households (FAO, 2001). In Kenya, pastoralism is practiced in about 75% of the land and is contributing to about KES 318.971 billion to the economy annually (Behnke & Muthami, 2011). One region in Kenya where pastoralism dominates is Turkana County, but this livestock based livelihood is continuously destabilized because of its vulnerability to a myriad of livelihood shocks.

These shocks include increased climate variability resulting in severe scarcity of pastures, water, erosion of authority of traditional institutions in control of natural resources, reduced access to pasture and water resources due to rapid change in land use, and cultural shock (Thornton *et al*., 2006; Schilling *et al.*, 2012). Emergency interventions have included famine relief food supplies, which have not sufficiently stabilized livelihoods from frequently reoccurring shocks. In an effort to build stable livelihood base, the government and development agencies have shifted intervention strategies from food for work during the periods of shocks to livelihood asset diversification. One popular livelihood diversification strategy being implemented by development agencies and the County government is introduction of Indigenous Chicken (IC) to pastoral households on the premise of reducing food insecurity and poverty incidences.

In Kenya, use of indigenous chicken has predominantly been in rural agricultural households where chicken are traditionally left to scavenge for food crops and kitchen waste food. But there is evidence of utilizing IC to achieve the millennium development goals where limited livelihood alternatives exist (Sonaiya, 2007). Often, IC are managed with limited resources (Sonaiya, 2007; Kingori *et al.,* 2010) and therefore could be introduced in pastoral livelihoods where nomadic pastoral households are shifting to sedentary lifestyles and have capacity to try out non-pastoral livelihood options (Mureithi and Opiyo, 2010). The ongoing changes in pastoral livelihoods justify introduction of diversified livelihood base to stabilize livelihoods in times of shocks impacting on livestock assets and natural resource base.

However, rearing IC in pastoral households will need new management skills in sourcing breeding stock, accessing extension services for uptake of technologies and capacity building to apply improved management practices. The challenge is that IC has been introduced without accompanying capacities in management practices and access to extension services to support sustainable utilization. This is likely to limit the contribution of IC to livelihoods of pastoral households relative to those already observed in the agricultural households. Application of livelihood analysis framework can better inform options for enhancing livelihood roles of IC to pastoral households.

1.2 Statement of the problem

In Turkana County, development agencies and the County government are introducing indigenous Chicken (IC) to pastoral households on the premise of reducing food insecurity and poverty incidences. Therefore, pastoral households of Turkana County are integrating indigenous chicken (IC) production into their livelihood asset base for food security and poverty reduction. The integration of IC into pastoral livelihoods without support in accessing extension services and capacity building to apply improved management practices has led to failure to exploit the potential of IC contribution to livelihood assets. However, in rural agricultural households, IC is a traditional livelihood asset and food crops and kitchen food waste are available to feed them with limited expenses. Farmers in agricultural households also easily access breeding stock and extension services unlike the pastoral households.

1.3 Objectives of the study

1.3.1 Broad objective

To contribute to enhanced livelihood roles of IC in pastoral households by applying management practices used in IC production in agricultural households.

1.3.2 Specific objectives

i. To determine management practices for utilization of IC in pastoral and agricultural households.
ii. To determine livelihood roles of IC in pastoral and agricultural households.
iii. To determine access to extension services that support utilization of IC in pastoral and agricultural households.

1.4 Research questions

i. Are the IC management practices significantly different between pastoral and agricultural households?
ii. Are the livelihood roles of IC significantly different between pastoral and agricultural households?
iii. Does the access to extension service supportive to IC utilization significantly differ between pastoral and agricultural households?

1.5 Justification of the study

Pastoral communities are increasingly reducing herds of ruminant assets in the face of changing land use and urbanization (Manoli *et al.,* 2014). This narrows their coping strategies in the advent of calamities portended by climate change and other natural disasters (Ndikumana *et al*., 2002). This has led to vulnerability of livelihood assets in the ASAL and integration of new livelihood strategies like chicken keeping (Kirwa *et al.,* 2010). As a result, development agencies and recently the County government have assisted a number of households to acquire indigenous chicken. This is based on the premise that it will reduce food insecurity and poverty.

Therefore, there was need to understand the management practices and extension services in place to support sustainable utilization of IC in pastoral livelihoods. This study aimed at filling the knowledge gap on roles of indigenous chicken as a livelihood asset in pastoral households so that governments and development agencies can design sustainable interventions more appropriately. The comparative analysis between pastoral and agricultural households' management practices, livelihood roles and access to extension services associated with keeping IC can inform the potential for sustainable utilization of IC and the necessary targeted interventions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Pastoral livelihoods

Pastoral areas have been traditionally known to be characterized by large tracts of land that have been suitable majorly for livestock production enabling the pastoralists to keep large herds of livestock and move from one place to another when feeding resources are depleted (Musimba and Nyariki, 2003). Livestock especially ruminants are the main source of livelihoods for pastoralists providing them with immediate family needs both valuable and invaluable (Shibia *et al.,* 2013). About 30% of the total Kenyan population occupy nearly 80% of the land which is ASAL holding close to 70% of the national livestock population (Opiyo *et al.*, 2014). Livestock as assets are vulnerable to natural disasters that have been exacerbated by climate change in Kenya leading to food scarcity (Opiyo *et al.,* 2011). However, due to decreasing grazing land occasioned by increasing human population and effects of climate change, most pastoralists have resorted to sedentary lifestyles (Watson and Binsbergen, 2008).

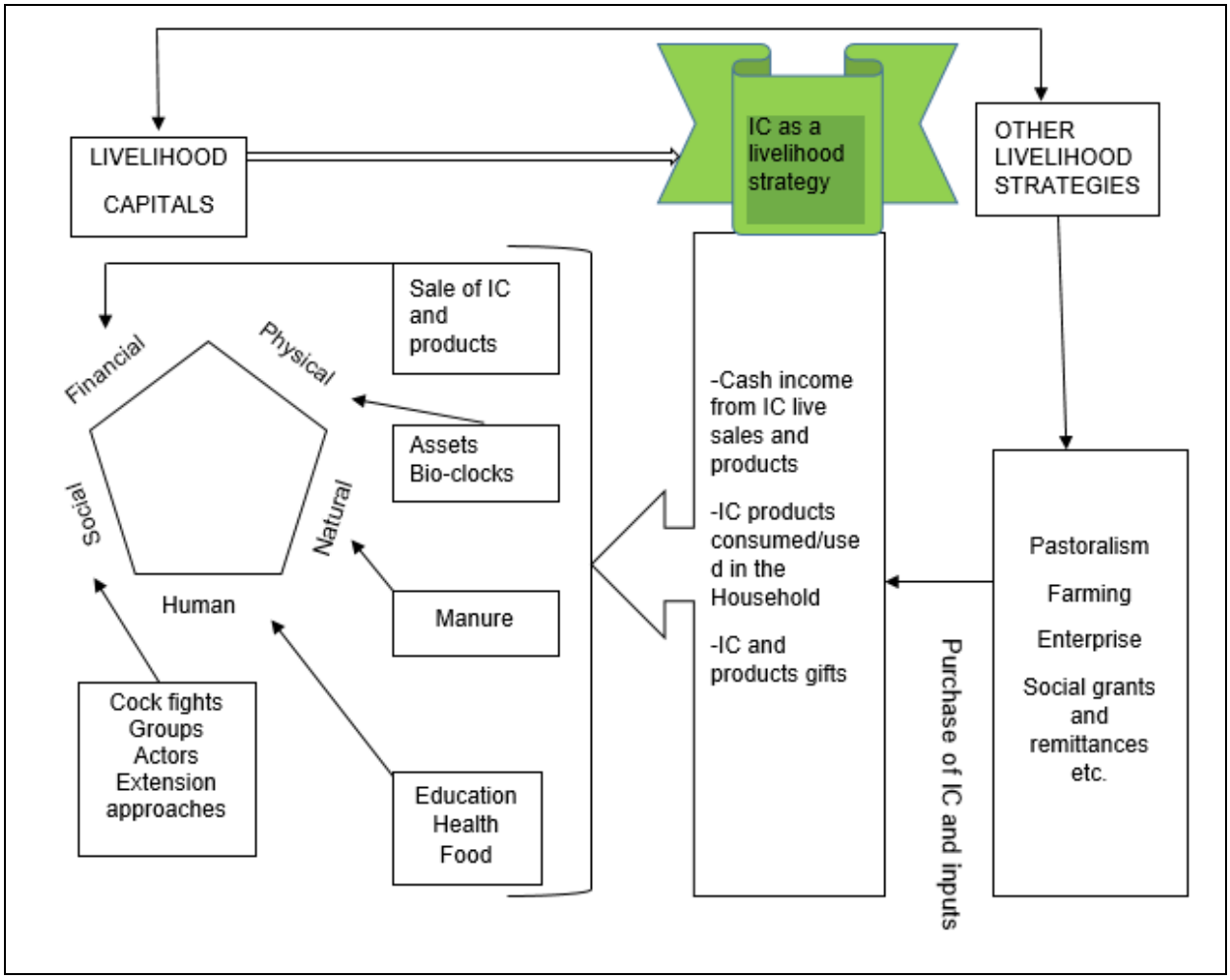
Other drivers of change of livelihood strategies related to climate change are socially facilitated by more frequent group associations and capacity building, decreased distances to markets and diversification of income from off-farm sources (Bebe *et al.*, 2012). The same study also concluded that diminishing land sizes and longer distances to watering points forms the basis for the observed shift of pastoral households to other forms of livelihoods.

