ASSESSING THE PRODUCTIVITY OF INDIGENOUS CHICKEN IN SOUTHERN NYANZA, KENYA

Portas Odula Olwande (BVM-UoN)

A thesis submitted to the University of Nairobi in partial fulfilment of the Master of Science (MSc) degree in Veterinary Epidemiology and Economics.

Department of Public Health Pharmacology and Toxicology,

Faculty of Veterinary Medicine,

University of Nairobi

2008

Declaration

This thesis is my original work and has not been presented for a degree in any other University.

Dr. Portas O. Olwande (BVM)

Signature..... Date 27-07-2009

This thesis has been submitted for examination with our approval as University Supervisors.

Dr. William O. Ogara (BVM, MSc, PhD)

Signature..... Date 27.07.2009

Dr. Gerald Muchemi (BVM, MSc, PhD)

Signature..... Date 27.07.2009

Dr. Samuel O. Okuthe (BVM, MSc, PhD)

Signature..... Date 27.07.2009

Dedication

This thesis is dedicated to my whole family, and specifically my wife, Joyce Olwande, my children Isaac Omondi, Deborah Akoth, Jael Achieng, Praise Akinyi and Joy Anyango and my nieces Purity Akinyi and Everlyne Awino for their continuous encouragement and prayers.

Acknowledgements

I give all glory and honour to the almighty God whose divine guidance and provision made this work to succeed. I express my sincere gratitude to the University of Nairobi and African Institute of Capacity Building and Development (AICAD) for their financial and material support to this work and more particularly to Drs. William Ogara and Maurice Odindo and Rubina Adhiambo for accepting me to carry out the study within their southern Nyanza AICAD sponsored poultry project.

Special thanks go to my supervisors Drs William Ogara, Gerald Muchemi and Samuel Okuthe for their guidance and continuous help. In addition I am greatly indebted to all lecturers and researchers involved in the teaching of the course, from the Faculties of Veterinary Medicine and Agriculture, University of Nairobi.

I extend my appreciation to the field staff of the Ministry of Livestock and Fisheries Development in Rongo and Rachuonyo districts for their cooperation during the entire study period. Special thanks go to our contact farmers in the two districts for their cooperation and availability whenever our research team needed them. I am grateful to Zachary Juma, Jacob Okongo, Constansia Adhiambo and Damaris Awino, who worked tirelessly in the field, to assist in the data collection.

Finally I am grateful to my family for their moral support and understanding when I was away from home for my studies.

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Abbreviations

AICAD	African Institute of Capacity Building and Development
AHA	Animal health assistant
ASAL	Arid and semi-arid land
BVM	Bachelor of Veterinary Medicine
CBS	Central Bureau for Statistics
DANIDA	Danish International Development Assistance
DDVO	Deputy District Veterinary Officer
DLPO	District Livestock Production Officer
DVO	District Veterinary Officer
DVS	Director of Veterinary Services
GDP	Gross Domestic Product
GoK	Government of Kenya
IDS	Institute for Development Studies
KARI	Kenya Agricultural Research Institute
MA	Ministry of Agriculture
MLFD	Ministry of Livestock and Fisheries Development
MSc	Master of Science
ND	Newcastle disease
NPDP	National Poultry Development Project

RRA	Rapid Rural Appraisal
SPSS	Statistical Package for Social Scientist
UoN	University of Nairobi

Abstract

The aim of the study was to determine the productivity and; product output per unit input in a given time frame, productivity constraints of indigenous chickens under village management conditions and to recommend specific intervention to improve productivity and sustainability of small-scale indigenous chicken production. Productivity of an animal can be defined as Product output per animal unit per unit time e.g. eggs per hen per year or product output per unit of input e.g. live weight gain per kilogram of feed or the value of product output per unit input in monetary terms.

The study was conducted in three phases in Komolorume and Kawere villages in Rongo and Rachuonyo districts respectively. Firstly, a rapid rural appraisal (RRA) was carried out in October 2007 to rank and prioritise the productivity constraints of the indigenous chickens. The second phase was a cross-sectional study conducted in 81 households from late October to November 2007 to determine the indigenous chicken production baseline data and to triangulate some of the RRA findings. A four-month prospective observational study lastly followed from November 2007 to end of February 2008 to monitor the productivity indicators, which included clutch and flock sizes, hatchability rates, egg and live body weights and body weight gain and chick survival rates. The data was obtained by actual measurement, on spot observation, interview of household members directly responsible for care of chickens and community group discussions.

Diseases were ranked as the most important constraint to indigenous chicken production. The important diseases identified in order of importance were Newcastle (ND), fowl typhoid, Gumboro and fowl pox. Predation of the chicks by birds of prey (eagles and craws) and animals including mongoose, wild dogs and cats ranked second most important. Other

important constraints were scarcity of feed and poor housing, animal health care and breeding selection.

The mean flock sizes were 20 birds and 18 birds per household for Komolorume and Kawere villages respectively. The overall mean flock size for the two study villages was 19 birds per household with a range of 1-64. The mean clutch size, egg weight and hatchability were 12 eggs, 48 g and 80 % respectively in Komolorume village and 10 eggs, 46g and 70 respectively in Kawere village. Chick survival rates to the age of eight weeks were 13 % and 10 % for Komolorume and Kawere villages, respectively. Mean live weights for cocks and hens were 2096 g and 1599 g for Komolorume village and 2071 g and 1482 g for Kawere village, respectively. The mean cock to hen ratio per household was 2:5 in Komolorume and 2:4 in Kawere. The mean growth rates to the age of 10 weeks were 4.3 and 4.7 g/day for female and male chicks in Komolorume village and 3.8 and 4.3 g/day for female and male chicks in Kawere village, respectively. These parameters indicate low productivity, which is typical of the extensive management of the indigenous chicken production. The results of this study indicate that indigenous chicken production is an important undertaking in southern Nyanza and largely contribute to household income and protein malnutrition alleviation. Women controlled most of the activities related to the daily management of the birds. The major production system was free-range whereby the birds got much of their own food through scavenging with irregular and inconsistent supplementation (mostly cereal grains) and housing mainly provided at night in human dwellings. Strategies that will improve housing, feeding, disease control and breeding will be able to improve the indigenous chicken production in southern Nyanza. The study further noted the importance of using integrated study approaches (qualitative and quantitative) in the assessment of the indigenous chicken

production and production constraints. The involvement of farmers in all stages of the study led to high level of interest and 100% response rate among respondents.

Chapter One

1.1 Introduction

Kenya is one of the East African countries bordering Tanzania to the south, Uganda to the west, Sudan and Ethiopia to the north, Somali to the east and Indian Ocean to the southeast. It is situated between longitudes 34^0 and 42^0 east and latitudes $4^022'$ N and $4^024'$ S. It has a human population of about 32 million people (CBS, 1999) and a land area of 564,662 square kilometres. The country has high population growth rate of 2.57% and high levels of poverty, with 50% living below poverty line (KNBS, 2008). Between 65-80% of the population live in rural areas eking out a living from subsistence farming, often under very difficult climatic and economic conditions (KNBS, 2008). Of the total land surface area, only 8% is considered suitable for arable farming (KNBS, 2008; MA, 2007) which worsens the level of poverty. The rest of the land is low potential and mostly suitable for livestock farming and is classified as arid and semi-arid lands (ASALs), characterized by high ambient temperatures and low rainfall.

Kenya has since independence relied on the agriculture sector as the base for economic growth, employment creation, and foreign exchange generation. Agriculture's contribution to gross domestic product (GDP) has been declining over the past few years but still remains one of the most important sector driving economic growth and plays central role in employment generation (MA, 2007; KNBS, 2008).

Livestock make a significant contribution to nutrition in sub-Saharan Africa, providing 17 to 18% of the protein in the human diets (Pricewaterhousecoopers, www.pwc.com). In Kenya livestock contributes about 10% of GDP and 30% of farm-gate value of agricultural commodities (MLFD,

2007). These figures are higher than the average for sub-Saharan Africa that is 8 and 25% respectively (Okuthe, 1999). The sub-sector employs over 50% of the agricultural labour force (MLFD, 2007). Livestock production is a major economic activity for the communities that live in the high potential areas for dairy production and ASALs for beef production (MLFD, 2007). The population of major livestock species is estimated at 12.3 million cattle, 8 million sheep, 11 million goats, 850,00 camels, 330,000 pigs, 30 million chickens and 470,000 rabbits (MLFD, 2007).