2.2 Livelihood analysis framework

A livelihood includes the strengths, assets both tangible and intangible and activities needed to make a living as described by Chambers, 1995. It therefore becomes sustainable when it can increase its outcomes without jeopardizing the natural resource base on which partly, they are dependent (Scoones, 1998). These capital assets are broadly categorized into five namely; human, social, physical, natural and financial assets. Assets include social networks created through bonds and bridging and indigenous chicken. Although different livelihood frameworks have been considered as difficult to understand and unable to capture other process that are capable of influencing livelihood outcomes like political and institutional processes, they have been useful in demonstrating linkages (Scoones, 2009).

In the face of these criticisms, livelihoods approaches are essentially helpful because they focus on the household thereby enabling one to understand the value of assets arising from the utility of a particular resource from the household point of view (Chaminuka *et al*., 2014). This study used a livelihoods analysis framework, coupled with commodity valuation approach to arrive at the livelihoods contribution of valuable and non-valuable indigenous chicken produce, and the value of intangible roles of indigenous chicken as described by Moll, 2005. Depending on the specific livelihood being analyzed, different livelihood frameworks can be developed to suit a particular situation. Livelihood frameworks have been developed to assess livelihood strategies (Rakodi, 1999), and have also been used in analysis of social issues and business response plans (Sethi, 1979).

The livelihood analysis framework used in this study (Figure 1) was selected because it had been used successfully to analyze the livelihood roles of cattle to rural poor households and therefore fitted well for use by this study. Choice of indicators depends largely on the livestock system being investigated (Moll, 2005). Other livelihood strategies in the context of this study included income flows from pastoralism, farming, small business enterprises, social remittances from household relatives and social grants from social protection programs which could be invested in acquiring IC and production inputs. Management in the context of IC production entails production assets such as breeding flocks, housing, feeding, brooders and labor which an household can invest directly from other sources of income or reinvest income from IC.



Source: Adapted from Chaminuka *et al*. (2014)

Figure 1. Livelihood analysis framework

2.3 Indigenous chicken production in Kenya

Indigenous chicken history date back to the origin of the migration routes of mankind from where it was thought to be dispersed to the rest of the world with its initial domestication thought to have been in South East Asia (Magothe *et al*, 2012). Poultry, especially indigenous chicken are the most widely domesticated of the livestock species in the human settlements and are also the highest in numbers (Moreki *et al*., 2010). They are almost found in every urban and rural dwellings where they are an important source of cash and food for the households (Hailemariam *et al*., 2010). In the African continent, indigenous chicken constitute a majority of the poultry kept making more than 70% of the chicken kept. In Kenya majority of the households keep IC with other livestock species with an overall mean of 22.4 birds per household (Okeno *et al*., 2012).

Indigenous chicken in Kenya are mostly kept in free range systems without proper management practices in place (Moges *et al.*, 2010; Okeno *et al*., 2012). Free range system is characterized by keeping of chicken without use of proper knowledge. Chicken are left out in the morning to feed on anything they can find on their surroundings and they are housed in rudimentary structures at night to keep them away from predation and harsh weather (King'ori, 2004). Supplementation is not guaranteed although agricultural households seldom feed birds on crop residues and crops industrial byproducts (Moreki *et al*., 2010). Poor management practices and a mix of other challenges result in low productivity from IC in egg and meat production (Olwande *et al*., 2010).

Most of the IC keepers in Kenya usually employ the free range production system with a few others using semi intensive and intensive systems depending on land and the production objective of the chicken enterprise (Magothe *et al*., 2012). Unlike the free range system, semi intensive system of production is practiced by farmers who are able to spare extra cash in chicken production with major chicken types being crosses. Chicken are left to scavenge for feed and are supplemented with crop residues and sometimes with concentrates (Kingori *et al.,* 2010). Chicken production in Kenya has however not been well exploited due to poor and highly different production levels mostly due to diseases occasioned by lack of vaccination (Kingori *et al.,* 2010).

Small livestock particularly indigenous chicken have been shown to be important in the food nutrition and income security especially of marginalized groups in the communities where they are kept (Hailemariam *et al*., 2010). This has gained popularity by development organizations implementing food security programs in rural and urban poor in Kenya. Studies have also shown the change in pastoral land uses to activities that were initially considered a preserve of agricultural areas and change of attitude to embrace chicken production (Munyasi *et al*., 2012). This is influenced partly by the growing population and increase in demand for meat from indigenous chicken due to its preference.

2.4 Livelihoods derived from indigenous chicken

2.4.1 Role of IC as human assets

Indigenous chicken production can serve to enhance human capital in several ways. One of the major uses of indigenous chicken is food through provision of meat and eggs which are sources of high quality protein. This is particularly important to the rural poor in sub-Saharan

Africa because majorities are poor and cannot afford to buy foodstuffs of animal origin. Studies demonstrate that poultry contribute significantly to protein in this population category because they are available in large numbers than any other livestock species (Sonaiya, 2007). Apart from satisfying their food requirements, good nutrition is key to alleviating disease burden occasioned by HIV/AIDS pandemic that is high in SSA countries. Family poultry play an important role in nutrition security of the vulnerable and those disadvantaged in the society like women, children and the disabled (Moreki, 2012; Gabanakgosi *et al.,* 2013). Although poultry population in rural areas is low, the number of household poultry (flock size) does not affect the households protein security despite their low productivity (Blackie, 2014).

2.4.2 Role of IC as financial assets

Poultry contribute to the food security of rural households through income which is obtained from sale of live birds and eggs. In most households chicken is not a major economic activity but rather kept to supplement income. Sales for purposes of income generation is based on the demand for incomes for the family and during festive seasons when returns are high (Aboe *et al.,* 2006). This clearly demonstrates that chicken can provide significant emergency disposable cash to households to enable them to offset urgent family needs even when they are deficient of other productive assets like arable land and other livestock species (Akinola and Essien, 2011).