Poultry production in Kenya, like in many other developing countries, is carried out in two basic systems. The first and the largest is extensive production, which depends mainly on scavenging type of feeding (Siamba *et. al.*, 2002; Bebora *et. al.*, 2005; Okitoi *et. al.*, 2006). The second is intensive system of production that is based on improved breeds and found mainly in urban and peri-urban areas (Okitoi *et. al.*, 2006; MLFD, 2007). Even though most of the 21 million indigenous chickens (70% of the total poultry population) are raised under the extensive system, the value of the products is low compared to the intensive system since the potential of the indigenous chickens has not been fully exploited (Beborah *et. al.,* 2005; Ondwassy *et. al.,* 2006; Okitoi *et. al.*, 2006). For majority of the people living in the rural areas the importance of indigenous chicken is quite evident. The chickens play a role in providing quality meat and eggs as food and cash income from the sales of the products (Ndegwa *et. al.*, 1998; Okuthe, 1999).

Due to minimal inputs associated with this type of poultry production, the indigenous chickens do not attain their full production potential (Okitoi *et. al.,* 2006; Ondwassy *et. al.*, 2006). With a little extra effort in management, feeding and genetic selection, indigenous chickens have the

potential of increasing their egg yields. There are some indigenous chickens with higher laying capabilities than commercial ones (Bebora *et. al.*, 2005).

The present study was conducted in order to get information on the performance and constraints of indigenous chickens as a build up to previous work conducted by African Institute of Capacity Building and Development (AICAD). The study by AICAD identified indigenous chicken as the major poultry production system contributing to resource poor farmers' livelihood and food security. It was expected that the results from the study would form a basis for the formulation of strategies for improvement of indigenous chickens. The study was carried out in three phases using an integration of qualitative and quantitative methods. The first was a rapid appraisal phase using various tools that included, secondary data collection, key informant interviews, community group interviews, transect walks, scoring and general observations. This preceded a cross-sectional study using structured questionnaires and formal interviews to triangulate the findings of the rapid appraisals. The last phase was a four-month observational longitudinal study on productivity. The approach was suitable for the assessment of productivity constraints in indigenous chicken production since farmers were explicitly involved in the process. The reviewed literature on the previous research work on indigenous chickens within and outside Kenya offered useful guidelines that led to the successful outcome this work.

The thesis consists of seven chapters. Chapter 1 introduces the whole thesis followed by literature review in chapter 2. Materials and methods, results, discussions, conclusions and recommendations are presented in chapters 3, 4, 5, 6 and 7 respectively.

1.2 Problem statement and significance of the study

Assessing indigenous chicken productivity results in quantification of key parameters including hatchability rate, egg and live body weights, flock and clutch sizes and weight gain and survival rates. Previous studies carried out in the area identified poultry productivity constraints without prioritisation and quantification. The productivity data obtained would provide useful information to guide allocation of resources by different stakeholders to improve productivity.

1.3 Objectives

The overall objective of this study was to assess constraints limiting indigenous chicken production.

Specific objectives: -

- To assess the productivity of the indigenous chickens
- To rank and prioritise productivity constraints of the indigenous chickens
- To recommend appropriate intervention to improve productivity and sustainability of small-scale indigenous chicken production in the project area

Chapter Two

2.0 Literature review

2.1 Background information on indigenous chicken production

Production of indigenous chicken has been described variously as backyard poultry rearing, rural poultry production, scavenging or village poultry (Gueye, 2002a; Bebora *et. al.*, 2005; Pagani and Kilay 2007; Okitoi *et. al.,* 2007). This production system is practiced in sub-Saharan Africa and

other parts of the world (Mapiye and Sibanda, 2005; Mandal *et. al.*, 2006; Goromela *et. al.*, 2006; Sekeroglu and Aksimsek, 2009). Food and Agriculture Organisation (FAO) classifies indigenous chickens in sector 4, this category of poultry is rural (non-urban) in location and subsistent or non-commercial in purpose (Adene and Oguntade, 2006). The indigenous chickens are generally multicoloured, long legged and smooth feathered with a few fizzled feathered, naked necked and dwarf birds (Njenga, 2005; Mogesse, 2007). The birds are mostly kept under extensive system of management with no breed selection or improvement by cross breeding (Duguma, 2006; Ondwasy *et. al.*, 2006). Indigenous chicken production requires the lowest capital investment of any livestock species; they have a short production cycle (Sonaiya and Swan, 2004, Sekeroglu and Aksimsek, 2009) and mainly feed through scavenging with little grain supplement (Swai *et. al.*, 2007). The output of indigenous chickens is lower than that of intensively raised hybrid chickens but is obtained with a minimum input in terms of housing, disease control, management and supplementary feed (Siamba *et. al.*, 2002; Sonaiya and Swan, 2004). In Kenya the average egg production ranges from 36-97 eggs per hen (Okitoi *et. al.*, 1997; Okuthe, 1999; Siamba *et .al.*, 2002), compared to 250-280 eggs per exotic hen (MLFD, 2007). Efforts to improve the indigenous chicken production have been tried by the Government. A cockerel exchange programme was carried out in Kenya from 1976 to 1990 under the auspices of the Nation Poultry Development Programme (NPDP), jointly funded by the Government of Kenya (GoK) and the Netherlands Government but failed due to high mortalities and non-broody nature of the progeny (NPDP, 1985-1986; Njenga, 2005). In 2003, the Smallholder Poultry Development Project was initiated under the Agricultural Sector Programme Support (ASPS), funded by the Danish International Development Assistance (DANIDA) in collaboration with GoK, and based on

Bangladesh model in two districts in Coast province. ISA Brown hybrid hens were used together with local cocks to produce eggs that were given to broody local hens for hatching. The major challenges will be that the hybrids will require a constant external parent stock supply, which means the presence of a well managed hatchery facilities and grandparent stock, that is beyond the scope of smallholder farmers (Njenga, 2005; Bebora *et al.*, 2005).

One way of overcoming the above challenges posed by the past strategies in improving sustainable productivity of indigenous chicken is to employ both qualitative and quantitative methods in the identification of the productivity constraints, thereby coming up with recommendations for specific intervention measures, that will consider the social, economic and cultural aspects of poultry production of the target population (Okuthe *et. al.,* 2003).

2.2 Productivity of indigenous chickens

Productivity of an animal can be defined as Product output per animal unit per unit time e.g. eggs per hen per year or product output per unit of input e.g. live weight gain per kilogram of feed or the value of product output per unit input in monetary terms (Okuthe, 1999; Sekeroglu and Aksimsek, 2009).

Indigenous chickens in sub-Saharan Africa and other parts of the world have not attained their full production potential due to exposure to risk factors that constraint their survival and productivity (Gueye, 2002a; Gondwe and Wollny, 2005; Ondwasy *et.al.*, 2006; Swai *et. al.*, 2007; Sekeroglu and Akisimsek, 2009). A study by Adene and Oguntade (2006), in Nigeria showed an average flock size of 16 chickens per household. Mwalusanya (1998) in Tanzania and Siamba *et. al.,* (2002) in Kenya indicated similar findings. Findings by Nahamya *et. al.,* (2006) in

Uganda showed mean flock size of 26 in vaccinated group compared to a mean size of 17 chickens in control flock, confirming the production potential of indigenous chickens with interventions.

A flock structure of ratio of chicks to growers to adults of 16.4 to 10 to12.7 and chick survival rate after one month of 66% have been reported in Tanzania by Msami *et. al.,* (2002). Studies have shown that cocks are the fewest of all the categories of chickens kept (Adene and Oguntade, 2006), with the mean cock to hen ratio of 1:4.3 observed in Tanzania by Mwalusanya (1998).

A study in Cote d'voire by Gnakari *et. al.*, (2007) showed that the indigenous chickens are characterised by slow growth and low output. The finding is supported by Mandal *et. al.,* (2006) in India who reported average age of the indigenous chickens at first laying as 7.6 months, compared to the improved (commercial) chickens that start laying at 5 months of age (MLFD, 2007). Findings by Mwalusanya (1998) in Tanzania reported mean growth rate to 10 weeks of age of 4.6g/day (d) and 5.4g/d while that of 10 to 14 weeks to be 8.4 and 10.2g/d for female and male chicks, respectively. There is an influence on the weight gain by the hatching weights of chicks, which in turn follows the egg weight pattern of the parental population. A 1g difference in egg weight increases to 1.5g difference in body weight at hatching, to 7g at 6 weeks and to 32g at 12 weeks of age based on hatchability weight and mean weight gains of indigenous chicks (Tadelle *et. al.* 2003) in Ethiopia. In Tanzania, the mean live weight for cocks and hens was reported as 2261g and 1441g respectively (Msoffe *et. al,* 2002) and 1948.1g and 1348g respectively (Mwalusanya, 1998). The live weight at one week of age was 37.7 ± 5.3g and at 3 months were 398 ± 107g for females and 588 ± 152g for males (Missohou *et. al.,* 2002). Low annual egg production levels have been reported in different studies. Mapiye and Sibanda (2005)

in Zimbabwe reported average number of eggs laid and incubated per clutch and egg weight to be 10 ± 2, 8 ±1 and 52.2g ± 2 respectively. Msoffe *et. al.*, (2002) in Tanzania reported mean flock egg number/clutch/bird, clutch number/bird/year and egg number/bird/year as 17.7 ± 0.25, 2.6 ± 0.06 and 46.4 ± 0.86. High hatchability rates of 100%, 77% and 60-65% have been observed in Tanzania (Msami *et. al.*, 2002), Senegal (Missohou *et. al.*, 2002) and India (Mandal *et. al.*, 2006) respectively.

In Kenya, Siamba *et. al.*, (2002) reported the average flock size of 16 chickens with wide variations among regions (range 10-21 chickens). The same study has shown that majority of chickens in the flock were immature birds. Annual egg production rate ranges from 36 to 97 eggs per hen (Okitoi *et. al.*, 1997), with an average egg weight of 42.7 ± 4.94g (Njenga, 2005). Hatchability as well as fertility of indigenous chickens have been reported to be fairly good in Kenya. Studies carried out by Siamba *et. al.,* (2002) and Okitoi *et. al.* (2002) indicated hatchability rate of 84% and over 70% respectively. Despite the good hatchability of indigenous chicken eggs, most of the chicks hatched die in their early life due to both diseases and predation (Okuthe, 1999; Ondwasy *et. al.*, 2006). A study by Okitoi *et. al.*, (2002) to evaluate the impact of introducing simple technologies such vaccination against Newcastle disease, daytime housing of chicks and supplementation with locally available feed ingredients showed reduction in chicken losses by more than 75% and an increase in average flock size to 17.5 chickens per household. The studies from Kenya show that the potential of the indigenous chickens has not been fully exploited.

2.3 Indigenous chicken productivity constraints

Most indigenous chickens in sub-Saharan Africa are on free-range system and are fed little grain (Missohou *et. al.,* 2002; Mandal *et. al.*, 2006). Increased indigenous chicken production is hampered by several factors. Msoffe *et. al.*, (2002) in Tanzania, Mapiye and Sibanda (2005) in Zimbabwe, Adene and Oguntande (2006) in Nigeria and Mandal *et. al.,* (2006) in India identified diseases and lack of proper production technologies as the most important constraints to the indigenous chicken production. Findings by Aboe *et. al.,* (2006) in Ghana was in agreement with those from other parts of the world that Newcastle disease is the most important health issue. The disease occurs every year and kills on average 70-80% of the unvaccinated indigenous chicken flocks (Gueye, 2002b). Gondwe and Wollny (2005) and El Zubeir (1997) showed inadequate feeding as an important constraint to the indigenous chicken production in Malawi and Sudan, respectively. Tadelle *et. al.,* (2003) in Ethiopia reported a considerable loss of eggs in terms of the time taken by the laying hen to incubate eggs and brood small chicks, implying the use of improved technology could reduce such a loss. Other constraints to indigenous chicken production are low genetic potential of the local chicken due to lack of breed selection (Mohammed *et. al.,* 2005; Duguma, 2006; Fayeye and Oketoyin, 2006) and unreliable poultry marketing systems (Gausi *et. al.,* 2004). Most of the above-mentioned studies report lack of proper housing, high chick mortality, parasites and predation as constraints to the indigenous chicken production.

In Kenya, indigenous chicken production is limited by several factors (Ondwasy *et.al.*, 2006; MLFD, 2007). The chickens are kept under poor management condition due to lack of skills and finance (Okuthe, 1999; Okitoi *et. al.*, 2006). A study by Okitoi *et. al.,*(2006) showed the major

constraints to indigenous chicken production as diseases (particularly Newcastle), feed deficit and heavy loses of chicks through predation. Okuthe (1999) reported the major predators for the chicks as hawks and eagles whereas the predators for growers and adults were mongoose. Kingori *et. al.,* (2007) indicated inadequate crude protein intake to be responsible for lower growth rate and mature body weight in indigenous chickens than in the commercial (hybrid) growers. The study showed that protein supplementation of 3.2 g/bird/day to growing indigenous chickens on free range was mandatory for optimum growth. Lack of genetic manipulation to improve indigenous chicken flocks was another constraint reported in the same study. Mungube *et. al.* (2007) described parasites as a problem in the indigenous chicken production systems in the ASALs of Kenya. There is very little documented quantitative research on indigenous chickens. Available information is mainly in the form of passive reports of notifiable diseases (KARI, 1998) that include Newcastle, fowl typhoid, fowl pox and Gumboro diseases.

There is no well-organized marketing system and everything depends on the individual efforts of the farmer (Okuthe, 1999).

2.4 Approaches commonly used in assessment of livestock production

2.4.1 Rapid rural appraisals

Rapid rural appraisal (RRA) is a rapid study within a fairly short period, using mainly qualitative tools (Bhandari, 2003), including those commonly used for participatory rural appraisals (Townsley, 1996). Local knowledge is respected and forms a major part of the data gathered but the process is essentially "extractive" (Leyland, 1991; Bhandari, 2003) in that the researchers take the information away. It is mainly seen as a means for outsiders to gather information (IDS,

1996). Rapid appraisal methods have been developed to overcome limitations of baseline questionnaire surveys (Ghirotti, 1993). The use of rapid appraisals is increasing rapidly and becoming more popular in livestock work. Examples include Okuthe *et. al.,* (2003) who assessed constraints in smallholder cattle production systems in western Kenya, Okuthe *et. al.*, (2005) assessed livestock diseases in Somalia. Catley (2006) used matrix-scoring method to compare the clinical veterinary knowledge of pastoralists and veterinarians in East Africa. Catley *et. al.*, (2001) and Catley *et. al.,* (2002) used RRA tools to assess cattle diseases in southern Sudan.

2.4.2 Cross-sectional Studies

Cross-sectional studies are used to investigate a population at a particular point in time. They can be used to monitor diseases in field by recording prevalence data (Martin *et. al.*, 1987). They are also used to provide data on a large number of other variables present in livestock populations (Okuthe *et. al.*, 2003). These studies can be quick, relatively inexpensive to conduct and if done well, can give a very informative 'snapshot' of the situation at the time in question (French, 1999). Cross-sectional studies have disadvantages of the inability to determine 'cause or effect' when examining associations between 'risk factors' and disease (Noordhuizen *et. al.*, 1999).

2.4.3 Observational longitudinal studies

A longitudinal study uses repeat visits over a period of time, with a combination of research observation and structured questionnaires (Schwabe *et. al.*, 1977; Martin *et. al.*, 1987; Toma *et. al.*, 1999).

This method of collecting accurate and representative field data in the form of active monitoring and evaluation is expensive (Martin *et. al.*, 1987). They are most suitable for research projects.

They are useful for disease incidence data, confirmation of diseases and recording of livestock production parameters for species e.g. small ruminants and poultry for which farmers may not have a good recall of counts.

Chapter Three

3.0 Materials and methods

3.1 Study areas

The study was conducted in Komolorume (Awendo division) and Kawere (Kasipul division) villages of Rongo (Figure 3.1) and Rachuonyo (Figure 3.2) districts respectively, in southern Nyanza.