The cash proceeds from chicken economically empowers the family to access other commodities and foodstuff as well as cater for needs beyond food such as clothing, school fees and paying medical bills according the families decent livelihoods (Aboe *et al.,* 2006). This is likely to improve the households further because indigenous chicken products are preferred to commercial chicken products hence enjoy premium prices at the market and is more profitable than other chicken production systems with little or no investment (Khobondo *et al.,* 2015). Chicken is useful in asset building and is often the ladder to acquiring other livestock species and other assets and is the first and the last when a household is climbing the wealth ladder especially where other livestock are kept as is often the case (Aklilu *et al.,* 2008).

2.4.3 Role of IC as social assets

Livestock is important in creating and sustaining social relationships. Loaning and sharing of IC as gifts helps in development of bonds, bridges and linkages. Indigenous chicken have social, cultural and symbolic roles in people's livelihoods that surpasses their practical use as food or income (Magothe *et al.,* 2012). Chicken are often sold and bought in order to realize social and cultural needs; for example, a ceremony may require a bird of a particular color, which is most conveniently acquired at a local market. Moreover, smallholders engaging in animal husbandry target particular holidays like Christmas and Easter. When the consumption of poultry and other animals is culturally important (Larbi *et al.,* 2013).

Chicken are used in the cock fighting which is a popular sport especially in western part of Kenya, which can earn the country foreign exchange if efforts towards its marketing are increased (Maina, 2000). Birds are given away as gifts, they are sacrificed to ancestors and gods, or they are consumed as part of rituals and religious celebrations thereby strengthening important social bonds (Kryger *et al.,* 2010).

2.4.4 Role of IC as natural assets

Chicken provide high quality manure which is the only source of fertilizer to rural poor who cannot afford to buy inorganic fertilizer. Because chicken production usually coexists with other agricultural activities, chicken manure helps in the maintenance of agricultural ecosystems through increasing diversity enabling households to meet multiple obligations (Muchadeyi *et al.,* 2005). Chicken manure has also been extensively used in smallholder in the livestock production to replace other sources of nitrogen that are always limited by cost and increase livestock incomes (Lanyasunya *et al*., 2006).

2.4.5 Role of IC as physical assets

Most chicken keeping households utilize IC as biological timers to wake them up and attend to other important household chores (Magothe *et al.,* 2012). Poultry have also been used to graze down weeds and control pests mechanically due to demand by the consumers for food produced organically (Glatz *et al.,* 2005). Due to the low numbers of the IC in rural households, there is not much in literature suggesting utilization of wastes because they do not generate substantial wastes to pose a threat to the environment.

2.5 Poultry management practices

The main outstanding feature of indigenous chicken production systems in developing countries is that birds are produced in an extensive/free range (Olwande *et al.,* 2010; Okeno *et al.,* 2012). Flocks are left out to scavenge for their own feeding resources with little non-scheduled supplementation with extra grain, kitchen leftovers or none at all (Moges *et al.,* 2010).The high populations of IC in medium to high potential agricultural areas can be attributed to their requirement for small space and availability of extra grains for supplementation unlike in ASAL (Okeno *et al.,* 2012).

The harsh environmental conditions in ASALs can also explain the low productivity because chicken do not express their genetic potential to the fullest, small flock size and therefore low ranking of IC as a source of livestock income (Okeno *et al.,* 2012). Despite the low productivity due to high ambient temperatures, IC possess unique genes that enable them manage heat load and continue to produce at high ambient temperatures (Ngeno *et al.,* 2014). Flocks are sheltered especially at night (Dorji and Gyeltshen, 2012) with majority being confined in various rudimentary structures without a separate house predisposing them to the vagaries of weather and predators (Moges *et al.,* 2010; Amadou *et al.,* 2011). Management of the flock health is one of the challenges facing the IC productivity in the developing countries (Kaingu *et al.,* 2010) with seasonal disease outbreaks leading to flock mortalities.

A study by Kaingu *et al.* (2010) demonstrated a lower prevalence of gastro intestinal parasites in chicken from hotter areas which is typical of pastoral areas compared to humid environments giving indigenous chicken higher survival rates in pastoral systems. A similar study by Njagi *et al.* (2010) showed a higher presence of Newcastle virus in warmer areas. However, most rural poultry populations are administered alternative treatments (Simainga *et al.,* 2010; Nyoni and Masika, 2012).

Indigenous chicken breed freely with only selection practices done to reduce cock fights. Most breeding flocks acquired locally are raised as chicks through natural brooding (Ochieng *et al.,* 2013). A few of the IC keepers rarely use artificial incubation of eggs or separate chick rearing because of the labor implications and extra investment in equipment (Okeno *et al.,* 2012).

2.6 Poultry extension services

Lack of adequate extension services is one of the major causes of low productivity of agriculture in the whole of the East African region (Ngugi *et al.*, 2014). This has led to change in approaches including encouraging multi-stakeholder involvement and farmer participation to improve uptake (Ochola *et al.*, 2014). Extension services for the livestock sector has for long been focused on conventional rather than pro-poor interventions. The poor are characterized by ownership of small stock and practice extensive system of production (Omore *et al.*, 2009). Most IC keeping households are either totally unaware of the existence of extension services (Kingori *et al*., 2010) or do not have contacts with the extension service providers due to remoteness of their households and sometimes they are incapable of paying for some of the services offered at a fee (Adeniyi and Oguntunji, 2011). In most of the free range production systems, chicken farmers receive minimal institutional support towards extension services, healthcare, loaning facilities and facilitation to market linkages (Ochieng *et al.*, 2013).

The indigenous chicken production continues to suffer from the constraints of diseases, pests, predation, and poor management in relation to feeding, housing, breeding and disease control despite the availability of extension services. Housing, feeding, disease control and breeding management present opportunities for the improvement of indigenous chicken production (Olwande *et al.*, 2010). This can be improved through provision of better healthcare and husbandry practices like housing, breeding management and extra feeds (Kingori *et al.*, 2010). This can be achieved through enhancing capacity building and providing support services such as veterinary and animal health-care, extension, information access and exchange and loans to chicken farmers (Bett *et al*., 2014).

2.7 Statistical analysis for two independent samples

2.7.1 Comparing two independent population means

Independent samples consist of two groups of individuals who are randomly selected from two different populations. They are “independent” because the individuals in one sample must be completely unrelated to the individuals in the other sample. However two assumptions must be met:

i. The two samples are random and they come from two distinct populations. The samples are independent. That is, one sample has no influence on the other. Additionally, the same variable must be measured for each variable.
ii. Both populations are normally distributed.

When data is obtained from two random samples or two groups in a randomized experiment, the difference between the sample means is the best estimate of the difference between the population means (Moore *et al.*, 2013).
To test whether the difference between two independent groups of individuals is statistically significant the α will be set at predefined confidence level of significance (Gatington, 2003).

2.7.2 Comparing frequency response difference between two independent samples

For frequency data, a chi-square test statistic is more relevant for detecting differences between proportions for two independent sample populations. The Chi square test is a non-parametric test which does not require assumptions about population parameters nor do they test hypotheses about population parameters. This differs from a parametric test t test which has assumptions about parameters and hypotheses about parameters. The most significant difference between the chi-square tests and the other hypothesis tests like the t-test is the nature of the data. Chi-square is relevant for count or frequency data presented in a matrix with the different samples defining the rows and the categories of the variable (Moore *et al.*, 2013). T tests are relevant for continuous scale data from a random sample.

A χ^2 statistic is computed to measure the amount of difference between the ideal sample (expected frequencies from null hypothesis) and the actual sample data (the observed frequencies). It's computed thus;

$$\chi 2 = \sum \frac{(f_o - f_e)2}{f_e}$$

Where f_o is the observed frequency and f_e is the expected frequency.