3.1.1 Rongo district

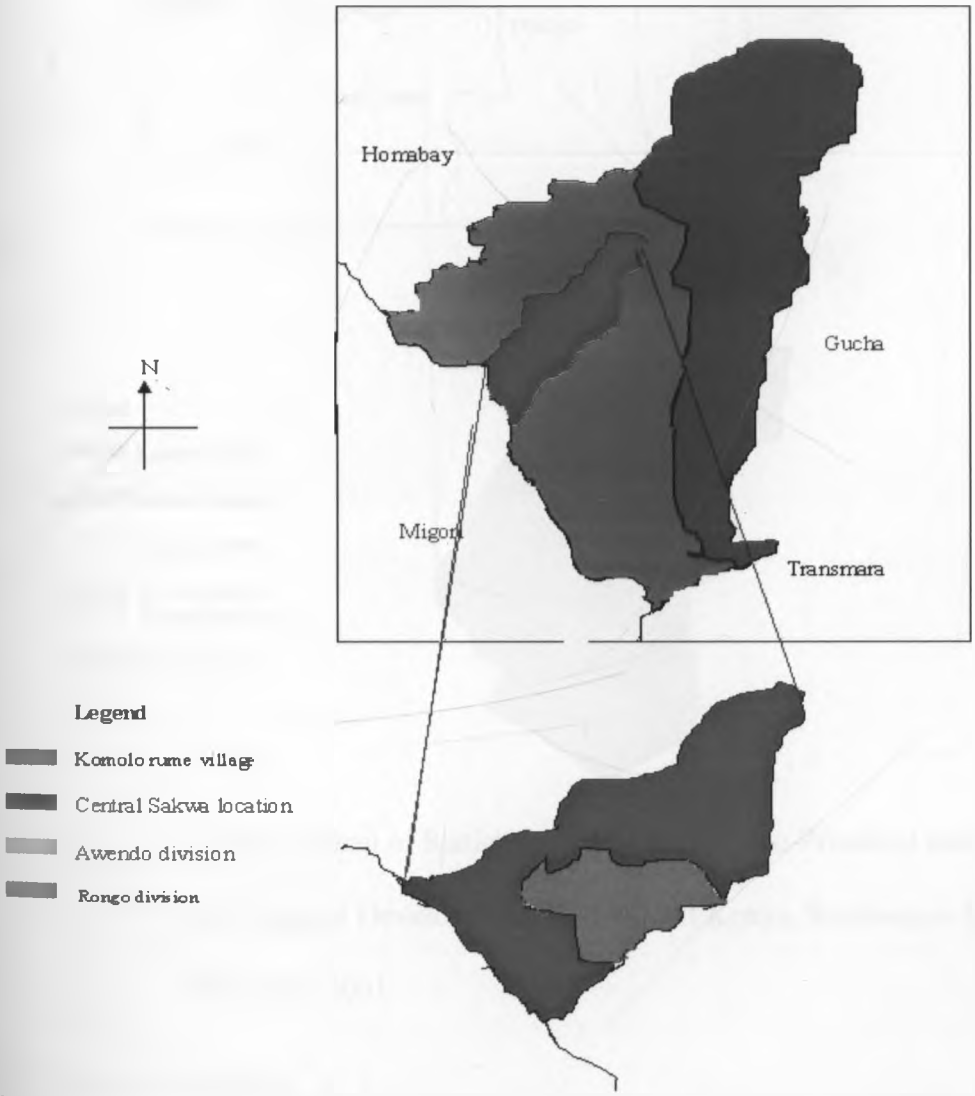
Rongo district lies between latitudes 0 ^{0}40' and 0 ^{0}south, longitudes 34^{0}and 34^0 50'east. The district is 825 km^2 in area (GoK, 2002). Altitude ranges between 1135 and 1700 metres above sea level. Temperature ranges between 17 ^{0}C and 25 ^{0}C. Rainfall pattern is bimodal and ranges from 700mm to 1800mm (GoK, 2002). The population is estimated at 330,000 with a density of 387 persons per km^2 (KNBS, 2008). Main crops grown in the district are sugarcane, maize, sweet potatoes, tobacco and pineapples. Zebu cattle and indigenous sheep, goats and chickens are the main livestock kept by the farmers.

3.1.2 Rachuonyo district

Rachuonyo district lies between latitudes 0^0 15' and 45' south, longitudes 34^0 25' and 35^0 east. The district covers an area of 931km^2 (GoK, 2002). Altitude ranges between 1135 to 1600 metres above the sea level and temperatures range between 14 and 25 ^{0} C. rainfall pattern is bimodal and ranges between 250mm to1000mm (GoK, 2002). Estimated population of 380,000 and 400 persons per km^2 (KNBS, 2008). Main crops grown in the district are maize, sweet potatoes,

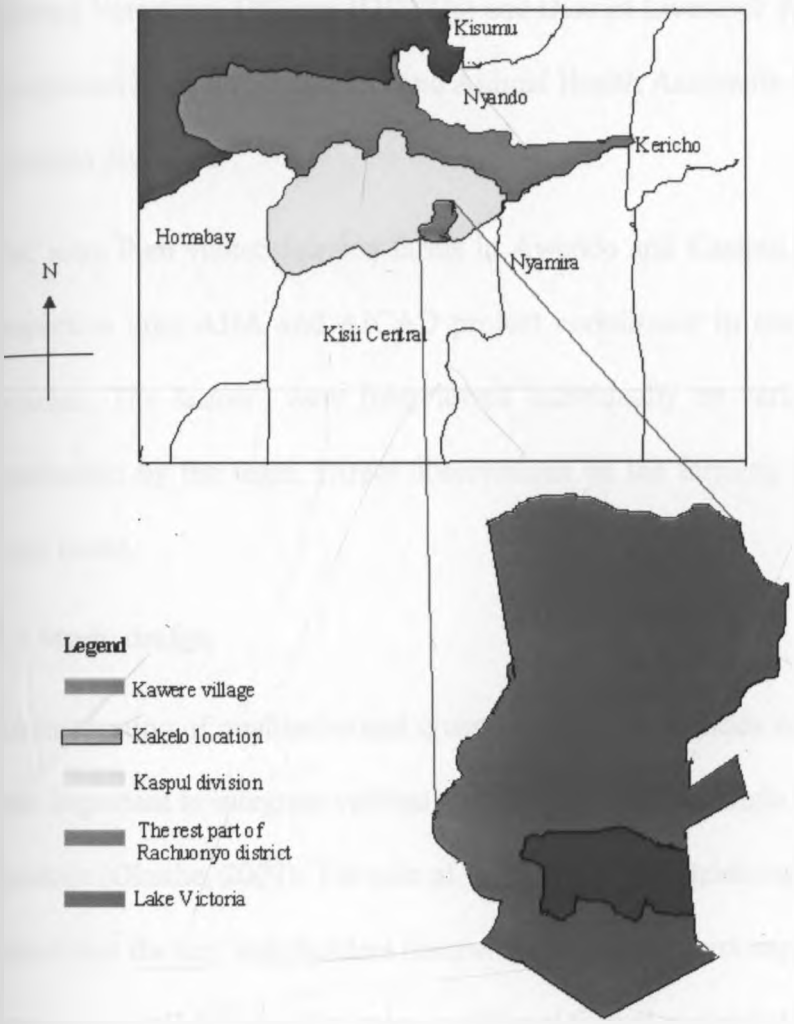
sorghum and pineapples. Zebu cattle and indigenous sheep, goats and chickens are the main livestock kept by the farmers.

Figure 3.1 Map of Rongo district showing study village (Komolo rume)



Source Central Bureau of Statistics, Ministry of Finance and Planning, Republic of Kenya, Migori District Development Plan 2002-2008.

Figure 3.2 Map of Rachuonyo district showing study village (Kawere)



Source Central Bureau of Statistics, Office of the Vice-President and Ministry of Planning and National Development, Republic of Kenya, Rachuonyo District Development Plan 1997-2001

3.2 Study preparation

Permission to conduct the study was obtained from the Director of Veterinary Services (DVS) at the beginning of April 2007. The team visited the two districts for four days (each district was

visited for two days) in mid April 2007 to meet the relevant field staff that included the Deputy District Veterinary Officers (DDVOs) and District Livestock Production Officers (DLPOs) Rongo and Rachuonyo districts and Animal Health Assistants (AHAs) in charge of Kasipul and Awendo divisions.

The team then visited thirteen farms in Awendo and Kasipul divisions in collaboration with the respective area AHA and AICAD project coordinator in order to familiarise with the farming systems. The farmers were interviewed individually on various aspects of indigenous chicken production by the team. Direct observations on the farming systems and prevailing constraints were noted.

3.3 Study design

An integration of qualitative and quantitative study methods was used to meet the objectives. It was important to integrate various methodologies as no single methodology offers universal panacea (Okuthe, 2003). The aim of using various methodologies was to assess and identify issues that the key stakeholders (farmers) considered most important. Informal techniques (rapid rural appraisal) followed by more traditional formal methods (cross-sectional and longitudinal studies) to produce quantifiable results were used.

The first phase of the study involved the use of the rapid rural appraisal (RRA) tools to rank and prioritise the productivity constraints. A cross-sectional survey followed after two weeks to determine the indigenous chicken production baseline data and triangulate some of the RRA findings; this was then followed by a four-month prospective observational study to monitor the productivity indices. Structured questionnaires were used in both the cross-sectional and the

observational studies. The study findings were used to recommend appropriate intervention to improve productivity and sustainability of small-scale indigenous chicken production in the project area.

3.3.1 Rapid rural appraisal

The informal survey was conducted in the two study villages (Komolorume and Kawere) in collaboration with extension staff of MLFD in the respective areas in the month of October 2007. This was a period when farmers were less committed in their farming activities as indicated in the two districts annual reports (MLFD, 2006) and from discussions with farmers, extension staff, agro veterinary shop owners and other leaders.

One location was purposively selected in each of the two divisions (Awendo and Kasipul); the locations where ICAD sponsored poultry projects were on going. One sub-location was randomly selected in each of the two locations. A sampling frame of villages was then drawn in each selected sub-location. Finally two villages were randomly selected one from each of the two sampling frames forming two study sites; Komolorume and Kawere in Awendo and Kasipul divisions respectively.

Twenty-five participants (farmers) both men and women were randomly selected in each study village in consultation with the local AICAD sponsored poultry project coordinator. The coordinators who visited the farms two weeks prior to the RRA exercises invited the selected farmers.

Farmers and project coordinators chose the meeting sites. These were localities where the two groups felt that the discussions would be conducted in a free atmosphere without interference.

The RRA team composed of the author, local AICAD sponsored poultry project coordinator and two veterinarians of whom one was the recording clerk.

RRA tools as described by Townsley, (1996) were employed during this phase of the study. These tools were secondary data collection, key informant interviews, semi-structured community interviews guided by a check list (Appendix 3), transect walks, seasonal calendars, scoring and ranking.

The two community group discussions were conducted in Luo language that was understood by all farmers participating in the exercises. The facilitators played a more passive role of listening and learning whilst farmers played more active roles of teachers. This led to active participation by farmers in the form of production of community maps, seasonal calendars, Venn diagrams and ranking using local materials i.e. maize and beans. The active participation resulted in a free flow of information as the farmers felt they were part of the discussion. A dominant farmer in Komolorume had to be controlled by the facilitator in order to allow other participants chance to give their opinions.

During the key informant interviews local DDVO, local AHA, a village elder, one agro veterinary shop owner and one prominent farmer were interviewed guided by checklist (Appendix 3) in each study site.

Transect walks were also held in the same areas but at different times. This was done to probe, triangulate and confirm some of the unclear issues from discussions.

3.3.2 Cross-sectional study

Following the findings of the informal qualitative survey (using RRA techniques), a formal cross-sectional survey was designed to triangulate findings of the informal surveys and also to compare the findings of the two methods.

The DVOs Rongo and Rachuonyo districts were briefed before survey began. The longitudinal study farmers were informed of the survey by their respective local AICAD project coordinators, who visited their homes in person two weeks in advance.

The objective of the research and expected output were discussed with extension personnel and the enumerators. Subsequently a training session on survey techniques with emphasis on questionnaire administration was conducted. The trainees were made to understand the objective and the concepts of the whole programme and procedural ideals of questionnaire administration.

The questionnaire (Appendix 1) was pre-tested in twelve farms, six in each study site. This was done to estimate the time required to administer the questionnaire. Necessary corrections were made and any queries concerning the questionnaire were sorted out. The pre-testing was also part of the training procedure for the enumerators who conducted the interviews together with the author.

The cross-sectional study was carried out two weeks after the RRA studies. Cluster sampling method was used to select study farms in the RRA study villages (Komolorume and Kawere). A total of eighty-one farms were selected, forty in Komolorume and forty-one in Kawere. Primary data collection was carried out through personal interview of household members responsible for the indigenous chickens in the selected villages. A structured closed questionnaire was used to

allow for ease of coding of various variables. The author, two veterinarians and local AICAD poultry project coordinator carried out the interviews. The data collected included: socio-demography of chicken keepers, flock size, composition, ownership, type of housing, feeds and feeding practices, diseases and perceived flock mortalities, utilization of chicken products and animal health service provision. Flocks were categorized as follows: Chicks (aged between 0- 3 months), growers (aged >3-9 months) and adult (aged > 9 months) (Swai *et. al.,* 2007).

3.3.3 Observational longitudinal study

The four-month observational longitudinal study was carried out from November 2007 to end of February 2008 in the two study villages (Kawere and Komolorume) where rapid rural appraisal (RRA) and cross-sectional studies were previously carried out, with the objective of assessing the indigenous chicken productivity parameters. All the 81 farms (41 in Kawere and 40 in Komolorume) previously covered by the cross-sectional study were included in the sampling frame. Sixty farms (thirty in each village) were randomly selected from the 81 study farms.

The data were obtained by the use of questionnaire (Appendix 2), direct observation and weighing of live chickens and eggs. The questionnaire was derived from the cross-sectional one (Appendix 1) and was therefore not pre-tested as pre-testing was done earlier. The number of chickens and eggs weighed depended on the availability of chickens and eggs at the time of taking the measurements. During the study period, each farm was visited twice a month by the local enumerators. The author also visited each farm twice a month to confirm production monitoring. Qualitative monitoring by direct observation and open interviews was conducted

depending on the opportunity that came by. The enumerators recorded the following information since the previous visit by administering the questionnaire.

- Flock structure by age and sex.
- Exits in the form of deaths, consumptions, sales, gifts and entrustments.
- Entries in the form of purchases, gifts, entrustments and births.
- Tentative causes of death.
- Types of housing for the indigenous chickens.
- Types of feed and their source.
- Animal husbandry practices that included:
    - Vaccination done (disease vaccinated against)
    - Treatment done and the amount of drugs used
- Sales and purchases of chickens and eggs.
- Prices chickens and eggs

The enumerators had field notebooks to record other observational data and any other miscellaneous findings. Farmers were given hard covered field notebooks to record any events that occurred between visits.

3.4 Disease diagnosis and ranking

The farmers presented the clinical signs of the diseases, which were subsequently used by veterinary specialists (investigators) to give tentative diagnosis. Farmers then ranked the diseases in order of prevalence and mortality rate.

3.5 Weighting of constraints and disease rankings

All responses to indigenous chicken production constraints and disease rankings were tabulated. Constraints and disease ranking were then weighted by awarding scores from 1-6 and 1-2 respectively to each respondent as follows:

- Constraints to indigenous chicken production

First	6
Second	5
Third	4
Fourth	3
Fifth	2
Sixth	1

- Diseases

First major disease	2
Second major disease	1

The cumulative sum of all the responses was then considered as the weighted score for the particular constraint. Thus the constraint with largest score was considered to be the most important one.

3.6 Data management and statistical analysis

All the data obtained from the field were entered in Microsoft access programme (Microsoft Corporation, 2000). Descriptive statistics such as mean, range, frequency and percentage were obtained using Statistical Package for Social Scientist (SPSS for windows 10) and Microsoft

Excel (Microsoft Corporation, 2000). The indigenous chicken productivity parameters measured during the study were number of chickens by age category, adult chicken live body weights in the same sex group, chick body weight gains per day between 1-10 weeks in the same sex group, egg weights, clutch sizes, hatchability rates and chick survival rates at 8 weeks in the same sex group.

Chapter Four

4.0 Results

The survey results indicated that keeping of indigenous chickens is widely practised in southern Nyanza. Over 65% of the respondents were females in both villages.

4.1 Methodological issues

During the RRA meetings (Figure 4.1) farmers were able to discuss indigenous chicken production constraints freely and were allowed to take charge of the discussions with guidance from the facilitator. A facilitator controlled the dominance of the discussions by some farmers and attempts were made to encourage the quiet ones to contribute to discussions although dominance ones still gave more information. Most of the results from the RRA study were similar to those of the cross-sectional study findings.

Figure 4.1 Participants during community group discussions in Kawere village (October 2007)

4.2 Household characterization

Household characterization was done during the cross-sectional studies (Table 4.1). There were more family members per households in Komolorume than Kawere village. Male headed about 80% of the households in both villages. Over 70% of the household heads in both study villages had primary education or below. Over 90% of children left school mainly at primary level in both villages and never joined college. Women and children were responsible for about 78% of indigenous chickens' daily management activities in both villages. In 60% of the cases women in the two villages made decision to dispose indigenous chickens and their products. Mean family annual income from indigenous chicken production in Komolorume was Kshs. 2402, this accounted for only 3% of total farm income (Kshs. 83,940). In Kawere the mean family annual income from indigenous chicken was Kshs.1400 accounting for 7% of total farm income (Kshs. 20,780).

Table 4.1 Descriptive statistics of the households in Komolorume and Kawere of Rongo and Rachuonyo districts respectively (Cross-sectional studies in October - November 2007)

Variable	Statistics	Komolorume	Kawere
Family members per household	Mean	8.28	6.71
	Range	3-30	3-13
Male household heads	Proportion (%)	75	81
Female household heads	Proportion (%)	25	19
Family head's level of education:			
Form one and above	Proportion (%)	25	22
Primary 2-8	Proportion (%)	63	59
No formal	Proportion (%)	12	19
Children education:			
Number in school per household	Mean	4.0	3.07
	Range	0-12	0-10
Number in college per household	Mean	0.45	0.05
	Range	0-8	0-1
Involvement in indigenous chicken management daily activities:			
Men	Proportion (%)	22	22
Women and children	Proportion (%)	78	78
Involvement in decision to dispose of indigenous chickens:			
Male	Proportion (%)	30	37
Female	Proportion (%)	70	63
Family annual income in Kenya shillings from:			
Whole farm	Mean	83,940	20,780
	Range	2,000-400,000.	3,000-100000.
Indigenous chicken	Mean	2,402	1,402
	Range	0-10,000.	0-3,000.
Family head non-farm employment	Proportion (%)	35	37

4.3 Farm characterization

Table 4.2 shows the descriptive statistics of farm sizes in the study area as revealed by rapid rural appraisal and cross-sectional study methods. The two approaches revealed farm sizes ranging from a mean of 3 to 4 acres. Transect walks revealed that Komolorume farmers owned better residential houses compared to Kawere farmers, some Komolorume farms had piped water.