The null hypothesis is rejected when $\chi^2 > \chi^2\alpha$ where $\chi^2\alpha$ is a critical value for the significance level α, that is a value of $\chi 2$ such that $P(\chi^2 > \chi^2\alpha) = \alpha$ (Kaps and Lamberson, 2004).

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study area

The study was undertaken in peri-urban and rural households of Turkana and Trans-Nzoia Counties (Figure 2), which differ in traditional importance of IC as a component of the livelihood. Turkana County is in arid and semi-arid land (ASAL) where pastoralism is a dominant livelihood reliant on utilization of ruminant livestock assets (Jaetzold and Schimdt, 1983). Turkana County is the second largest County in Kenya, with an estimated land area of 68,680 km^2. It borders Uganda to the west, Sudan to the North West and Ethiopia to the north east, Samburu and Marsabit Counties to the south east and to the south it borders Baringo and West Pokot Counties. It lies between latitudes 0° 51′ and 5° 30′ N and longitudes 34° and 30° 40′ E (Watete *et al*., 2016).

The main socio-economic activity in Turkana County is pastoralism with livestock movement in search of pasture/browse and watering points. The main livestock species kept are indigenous cattle, sheep, goats, camels and donkeys (Imana and Greyling, 2008). Apiculture and indigenous poultry keeping are other emerging livestock being embraced by some households. Crop production is also a major livelihood that has been embraced by settled communities along the two major rivers; Turkwel and Kerio. Most of the riverine crop farmers are former pastoralists who have quit livestock keeping after they lost viable herds (Watete *et al*., 2016). In contrast, Trans-Nzoia County is located at latitude 1°01'N, longitude 35°7.5'E, at an elevation of 1,890 meters above sea level. It receives on average 1,143 mm of annual rainfall and the soils are fertile (Nyukuri *et al*., 2013) and is a high potential agricultural- maize growing area (Jaetzold *et al.*, 2005) where IC is traditionally an important component of the livelihood. In Turkana, IC keeping is relatively newer, recently introduced to diversify the livelihood base from dependency on ruminants, which are highly vulnerable to the recurring drought events (Okeno *et al*., 2012).

Trans-Nzoia County has close to 70% of households keeping chicken that scavenge for food from croplands and from kitchen food waste (Okeno *et al.*, 2012; Ochieng *et al.*, 2013).

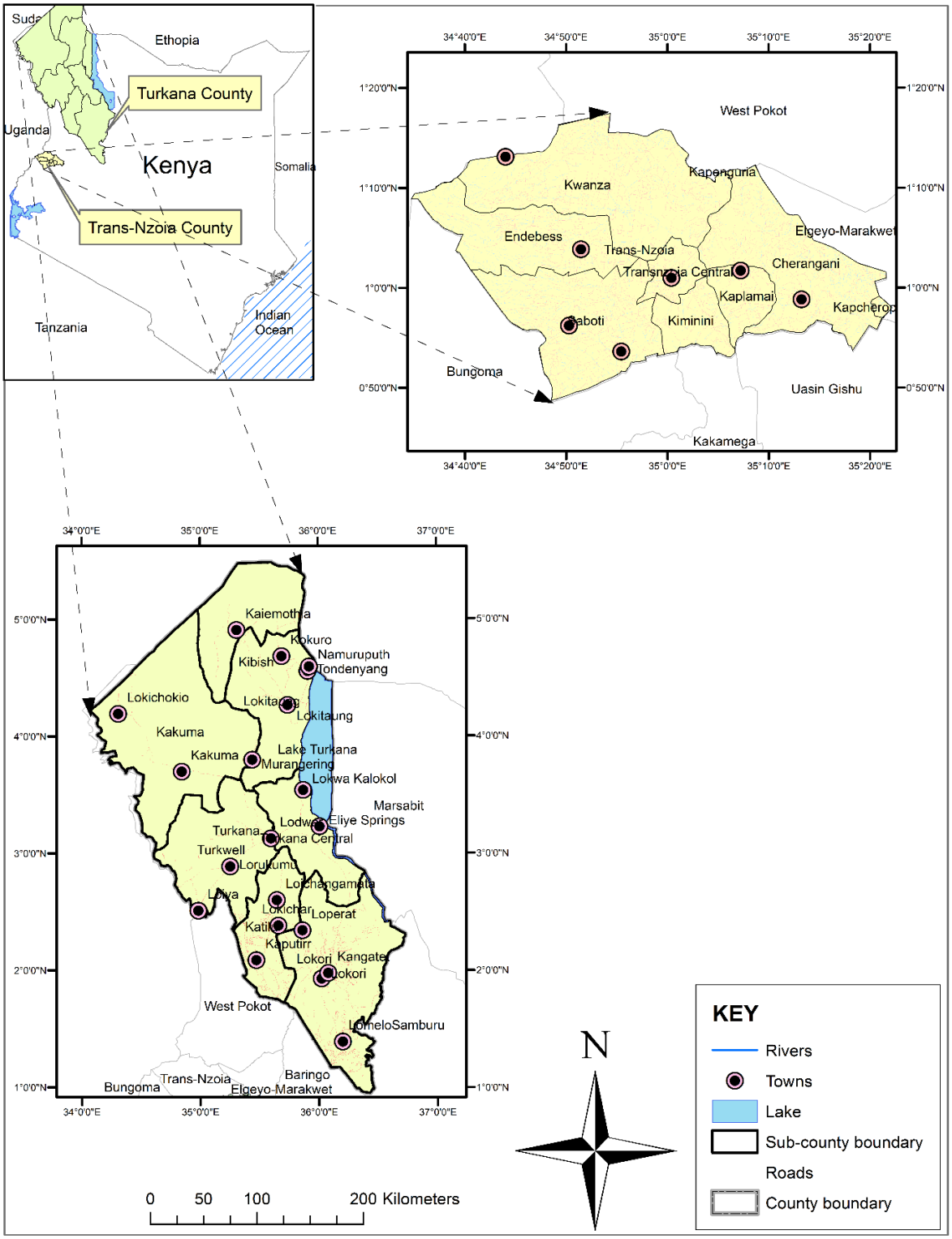


Figure 2. Map of Kenya showing the study areas (Source: Google maps)

3.2 Sample size determination

The minimum required sample (n) was estimated at 256 households from the formula of (Kish, 1965):-

$$n = \left[1.96 * \frac{SD}{ME}\right]^2$$

Where SD is the standard deviation of flock size, ME is the margin of error for detecting significant change in flock size at 95% confidence interval represented by 1.96 value. The flock size standard deviation of 2.04 from the study of Okeno *et al*. (2012) in the study area was substituted in the above formula with a marginal error corresponding to the ability to identify 25% change in the flock size as being significant at 5% level of significance with 80% power. The computed sample size was equally distributed for the two Counties giving a total of 128 households per county.

3.3 Sampling procedure

The households were randomly selected in a cross sectional survey in a two multistage sampling. Turkana Central and Trans-Nzoia West sub-Counties, being representative regions in the two Counties where IC keeping dominates were purposively selected due to the financial limitations of the researcher. Two locations were then randomly selected in each sub-county, one in rural and another in peri-urban setting to control for the influence of urbanization in uptake of IC observed in Turkana County (Okeno *et al*., 2012). Two sub-locations in each location were further randomly selected in each sub-County. A list of IC keeping households was obtained in all the villages with the assistance of local administrators and agricultural officers. Thirty two households were obtained from the list selected in each of the four sub-locations in each County through simple random sampling procedure. These thirty two households were visited for data collection.