Table 4.2 Farm sizes in Komolorume and Kawere villages (RRA and cross-sectional studies, October - November 2007)

Study tool/method	Statistics	Komolorume	Kawere
Community group discussions/RRA	Range	1-10	1-6
	Mean	4	3
Transect walks/RRA	Range	1-15	1-8
	Mean	4	3
Questionnaire interviews/cross-sectional study	Mean	3.8	3.15
	Range	1-25	1-12

The study approaches revealed good road network systems in both villages leading to markets, schools and other public utility centres. All interviewed farmers kept indigenous chickens. Some of the farmers kept other livestock species (Table 4.3) that were managed under extensive system. Farmers practiced mixed farming in order to minimize cost of production since most of

the farm enterprises are complementary to each other. Indigenous chickens were kept for food (meat and eggs) and cash income in the two villages. Maize, sorghum, finger millet, pineapples and vegetables were grown in both villages while sugar cane and sweet potatoes were mainly grown in Komolorume and Kawere villages respectively.

Table 4.3 Number and percentage (in brackets) of farmers keeping various types of livestock in Kawere and Komolorume (cross-sectional studies, October - November 2007)

Village	Indigenous chickens	Cattle	Sheep	Goats	Ducks	Guinea fowls	Quails	Total
Kawere	41 (100)	24 (59)	13 (32)	23 (56)	0 (0)	0 (0)	1 (2)	41 (10
Komolorume	40 (100)	23 (58)	17 (43)	15 (38)	3 (8)	1 (3)	0 (0)	40 (10

4.4 Management system characterization

Table 4.4 presents the proportion of management practices for the indigenous chickens in the study villages. About 98% of the chickens were managed under scavenging or extensive system (Figure 4.2).

Figure 4.2 Indigenous chickens on free-range in search of food in Komolorume village (Cross-sectional study in October - November 2007).

About 100% of the farmers provided supplement feeds to their chickens and different age groups were fed together. The amount of feed supplements provided depended on the seasons (large quantity of cereal grains given during harvest seasons). Only 3 % of the chicken owners were providing feed supplements in containers or feeders, majority (97%) however threw the feed on the ground (Figure 4.3).

At the beginning of the planting seasons the free roaming of chickens for scavenging was restricted to certain areas or tethered in order to prevent scavenging on newly planted seeds.

Figure 4.3 Indigenous chickens of different age groups being fed maize grains together on the ground in the compound in Kawere village (Cross-sectional study October - November 2007)

Almost all farmers provided night shelter for their chickens either in the human dwellings (94%) or in separate shelters purposely made for chickens (6%), as shown in Figure 4.4. About 98% of the farmers confined their chickens during the night only. About 98 % of the farmers in the study area provided water for their chickens in plastic containers and only 30% of the respondents cleaned the water containers daily, 50% after one week and 20% did not clean the containers at all. In several cases the bowl was filled once per day

Table 4.4 Proportion (%) of management practices for indigenous chickens in Komolorume and Kawere (Cross-sectional studies, October - November 2007)

Variables	Komolorume	Kawere	Overall
Housing			
Separate shelter	10	2.4	6
Human dwelling quarters	90	97.6	94
Confinement			
Night only	95	100	97.5
All time	5	0	2.5
Feeding			
Scavenging/leftover	15	22	18.5
Grain/red herrings	5	0	2.5
Both	80	78	79
Water provision			
Yes	100	95.1	97.5
No	0	4.9	2.5
Feeding chickens			
In container/ feeder	5	0	2.5
Thrown on the ground	95	100	97.5

Figure 4.4 Indigenous chicken house located behind the main house in Komolorume village (Cross-sectional study in October - November 2007)

4.5 Constraints ranked by farmers

Table 4.5 presents lists of indigenous chicken constraints ranked in order of importance using RRA and cross-sectional study methods in the two villages. Diseases were ranked as the most important constraints in both villages by the two methods. Predation was ranked second most important except in Kawere where it was ranked third by community group discussions. Although the other constraints were ranked differently by the two study approaches, the overall ranking by scoring method in order of importance was diseases, predation, scarcity of feed, poor animal health service delivery, poor housing, neglect by Government extension agents, theft and poor production skills. Another mentioned constraint was low attitude by farmers towards indigenous chickens.

4.6 Ranking of disease constraints

The general constraint ranking indicated disease to be an important issue in indigenous chicken production. Table 4.6 presents farmers' ranking of indigenous chicken disease in Kawere and Komolorume villages. Newcastle was ranked as the most important disease in terms of prevalence and mortality. Fowl typhoid followed as the second most important disease of indigenous chickens. Other important diseases mentioned were non-specific coughing; Gumboro, fowl pox, helminthosis and aschitis were ranked as the least important. Different study methods in different villages ranked the other diseases differently as indicated in the Table 4.6.

Table 4.5 Constraints ranked by farmers keeping indigenous chickens in Komolorume and Kawere. RRA and cross-sectional studies (October - November 2007)

Constraints	Community group discussions		Key informant interviews		Cross-sectional studies	
	Komolorume	Kawere	Komolorume	Kawere	Komolorume	Kawere
Diseases	1	1	1	1	1	1
Scarcity of feed	4	2	4	4	3	3
Predation	2	3	2	2	2	2
Low attitude (by farmers)	-	-	-	8	-	-
Neglect by Government	-	-	5	5	4	6
Lack of housing	3	5	6	5	-	-
Theft	7	6	-	-	4	4
Poor veterinary services	5	-	5	3	5	5
Lack of skills	6	-	3	6	6	-
Poverty	-		7	-	-	-

Table 4.6 Farmers' ranking of indigenous chicken diseases in Kawere and Komolorume villages. RRA and cross-sectional studies (October - November 2007)

Disease	RRA studies				Cross-sectional studies	
	Prevalence		Mortality			
	Komolorume	Kawere	Komolorume	Kawere	Komolorume	Kawere
Newcastle	1	1	1	1	1	1
Fowl typhoid	2	2	2	2	2	2
Non-specific coughing	3	3	6	5	4	3
Gumboro	4	5	3	3	3	5
Fowl pox	5	4	4	4	5	4
Helminthosis	6	6	5	6	-	-
Aschitis	7	-	7	-	-	-

4.7 Disease control

Table 4.7 presents the proportions of indigenous chicken farmers who used various disease control methods and animal health service provision in Komolorume and Kawere villages. The various study methods revealed that animal health service delivery was poor in both villages. Less than 5% of the farmers received animal health services from either Government or private sector in both villages. Majority of the farmers in both villages were not aware that veterinarians could treat chickens and only associated them with cattle.

More farmers in Kawere (about 70%) were using herbs (mainly Aloe vera, pepper and sisal leaves) for the treatment and control of indigenous chicken diseases than farmers in Komolorume

(about 50%). More farmers in Komolorume bought veterinary products for the chickens from agro veterinary shops than Kawere and used them on their own. The major veterinary products bought were ND and fowl typhoid vaccines and oral antimicrobials and multivitamins. About 5% of the farmers in Kawere used human antibiotics (mainly tetracycline capsules) in treating their chickens. All farmers in the study area were aware of fowl pox but never took any control measures. Fewer farmers knew about Gumboro disease (20%) and helminthosis (15%) but took no action as identified during the rapid response studies. Similar results were obtained from the cross-sectional studies (Table 4.7).

Table 4.7 Proportion (%)of farmers using animal health services in Komolorume and Kawere. RRA and cross-sectional studies (October - November 2007)

Disease control method/ animal health service source	RRA studies		Cross-sectional studies	
	Kawere	Komolorume	Kawere	Komolorume
Farmers who knew where to get animal health services for their indigenous chickens	<5	<10	<5	20
Farmers who received either Government or private animal health service delivery	0	<5	0	<5
Farmers using herbs for treatment/disease control	70	50	70	40
Farmers who bought veterinary products on their own from agro veterinary shops for treatment/ or disease control:				
Antimicrobial and multivitamins	1	20	1	23
Newcastle vaccine	40	80	39	93
Fowl typhoid	0	5	1	10
Farmers using human antibiotics to treat sick birds	5	0	5	0
Farmers who knew about other indigenous chicken diseases and took no action:				
Gumboro	10	30	5	20
Helminthosis	10	20	10	10
Fowl pox	100	100	100	100

4.8 Flock structure

Table 4.8 shows descriptive statistics on flock composition in Rongo and Rachuonyo districts. The mean numbers of chickens per household were 19.87 and 17.95 in Komolorume and Kawere respectively. The respondents in both villages stated that flock size varied between seasons due to the availability of feed, disease occurrence, presence of predators and high consumption rates in festivity months. The smallest flock sizes were seen in the month of December.