3.4 Data collection

Data in scale, ordinal or nominal measurements was obtained with semi structured questionnaires previously pre-tested in non-study locations in the two counties. Primary data collected included household characteristics, flock size and structure, management practices (breeding, housing, vaccination, feeding, artificial incubation of eggs and artificial brooding), capital asset values of IC for defining livelihood roles and access to extension services. Data collected in management practices was categorical. These are variables that are nominal in

scale with distinct categories that define the variable. For management practices variables, data was collected as follows:

i. Breeding stock: use of either locally hatched birds or purchase of breeding flocks.
ii. Housing: type of housing whether improved or non-improved
iii. Vaccination: the practice or non-practice
iv. Supplementary feeds: purchase of feeds or non-purchase
v. Artificial incubation of eggs: the practice or non-practice.
vi. Artificial brooding: the practice or non-practice

Capital asset value of IC was defined under five categories namely; social, financial, human, natural and physical capital. Social capital are the networks or relationships that households can develop in the course of IC keeping to exploit livelihood activities. For this study, birds and eggs shared as gifts and loaned to relatives, the role of IC in social recreation through cock fighting and linkages created through external support to IC were considered as sources of social capital. Financial capital represents the economic assets, stocks and revenue flows which are key to attaining certain livelihood goals. For purposes of this study, total revenue flows obtained in KES from sale of live birds, manure and eggs was considered as financial capital. Human capital refers to factors that can enable household individuals to participate in livelihood activities like education and health. For this study, the extent to which households invested IC income in foodstuff, to pay school fess and to buy medicines for household members were variables for human capital.

Natural capital represents natural stock resources that have the ability to flow and provide services that can aid people's livelihoods. For this study, the use of IC manure as fertilizer in various farming activities by the household was used as proxy for IC contribution to natural capital. Physical capital is the infrastructure or services, tools and goods that are a necessity in making a living. The extent to which households used feathers in ceremonial events, eggshells use as supplement in chicken feed or household decoration, the use of birds as biological timers/clocks especially in waking up household members and use of birds as weed or pest controllers in farms were used as proxies for physical capital. The needs for extension services were based on whether the household had access or not to breeding stock, vaccination, veterinary services, market information and credit facilities directed to IC flock.

3.5 Data analysis

The statistical tests performed compared pastoral and agricultural households for the livelihood roles of IC, management practices of IC and access to extension services in utilizing IC. Two test statistics were used: the t-test of mean difference and Chi square test for independence. Both tests were performed in Statistical Package for Social Sciences (SPSS) version 22 (SPSS 2013).

All livelihood capitals were measured using categorical variables except financial capital. Social, human, natural and physical capitals in pastoral and agricultural households were variable counts and therefore the frequencies were subjected to chi-square test of independence. Financial capital was measured in Kenya shilling (KES) which was a continuous variable and means between the two samples were subjected to t test to detect if significant differences existed. Flock size and structure were in continuous scale units and therefore were subjected to t-test to detect if significant mean differences existed.

Management practices and extension services were count data therefore were subjected to Chi square test for independence between the practice or extension and the livelihood base (pastoral and agricultural). Statistical significance ($P<0.05$) indicated dependence.

CHAPTER FOUR

RESULTS

4.1 Household characteristics

Description of the sample characteristics showed that more females than males kept IC in both pastoral and agricultural households, but compared to agricultural households, keeping of IC in pastoral households was associated with lower literacy levels, younger age and lower income levels (Table 1).

Table 1. Sample characteristics of IC keeping households by livelihood

Factor	level	Livelihood base		Chi square (χ^2) statistics
		Pastoral (%) (n=128)	Agricultural (%) (n=128)	
Gender	Male	35.2	32.8	0.157
	Female	64.8	67.2	
Education	None	59.4	11.7	71.893*
	Primary	23.4	37.5	
	Secondary	8.6	40.6	
	Tertiary	8.6	10.2	
Age (years)	<35	68.8	33.6	36.749*
	36-50	27.3	44.5	
	>50	3.9	21.9	
Total income	<2000	97.7	46.9	82.738*
	2001-5000	2.3	28.9	
	5001-10000	0	11.7	
	>10000	0	12.5	

*P<0.05

The flocks were smaller (6.7 vs 26.6) but with more cocks (27.2% vs 10.2%) and fewer growers and chicks (40.4% vs 61.2%) in the pastoral households compared to the agricultural households (Table 2).

Table 2. Indigenous chicken flock size and structure by livelihoods

Factor	statistic	Livelihood base		Mean difference
		Pastoral (n=128)	Agricultural(n=128)	
Flock size	Mean ±SD	6.7±6.3	26.6±22.5	19.828***
Flock structure				
Cocks	%	27.2	10.2	0.992*
Hens	%	32.4	28.6	5.406*
Growers & chicks	%	40.4	61.2	13.509*

*P<0.05; ***P<0.001

4.2 Management practices for IC flocks in pastoral and agricultural based livelihoods

Among the sampled households results showed that breeding stock were obtained from hatching in both pastoral and agricultural households. However, Adoption of improved management practices were generally lower among the pastoral households compared to the agricultural households, whether improved housing (0 vs 28.9%), purchasing supplementary feeds (1.6% vs 28.9%), vaccinating flocks (12.5% vs 88.3%), practicing artificial incubation of eggs (0 vs 14.8%) or artificial brooding (0 vs 45.3%) as shown in Table 3.

Table 3. Management practices for IC flocks by livelihoods

Factor	Levels	Livelihood base		Chi square (χ^2) statistics
		Pastoral (%) (n=128)	Agricultural (%) (n=128)	
Breeding stock	Hatched	86.7	82.9	0.756
	Purchased	13.3	17.1	
Housing	Not improved	100.0	71.1	43.251***
	Improved	0	28.9	
Supplementary feeds	Not purchased	98.4	71.1	37.055***
	Purchased	1.6	28.9	
Vaccination	Not practiced	87.5	11.7	147.024***
	Practiced	12.5	88.3	
Artificial incubation of eggs	Not practiced	100	85.2	20.523***
	Practiced	0	14.8	
Artificial brooding	Not practiced	100	54.7	74.989***
	Practiced	0	45.3	

***P<0.001

4.3 Livelihood roles of the IC in the pastoral and agricultural households

Both pastoral and agricultural households utilized IC for social recreation, but more of the pastoral built their foundation stock from gifts (67.2% vs 18.8%) and external support from NGO (29.7% vs 3.1%) as shown in Table 4.

Table 4. Social capital derived from keeping IC by livelihoods

Social capital	Measures	Livelihood base		Chi square (χ^2) statistics
		Pastoral **(%)** **(**n=128)	Agricultural **(%)** (n=128)	
Source of foundation stock				77.8*
	Gift	67.2	18.8	
	Inherited	0	1.6	
	Purchased	32.8	79.7	
External support for sourcing IC				33.4*
	None	69.5	94.5	
	NGO	29.7	3.1	
	Government	0.8	2.3	
Use of IC cock fights-social recreation events				0.204
	No	98.4	97.3	
	Yes	1.6	2.7	

*P<0.05

Compared to agricultural households, pastoral households had KES 13,858.50 lower total monthly incomes and were entirely from IC, unlike in the agricultural households where IC contributed only 20% of the total monthly incomes (Table 5).

Table 5. Incomes and proportion of income from IC by livelihoods

Income	Statistics	Livelihood base		Mean difference
		Pastoral (n=128)	Agricultural (n=128)	
Total income	Mean (KES/month)	610.70	14, 469.20	13,858.50**
IC income contribution	%	100.0	20.0	80.0***

**P<0.01; ***P<0.001

Compared to agricultural households, fewer of the pastoral households used chicken manure in kitchen gardening (0.8% vs 92.2%) as shown in Table 6.

Table 6. Natural capital derived from IC keeping by households

Manure use	Livelihood base		Chi square (χ^2) statistics
	Pastoral (%) (n=128)	Agricultural (%) (n=128)	
None	98.3	5.5	220.778*
Tree planting	1.6	0	
Farms	1.6	2.3	
Live fences	2.3	0	
Kitchen gardening	0.8	92.2	

*P<0.05;

Compared to agricultural households, more of the pastoral households used the income from IC to purchase food (89.1% vs 58.6%), to finance school fees (94.5% vs 39.8%) or accessing health care services (95.3% vs 85.9%) as shown in Table 7.

Table 7. Expenditure of incomes from IC representing human capital livelihoods

Use of IC income	Livelihood base		Chi square (χ^2) statistics
	Pastoral (%) (n=128)	Agricultural (%) (n=128)	
Food purchases	89.1	58.6	34.054***
Healthcare	95.3	85.9	7.821*
School fees	94.5	39.8	49.256***

*P<0.05; ***P<0.001

Feather use was not practiced by both households (99.2% vs 98.4%) though a few agricultural households (1.6%) used feathers in cultural events. Eggshells were not utilized in the pastoral households but were used as feed ingredient and decorations in agricultural households (100% vs 11%). Both households depended on IC cocks as biological clocks although this was higher in pastoral households (90.6% vs 71.4%). Less than 30% of both households used IC in weed/pest control although this was lower in pastoral households (4.7% vs 28.9%) as shown in Table 8.

Table 8. Use of IC and IC products as physical capital by livelihood

Capital	Specific capital	Livelihood base		Chi square (χ^2) statistics
		Pastoral (%) (n=128)	Agricultural (%) (n=128)	
Feather use	No	99.2	98.4	3.004
	Cultural	0	1.6	
	Others	0.8	0	
Eggshell use	None	100	89.1	14.810*
	Chicken feed	0	10.2	
	Decorations	0	0.8	
Use IC as bio-clocks	No	9.4	28.6	15.045*
	Yes	90.6	71.4	
IC as weeds/pest controls	No	95.3	71.1	26.861*
	Yes	4.7	28.9	

*P<0.05

4.4 Access to extension services for IC management by pastoral and agricultural households

Except for accessing market information, fewer of the pastoral households than the agricultural households accessed vaccination (22.5% vs 59.4%) or drugs for treatment (30.5% vs 93.7%), agro-vet stores (30.5% vs 96.9%), extension advisory services (6.2% vs 27.3%) or credit facilities (2.3% vs 15.6%) for their IC flocks (Table 9).

Table 9. Households accessing inputs and services for IC management by livelihood

Inputs and services	Access	Livelihood base		Chi square (χ^2) statistics
		Pastoral (%) (n=128)	Agricultural (%) (n=128)	
Vaccination	No	72.7	40.6	26.737***
	Yes	27.3	59.4	
Treatment	No	69.5	6.3	108.903***
	Yes	30.5	93.7	
Agro vet store	No	69.5	3.1	16.430***
	Yes	30.5	96.9	
Advisory services	No	93.8	72.7	20.376***
	Yes	6.2	27.3	
Market information	No	58.6	57.0	0.064
	Yes	41.4	43.0	
Credit facility	No	97.7	84.4	13.806***
	Yes	2.3	15.6	

***P<0.001

CHAPTER FIVE

DISCUSSION

This study compared the livelihood roles of IC, their management practices and access to supportive inputs, and extension advisory services for utilizing IC between pastoral and agricultural households. A comparative analysis was performed to answer the research questions of whether the livelihood roles of IC, management practices of IC and access to inputs and services for utilization of IC significantly differs between pastoral and agricultural households. Because the households were two independent random samples, answers to the research questions were derived from empirical analysis applying t-test of mean difference for continuous variables and Chi square test for independence for count or frequency data.

5.1 Management practices in IC utilization

Pastoral households kept smaller flock size than the agricultural households, which could be an influence of the peri-urban where the sample households were residing and probably the ecological zones (Muchadeyi *et al*., 2007; Okeno *et al.*,2012) as well as livelihood roles and feeding capacity of the household. As expected, hens and growers comprised larger proportion of the flock to sustain flock growth and to supply eggs to the household, and so less are slaughtered or sold (Ochieng *et al.*, 2013). Adoption of improved management practices were adversely lower among the pastoral households in housing, supplementary feeds, vaccination, artificial incubation of eggs and artificial brooding which were worsened by poorer access to inputs and outputs markets to support their needs for vaccination, drugs, treatment and extension advisory services or credit facilities.

Management of IC flock was under women in both pastoral and agricultural households, which reflects strong cultural influence that associates women with less valued assets, leaving to men the highly valued ruminant livestock assets. This is in agreement with previous studies (Kirwa *et al*., 2010; Meseret *et al.*, 2011; Karmebäck *et al.*, 2015) which reported an increase in pastoral women keeping poultry. Their characteristics were low literacy, younger age and low income, which explained why IC was their sole source of income used to meet cash needs of the households. The high illiteracy levels among IC keeping households observed in this study had been observed in the past (Mwale and Masika, 2009). The findings that more younger pastoral households kept IC contradicts the findings of Adeniyi and Oguntunji (2011)

that most of the IC keepers are adults, although their study was among the agricultural households.

Raising breeding stock from within own flock is a practice among IC keeping households, which for IC sustainable utilization require advisory extension services to educate farmers on sustainable breeding (Okeno *et al.*,2012). Poor housing of IC among pastoral households could be exposing their flock to theft, predators and adverse weather found in the ASALs (Mlambo *et al*., 2011; Habte *et al*., 2015; Maumburudze *et al.,* 2016). Limited vaccination exposes flocks to New Castle Disease, which is a mass killer of the flock. Access to agro vets was limited to pastoral households compared to their agricultural counterparts. This observation could be due to lack of agro vet stores in pastoral areas or lack of the purchasing power to access it. Availability of agro vet stores to chicken keepers is important in accessing vaccines and other drugs to reduce IC mortality.

5.2 Livelihood roles of IC

This study shows that IC is of importance in provision of social capital among pastoral than among the agricultural households. These enabled households obtain foundation stock through gifts from other households or relations, in contrast to agricultural household who obtained foundation stock through purchases, implying making individual investment. Exploitation of social capital among the pastoral households is a cultural tenet that still encourages asset sharing, but it contradicts the findings of Kaye-zwiebel and King (2014) that pastoralists have reduced social capital sharing through gifts and sharing of resources. However, the present results showing agricultural households obtained their foundation stock through individual investments. This is in agreement with the observations of Mwobobia *et al*., (2016) that seed chicken was predominantly through purchases among the agricultural households. Both households did not use their flocks in cock fights as a social recreation activity, an indication of diminishing cultural practices as a result of urbanization among the Luhya community because the samples were drawn from peri-urban areas.

Agricultural households derived more financial capital from IC than pastoral households with earned cash income in excess of twenty times the amount earned by pastoral households. This could be attributed to the smaller flock sizes and limited commercialization of IC among pastoral households. Interestingly, the IC income in pastoral households represented the only source of income unlike in agricultural households. This is an important observation, demonstrating the success of IC in livelihood diversification under limited livelihood options

in the pastoral areas. More of the pastoral households used the income to purchase food (89.1% vs 58.6%), to finance school fees (94.5% vs 39.8%) and to access health care services (95.3% vs 85.9%).