Table 4.8 Composition of indigenous chickens in Komolorume and Kawere. Observational longitudinal studies (November 2007 - February 2008)

Category	Statistics	Komolorume	Kawere
Chicks	Mean	7.48	8.02
	Range	0-40	0-27
	Percentage	38	45
Growers	Mean	6.28	4.12
(3 to 9 month)	Range	0-37	0-16
	Percentage	32	23
Hens	Mean	4.58	4.32
	Range	0-13	1-17
	Percentage	23	24
Cocks	Mean	1.53	1.49
	Range	0-6	0-8
	Percentage	7	8

4.9 Reproduction and production parameters

Tables 4.9 and 4.10 show the descriptive statistics on the reproductive and production aspects of the indigenous chickens in Komolorume and Kawere villages of Rongo and Rachuonyo districts respectively. Pullets and cocks reached sexual maturity at an age ranging from 6-10 months.

Higher proportion of farmers (50%) in Komolorume compared to farmers (39%) in Kawere reported the maturity age of their indigenous chickens to be from 6-8 months. About 30% and 22% of the farmers in Komolorume and Kawere respectively reported maturity age of 9-10 months. About 20% and 39% of the farmers in Komolorume and Kawere respectively could not remember. The mean clutch size and hatchability rate were higher in Komolorume than in Kawere ($P<0.5$). Farmers used broody hens for incubation in both villages. About 38% and 39% of the farmers in Komolorume and Kawere respectively reported 2 clutches per hen per year. About 43% and 42% of farmers in Komolorume and Kawere respectively reported 3 clutches per hen per year. About 19% of the farmers in both villages could not remember.

Table 4.9 Farmers responses (%) to age at first laying and clutches per year of indigenous chickens in Komolorume and Kawere. Observational longitudinal studies (November 2007 - February 2008)

Farmers responses	Komolorume	Kawere	Overall mean
Clutches			
Two	37.5	39	38.3
Three	42.5	41.5	42
No memory (farmer)	20	19.5	19.8
Age at first laying (months)			
6-8	50	39	45
9-10	30	22	25
No memory (farmer)	20	39	30

Egg weighed 48.2g and 45.5g in Komolorume and Kawere villages respectively. The average weight of adult cocks and hens in Komolorume village was 2096.3 and 1599.37g respectively and 2071.1 and 1481.75g in Kawere village. Chick body weight gain per day from day old to 10 weeks of age was 4.7 and 4.3g for male and female chicks respectively in Komolorume and 4.3 and 3.8g for male and female chicks in Kawere village in the same age group.

Table 4.10 The productivity parameters of indigenous chickens in Komolorume and Kawere. Observational longitudinal studies (November 2007 - February 2008)

Variables	Komolorume	P-value	Kawere
Eggs per clutch	12.48	0.020	10.44
Egg weight (g)	48.22	0.129	45.5
Eggs incubated per hen	11	0.138	9.83
Hatchability (%)	80.61	0.024	70.16
Chick survival rate at 8wks (%)	13.43	0.367	9.73
Adult cock live body weight (g)	2096	0.906	2071.11
Adult hen live body weight (g)	1599.37	0.259	1481.75
Male chick body weight gain per day, 1-10 weeks (g/day)	4.7	0.789	4.3
Female chick body weight gain per day, 1-10 weeks (g/day)	4.3	0.684	3.8

Two-tailed test (95% confidence level)

4.10 Dynamics of the indigenous chickens

Tables 4.11 and 4.12 present the descriptive statistics on the dynamics of the indigenous chickens in Komolorume and Kawere villages. Deaths from diseases and predation emerged to be the most important mode of exit across the various age groups of the indigenous chickens. Highest proportion was recorded in the chicks while lowest in the cocks in both villages. Proportion of deaths in cocks was higher in Kawere (48%) than in Komolorume (32%) while that of growers was higher in Komolorume (64%) than in Kawere (56%). Consumption, sales and theft/ straying away were other important modes of exit of indigenous chickens. Higher proportion of cocks was consumed in Kawere (34%) than in Komolorume (25%) whereas higher proportion was sold in Komolorume (31%) than in Kawere (18%). Higher proportions of hens exited through consumption and theft/straying away in Komolorume than in Kawere whereas higher proportion exited through sales in Kawere (18%) than in Komolorume (0%). Larger proportion of growers was consumed in Kawere than in Komolorume while the proportion of exit by theft/ straying away was higher in Komolorume (10%) than in Kawere (0%).

Table 4.11 Number and Percentage (in brackets) of exits of the indigenous chickens in Komolorume and Kawere. Observational longitudinal studies (November 2007 - February 2008)

Category	Exit	Komolorume	Kawere
Chicks	Entrustment out	6 (0.7)	0 (0)
	Theft / straying away	42 (5.1)	40 (6.4)
	Deaths	783 (94.2)	588 (93.6)
Growers	Consumption	30 (13.8)	39 (20.3)
	Gift out	10 (4.6)	10 (5.7)
	Entrustment out	9 (4.1)	5 (2.6)
	Sales	8 (3.7)	19 (9.9)
	Theft / straying away	22 (10.1)	11 (5.7)
	Deaths	138 (63.6)	108 (56.3)
Hens	Sales	3 (2.8)	22 (17.5)
	Consumption	27 (24.8)	20 (15.9)
	Entrustment out	5 (4.6	3 (2.4)
	Gift out	4 (3.7)	5 (4.0
	Theft / straying away	13 (11.9)	10 (7.9)
	Deaths	57 (52.3)	66 (52.4)
Cocks	Theft / straying away	3 (5.1)	0 (0)
	Sales	18 (30.5)	8 (18.2)
	Gift out	4 (6.8)	0 (0)
	Consumption	15 (25.4)	15 (34.1)
	Deaths	19 (32.2)	21 (47.7)

Hatchings were the main mode of chick entries and contributed about 100 % of all entries in both Kawere and Komolorume villages. Major modes of entries in other age categories (growers, hens and cocks) were gifts and purchases. There were more grower entries through purchases (64%)

than gifts (36%) in Komolorume village. There was a higher proportional grower entry through gifts in Kawere (48%) than in Komolorume (36%). Proportional hen entry through purchases was higher in Komolorume (62%) than in Kawere (37%) whereas proportional entry through gifts was higher in Kawere (63%) than in Komolorume (27%). The proportional cock entries through purchases and gifts were similar in both villages (50%).

Indigenous chicken market was readily available in the neighbourhood (neighbouring households) and nearby market centres like Ringa and Oyugis and Awendo and Rongo in Rachuonyo and Rongo districts respectively.

Table 4.12 Number and percentage (in brackets) of entries of indigenous chickens in Komolorume and Kawere. Observational longitudinal studies (November 2007 - February 2008)

Category	Entries	Komolorume	Kawere
Chicks	Hatchings	1024 (98.7)	631 (100)
	Gifts	14 (1.3)	0 (0)
Growers	Gift in	13 (36.1)	42 (48.3)
	Purchases	23 (63.9)	44 (50.6)
	Entrustment	0 (0)	1 (1.1)
Hens	Gift in	15 (27.3)	39 (62.9)
	Purchase	34 (61.8)	23 (37.1)
	Entrustment in	6 (10.9)	0 (0)
Cocks	Purchases	5 (50)	3 (50)
	Gift in	5 (50)	3 (50)

4.11 Causes of mortality

Tables 4.13 and 4.14 present the proportion of farmers' response showing season with highest indigenous chicken mortality and mortality causes respectively in Komolorume and Kawere villages. The major causes of death of the indigenous chickens in the study area were seasonal outbreaks of chicken diseases, mainly ND followed by predation. Over 60% of the farmers in the two villages reported highest chicken death rate during the rainy season (Table 4.13). The main causes of chick mortality in Komolorume village were ND, predation and fowl typhoid with ND claiming the highest proportion (43%) of the deaths. The trend was similar in Kawere with ND leading (38%) except that fowl typhoid killed more chicks than predation. Newcastle and Fowl typhoid were the major killers of growers with ND leading in both villages. Newcastle proportional mortality in growers was higher in Kawere (69%) than in Komolorume village (57%). Non-specific infections and predation killed more growers in Komolorume than in Kawere. The main causes of deaths in adults were ND and fowl typhoid in the study area with ND as the major one. Newcastle proportional mortality in adults was higher in Kawere (66%) than in Komolorume (54%). Other important causes of mortality in adults were non-specific infections and predation. Higher proportion of adult predation was reported in Komolorume (9%) than in Kawere village (0%).