The highest mean monthly income of KES 14,469.20 from agricultural households in this study is within the range of less than KES 20,000 income observed in agricultural IC keeping households (Kyule *et al*., 2014). Fewer of the pastoral households were exploiting natural capital of IC compared to the agricultural households who nearly all used chicken manure on their kitchen gardens. This observation reflects limited agricultural activities among the pastoral households in the peri-urban areas in contrast to the agricultural households who are actively farming and need manure to sustain soil fertility for improved vegetable production which they consume and sell surplus for income (Muchadeyi *et al.*, 2004; Nakkazi *et al.*, 2014). It could also be limited by the volume of the manure produced by IC in pastoral households and the number of birds kept by a household.

Nearly all pastoral households did not benefit from physical capital from IC compared to agricultural households in use of feathers for cultural events and use of egg shells. This is an indication of poor poultry extension services in pastoral areas. Almost all sampled households used IC as timers or clocks to wake them up to engage in productive livelihood activities although this was higher for pastoral households. This was anticipated due to the effect of urbanization in agricultural areas with households using modern timing gadgets like watches and alarm clocks leaving this to rural areas (Magothe *et al*., 2012). Fewer of the sampled households used IC as weeds/pest controllers in their farms. This observation could be attributed to lack of crop production in pastoral households and the fear of destruction of crops by birds especially during certain periods of crop development. This was expected as the concept and the demand for food produced organically is not well developed in the country.

5.3 Access to extension services for IC utilization

Access to input and output markets support commercialization of IC and their contribution to livelihoods of the households. In the context of this study, access refers to availability or unavailability of a service or availability of a service with lack of money to purchase it. In this study, fewer of the pastoral households accessed vaccination, drugs for treatment, agro-vet stores, extension advisory services and credit facilities. Lack of vaccinations and treatment observed is due to lack of agro vets investors in pastoral areas probably due to lack of cold

chain support services or lack of demand for their products. This is in agreement with findings of Opiyo *et al*. (2015) who observed lack of access to professional animal health services, inaccessibility to extension services, unaffordable loans and livestock market inaccessibility in Turkana County as impediments to instituting long term drought coping alternatives in the livestock sector. In absence of these, IC roles will be greater in subsistence livelihood support and not in commercial transformation.

Lack of essential extension services can adversely affect sustainable utilization of IC for pastoral households in this sample that obtained their entire income from IC. Due to lack of these services pastoral households are unable to learn from the availability of best practices offered by players in the value chain. Consequently, their management practices will remain largely traditional as a case with most IC keepers (Adeniyi and Oguntunji, 2011) which lowers the contribution of IC to their livelihoods. Comparatively, better access to input and output markets by agricultural households has been important in improving IC utilization linked to value chain development (Ochieng *et al.,* 2013; Mwobobia *et al*., 2016). However, access to advisory services by both sampled households is still low.

This could be due to lack of extension services in the country occasioned by freeze of employment by the government in the past. Fewer pastoral households had access to credit facilities than agricultural households and therefore unable to invest in improved management practices and purchase inputs as observed in this study. Access to market information is similar in both pastoral and agricultural households because the sampled households had similar settings in access to markets.

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CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This study performed a comparative analysis to answer specific research questions of whether the livelihood roles of IC, their management practices and access to inputs and extension service significantly differ between the pastoral and agricultural households. From the results obtained with t-test of mean difference and Chi square test for independence, it was concluded that:

i. Adoption of improved management practices were lower among the pastoral households compared to the agricultural households in housing, supplementary feeding, vaccination of flocks, artificial incubation of eggs and artificial brooding.

ii. Livelihood roles of IC significantly differed between pastoral and agricultural households. IC contributed the entire household income among the pastoral households who used the income to purchase food, finance school fees and to access health care services, but did not use chicken manure for farming.

iii. Pastoral households had poorer access to extension advisory services.

6.2 Recommendations

i. Turkana County government needs to improve input and output markets, and extension support services to provide opportunities for households to continuously learn and adopt improved IC management practices so as to increase their livelihood contribution.

ii. Further research to investigate the integration of IC with other drought coping choices among pastoral households.

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APPENDICES

APPENDIX I: QUESTIONNAIRE

EGERTON UNIVERSITY

FACULTY OF AGRICULTURE

DEPARTMENT OF ANIMAL SCIENCES

QUESTIONAIRE FOR THE RESEARCH ON COMPARATIVE ASSESSMENT OF MANAGEMENT PRACTICES AND LIVELIHOOD ROLES OF INDIGENOUS CHICKEN IN PASTORAL AND AGRICULTURAL HOUSEHOLDS OF KENYA

Introduction

This survey is conducted by a post graduate student of Egerton University in the Department of Animal Sciences in partial fulfillment for a Master of Science Degree in Livestock Production Systems. The information provided will be used for academic work only and will be treated with ultimate confidentiality.

SECTION A: General household Information

Fill in your details by indicating appropriate numbers in the table below (choose the numbers below for gender and Education Level respectively).

Respondent's details	Name (optional)		Gender	Age (years)	Education level
Location details	County	Location	S/location	Date of interview (dd-mm-yy)	
Enumerators details	Name		Mobile. No		

Gender: 1=Male 2= Female
Education: 1= None 2= Primary 3=Secondary 4= Tertiary 5 =Others (specify)

SECTION B: Information on Chicken Management Practices

What management practices best reflects the situation on your flock at these times?

Management Practice	**Measure**	**Response**
1.1 IC in the HH	Number	[ ]
1.2 Flock structure	1=Hens 2=Cocks 3=Chicks &growers	1[ ]2[ ] 3[ ]
1.3 Source of breeding cocks	**1**= Own hatched and reared indigenous cocks **2**=Purchased cocks	[ ]
1.4 Housing for indigenous chicken	**1**= not improved **3**= Improved house	[ ]
1.5 Supplementary feeding	**1**=Purchased **2**=Not purchased	[ ]
1.6 Artificial incubation of eggs	**1**=Practiced **2**=Not practiced	[ ]
1.7 Artificial brooding	**1**=Not practiced **2**=Practiced	[ ]

SECTION C: Information on Social Networks

Provide the following information

Characteristic	**Measure**	**Response**
1.1 What was the source of seed chicken in your HH?	1=Purchased 2=Gift 3=Inherited	[ ]
1.2 What are the perceived benefits from being in a group beneficial to IC production?	1=Management skills 2=New technologies 3=Assets 4=Disease control 5=Marketing 6=Loans	[ ]
1.3 Are there institutional	1=None 2=Government 3=NGO 4=FBO	

actors that support IC?		[ ]
1.4 What are the extension approaches used by the actors in the IC sector?	1=Group approach 2=HH visits 3=Demos 4=Field days 5=others	[ ]
1.5 Are IC used in cock fighting in this locality?	1=No 2=Yes	[ ]

SECTION D: Information on HH IC Income Sources

Indicate the average income from the following products and by-products of your indigenous flock in the last three months

Product(s)	measure	Units sold	Price/unit	Total
Chicks	Kes each		[ ]	[ ]
Growers	Kes each		[ ]	[ ]
Hens	Kes each		[ ]	[ ]
Cocks	Kes each		[ ]	[ ]
One Egg	Kes each		[ ]	[ ]
Manure	Kes/ kg		[ ]	[ ]
Grand total				[ ]

SECTION E: Information on Use of IC Incomes to Enhance Human Capital

Please provide the uses of HH IC income in for the last three months

Use **Amount (KES)**

Food purchases

Healthcare

School fees

Total

SECTION F: Information on Utilization of IC as Physical Assets

Utility	**Measure**	**Response**
1.1 Do you use chicken feathers for any other purposes?	1=No 2=Cultural 3=Beddings 4=Arrows 5=Decoration 6=Others	[____]
1.2 Do you use egg shells for any purposes?	1=No 2=Chicken feed 3=Decorations	[____]
1.3 Do you depend on chicken as biological clocks?	1=Yes 2=No	[____]
1.4 Do you use chicken as mechanical weed/pest controllers in your farm?	1=Yes 2=No	[____]

SECTION G: Information on Use of Manure in Soil Fertility

1.1 Do the HH use chicken manure? 1=None 2=HH farm 4=Kitchen garden 5=Tree planting 6=Live fences

SECTION H: Information on Service Needs Demand

Service	**Measure**	**Response**
1.1 Is the HH accessible to	1=No 2=Neighbor 3=Market 4=Large commercial farms 5=Research	

breeding stock?	institution/farms	[____]
1.2 Do you have access to vaccination services for your chicken?	1=Yes 2=No	[____]
1.3 Do you treat your chicken when they are sick?	1=No 2=Self 2=Neighbor 3=Private vet 4=Vet staff	[____]
1.4 If self where do you get drugs?	1=Agro vet 2=Non-conventional 3=Ethno veterinary	[____]
1.5 Do you have access to extension services?	1=No 2=Extensionists 3=radio 4=newspapers 5=TV 6=mobile phone	[____]
1.6 Does the HH receive information on IC markets?	1=No 2=neighbor 3=radio 4=newspaper 5=TV 6=mobile phone	[____]
1.7 Is the HH accessible to loan facilities?	1=No 2=Bank 3=MFI 4=Farmer groups	[____]

APPENDIX II: Chi square results comparing livelihood roles of IC between pastoral and agricultural households

1. **Social capital**

County * IC use in cock fights

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.204[a]	1	.652		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.205	1	.650		
Fisher's Exact Test				1.000	.500
Linear-by-Linear Association	.203	1	.652		
N of Valid Cases	256				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.50.
b. Computed only for a 2x2 table

County * external support

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.400[a]	2	.000
Likelihood Ratio	37.749	2	.000
Linear-by-Linear Association	18.586	1	.000
N of Valid Cases	256		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.00.

County * source of foundation stock

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	77.804[a]	5	.000
Likelihood Ratio	94.415	5	.000
Linear-by-Linear Association	37.274	1	.000
N of Valid Cases	256		

a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is .50.

2. **Human capital**

County * school fees

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	49.256[a]	2	.000
Likelihood Ratio	55.228	2	.000
Linear-by-Linear Association	47.266	1	.000
N of Valid Cases	256		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.00.

County * food purchases

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.054[a]	2	.000
Likelihood Ratio	36.293	2	.000
Linear-by-Linear Association	23.293	1	.000
N of Valid Cases	256		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.50.

County * healthcare

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.821[a]	2	.020
Likelihood Ratio	9.457	2	.009
Linear-by-Linear Association	7.742	1	.005
N of Valid Cases	256		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.00.

3. **Natural capital**

County * Manure use

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	220.778[a]	7	.000
Likelihood Ratio	282.515	7	.000
Linear-by-Linear Association	208.489	1	.000
N of Valid Cases	256		

a. 12 cells (75.0%) have expected count less than 5. The minimum expected count is .50.

4. Physical capital

County * Feather use

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.004[a]	2	.223
Likelihood Ratio	4.163	2	.125
Linear-by-Linear Association	.000	1	1.000
N of Valid Cases	256		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .50.

County * Eggshell use

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.810[a]	2	.001
Likelihood Ratio	20.218	2	.000
Linear-by-Linear Association	13.902	1	.000
N of Valid Cases	256		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is .50.

County * IC as biological clocks

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	15.045[a]	1	.000		
Continuity Correction[b]	13.827	1	.000		
Likelihood Ratio	15.610	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	14.986	1	.000		
N of Valid Cases	253				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 23.91.
b. Computed only for a 2x2 table

County * IC as weed/pest control

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	26.861[a]	1	.000		
Continuity Correction[b]	25.156	1	.000		
Likelihood Ratio	29.384	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	26.756	1	.000		
N of Valid Cases	256				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 21.50.
b. Computed only for a 2x2 table

5. Financial capital

County * Total income

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	82.738[a]	3	.000
Likelihood Ratio	100.449	3	.000
Linear-by-Linear Association	65.899	1	.000
N of Valid Cases	256		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.50.

APPENDIX III: Chi square results comparing management practices of IC between pastoral and agricultural households

County * housing IC

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	141.740[a]	3	.000
Likelihood Ratio	167.757	3	.000
Linear-by-Linear Association	3.117	1	.077
N of Valid Cases	256		

a. 2 cells (25.0%) have expected count less than 5. The minimum expected count is 2.50.

County * supplementary feeding

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	150.934[a]	7	.000
Likelihood Ratio	188.938	7	.000
Linear-by-Linear Association	99.927	1	.000
N of Valid Cases	256		

a. 2 cells (12.5%) have expected count less than 5. The minimum expected count is 4.50.

County * vaccination

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	148.048[a]	2	.000
Likelihood Ratio	168.224	2	.000
Linear-by-Linear Association	107.748	1	.000
N of Valid Cases	256		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 25.00.

County * artificial incubation of eggs

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.523[a]	2	.000
Likelihood Ratio	27.864	2	.000
Linear-by-Linear Association	18.085	1	.000
N of Valid Cases	256		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 4.00.

County * Artificial brooding

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	74.990[a]	2	.000
Likelihood Ratio	97.647	2	.000
Linear-by-Linear Association	65.858	1	.000
N of Valid Cases	256		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.00.

APPENDIX IV: Chi square results comparing access to extension services of IC utilization between pastoral and agricultural households

County * Access to vaccination services

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	26.737[a]	1	.000		
Continuity Correction[b]	25.449	1	.000		
Likelihood Ratio	27.262	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	26.633	1	.000		
N of Valid Cases	256				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 55.50.

b. Computed only for a 2x2 table

County* Access to Market information

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.064[a]	1	.800		
Continuity Correction[b]	.016	1	.899		
Likelihood Ratio	.064	1	.800		
Fisher's Exact Test				.899	.450
Linear-by-Linear Association	.064	1	.801		
N of Valid Cases	256				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 54.00.
b. Computed only for a 2x2 table

County * Access to loan facilities

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	13.806[a]	1	.000		
Continuity Correction[b]	12.229	1	.000		
Likelihood Ratio	15.314	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	13.752	1	.000		
N of Valid Cases	256				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 11.50.
b. Computed only for a 2x2 table

County * Access to advisory services

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	20.376[a]	1	.000		
Continuity Correction[b]	18.895	1	.000		
Likelihood Ratio	21.725	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	20.296	1	.000		
N of Valid Cases	256				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 21.50.
b. Computed only for a 2x2 table

County * Access to veterinary drug shops (agro vets)

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	16.430[a]	1	.000		
Continuity Correction[b]	14.554	1	.000		
Likelihood Ratio	19.725	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	16.366	1	.000		
N of Valid Cases	256				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 9.50.

b. Computed only for a 2x2 table

County * Access to IC treatment

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	108.903[a]	1	.000		
Continuity Correction[b]	106.231	1	.000		
Likelihood Ratio	122.490	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	108.478	1	.000		
N of Valid Cases	256				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 48.50.

b. Computed only for a 2x2 table

List of publication and presentation

Lotesiro J E, King'ori A M and Bebe B O 2017: Comparative assessment of livelihood roles of indigenous chicken in pastoral and agricultural households of Kenya. *Livestock Research for Rural Development. Volume 29, Article #238.* Retrieved from http://www.lrrd.org/lrrd29/12/lote29238.html

Lotesiro J.E, King'ori A.M. and Bebe B.O. 2017. Comparative assessment of livelihood roles of Indigenous Chicken in pastoral and agricultural households of Kenya.11th Egerton University International Conference and Innovation week. 29th 31stMarch, 2017.Egerton University, Njoro, Kenya