Table 4.13 Farmers' responses (%) to season with highest indigenous chicken mortality in Komolorume and Kawere. Cross-sectional studies (October - November 2007)

Season	Komolorume	Kawere	Overall (81)
Dry season	25	29.3	27.2
Wet season	62.5	61	61.7
Both	12.5	9.8	11.1

4.12 Utilization of indigenous chicken eggs

Table 4.15 shows the utilization of eggs produced in the study area. Largest proportion of the eggs produced in both Komolorume and Kawere villages were incubated. Consumption was second to incubation in the utilization of eggs while sales ranked last in egg utilization in the two villages. The egg market was readily available in the neighbourhood and the nearby market centres like Ringa and Oyugis in Rachuonyo and Awendo and Rongo in Rongo.

Table 4.14 Number and percentage (in brackets) of indigenous chicken mortality causes in Komolorume and Kawere. Prospective observational studies (November 2007 - February 2008)

Category	Cause	Komolorume	Kawere
Chicks	Newcastle	335 (43)	221 (38)
	Fowl typhoid	91 (12)	145 (25)
	Fowl pox	13 (2)	23 (4)
	Predation	269 (34)	140 (24)
	Non-specific infection	75 (10)	59 (10)
Growers	Newcastle	78 (57)	74 (69)
	Fowl typhoid	23 (17)	26 (24)
	Fowl pox	0 (0)	1 (1)
	Non-specific infection	23 (17)	5 (5)
	Predation	11 (8)	2 (2)
	Accidents	3 (2)	0 (0)
Adults	Newcastle	41 (54)	57 (66
	Fowl typhoid	20 (26)	19 (22)
	Non-specific infection	8 (11)	11 (13)
	Predation	7 (9)	0 (0)

Table 4.15 Number and percentage (in brackets) of egg utilization in Komolorume and Kawere in a period of four months. Prospective observational studies (November 2007 - February 2008)

Egg use	Komolorume	Kawere
Consumption	270 (16.4)	287 (22.7)
Sales	123 (7.5)	74 (5.9)
Incubation	1249 (76.1)	902 (71.4)
Total	1642 (100)	1263 (100)

Chapter Five

5.0 Discussion

5.1 Methodological issues

The two study approaches (qualitative and quantitative) were complementary to each other and were useful in the generation of the data to meet the objectives. Productivity constraints were therefore ranked and prioritized, productivity parameters quantified and from the study findings the appropriate interventions to improve productivity and sustainability of indigenous chickens in southern Nyanza were recommended. Rapid rural appraisal study could be used to get clues (people's perceptions) on the subject of investigation, and then formal study (cross-sectional study) could follow thereafter to triangulate the RRA findings. The two study approaches formed the basis for the formulation of the observational longitudinal study that followed thereafter.

5.2 Household characterization

This study revealed that the majority of the households in both villages were male headed (over 70%). This is typical of rural households in most parts of Africa as reported by Missohou *et. al.*, (2002) in Senegal, Muchadeyi *et. al.*, (2004) in Zimbabwe, Swai *et. al.*, (2007) in Tanzania, Okuthe (1999) in Kenya. The trend was mainly due to cultural beliefs. In most cases men had authority over almost all activities in the households. These powers are usually misused hence women are denied opportunity of decision making in society, an issue that has retarded development in most parts of Africa. This partly explains the low productivity of the indigenous chickens observed in the study area since women (who did most chicken management) had to

seek men's permission to use any of the family resources on indigenous chicken production but sometimes they (women) could be denied permission to use such resources.

In the present study, over 70% of the household heads only acquired primary education and below and about 90% of children who left school (mostly at primary level) did not get any further college training. This agrees with findings of Mandal *et. al.,* (2006) in India and Swai *et. al.,* (2007) in Tanzania who revealed that over 90% of indigenous chicken owners acquired low level of education (primary level and below). The finding from this study could probably be due to low income witnessed in most households in the study area (as discussed towards the end of this section), most people could not afford the cost of education (especially higher level) causing majority of youth to drop out of school. Inadequate education could partially explain the low productivity of indigenous chicken in the study area; education being an important factor for growth and development of any enterprise as it results in change in overall behaviour for consequent adoption of new technology for improved production (Mandal *et. al.,* 2006).

In the present study women and children were found to be doing 80% of indigenous chickens' daily management activities, at the same time women did most of decision to dispose of indigenous chickens and their products. This agrees with most research findings on indigenous chicken in many parts of Africa including those by Mapiye and Sibanda (2005) in Zimbabwe and Njenga, (2005) in Kenya. Men could be giving little attention to indigenous chickens probably due to low income associated with the enterprise and instead concentrated on other better paying farm undertakings such as crop farming since indigenous chickens only contributed 7% of farm income.

The study showed that mean family annual incomes from all farm enterprises were Kshs. 83,940 and 20,780 in Komolorume and Kawere respectively (incomes from indigenous chicken contributed between 3-7%). Although the household mean farm annual income was higher in Komolorume than in Kawere village, the mean farm annual income was generally low in both villages and could not meet the household needs. The study indicated that over 60% of families depended on farm income for livelihood, and agreeing with the reports by Siamba *et. al.*, (2002) and MoLFD (2005). The low household income is expected to indirectly affect indigenous chicken productivity by hindering education; hence lowering people's ability to adopt new technologies for optimum production (Mandal *et. al.,* 2006) and also restricting enterprise expansion (due to lack of capital).

5.3 Farm characterization

The study showed that land sizes ranged from a mean of 3 to 4 acres and practiced mixed farming of crops and livestock. Keeping indigenous chicken was however subsidiary to other farming activities. Similar mixed production systems have been reported by Muchadeyi *et. al.,* (2004) in Zimbabwe. Mandal *et. al.,* (2006) in India reported that 27%, 48%, 20% and 5% of poultry farmers owned 0, 2.5, 2.5-5 and above 5 acres of land respectively and that poultry production was subsidiary to other farm enterprises. Most farmers in the study area preferred integrated (mixed) farming approach because the various farm enterprises benefited in one way or another from each other making farm work manageable; like indigenous chicken fed on cereal grains, crops benefited from manure from livestock and income from the sale of chickens was sometimes used to buy medicine for the other livestock species (mainly cattle). Indigenous chicken production though subsidiary to other farm enterprises due to its low returns, most farmers

practiced it throughout the year due to its low input requirement and its importance as source of animal protein for the family and cash income from the sale of chicken products (Okitoi *et. al.,* 2006).

5.4 Characterization management systems

The study showed that most farmers managed their chickens under free-range (scavenging) system with irregular and inconsistent supplementation (mostly cereal grains with increased quantity during harvest) and night housing in human dwellings. Similar findings have been reported by Okitoi *et. al.*, (2002) in Kenya and Missohou *et. al.,* (2002) in Senegal. Findings by Muchadeyi *et. al.*, (2004) and Mapiye and Sibanda (2005) in Zimbabwe showed that most farmers provided cereal grain supplements to their chickens and night housing in separate chicken houses made from local materials, indicating that majority of them were aware of the importance of chicken housing and feeding. Farmers in the study area preferred housing their chickens in either kitchens or main houses at night in order to keep away thieves and predators. Most farmers claimed that predators and thieves usually broke into most chicken shelters at night to carry away the birds; this therefore discouraged the use of such separate structure to house the birds at night. Although all indigenous chicken owners in the study area favoured free-range management due to its low input requirement, it usually resulted in heavy production losses. This type of management exposed birds to harsh conditions such as inadequate feeding, diseases, predation and extreme weather changes. The losses were due to chicken deaths, thefts and straying away and delayed maturity due to poor feeding. Improving feeding, health care and housing could therefore reduce the losses. Adults and chicks should be housed separately to avoid

disease spread. Chicks should be kept in-doors and provided with food until they can learn to notice and avoid the predators.

5.5 Disease control

In the present study animal health care was poor and most farmers used herbs for the treatment and control of indigenous chicken diseases, others bought veterinary products on their own from agro veterinary shops and used them without any technical advice while others took no action at all. This agrees with the findings by Okitoi *et. al.*, (2006) and others. The reasons were quite diverse, some farmers believed that indigenous chickens were resistant to most diseases and never required any health care. Majority of the farmers were poor and could not afford to pay for the veterinary medicine and therefore resorted to herbs, which were locally available and cheap to get even though they confessed that herbs were not very effective. Others who could afford veterinary products and lived near urban centres bought the products and used them on their own (mostly Komolorume farmers). Other farmers generally had low attitude towards indigenous chickens and it was like wasting time treating the birds. Veterinary personnel on the other hand blamed the poor health care on the fact that the birds are thinly spread and giving extension and disease control services was expensive. The study found that more farmers in Komolorume than in Kawere vaccinated their flocks against ND once a year though not consistently and this could partly explain the higher proportional mortality due to ND observed in growers and adults in Kawere compared to Komolorume. The chick proportional mortality due to ND was never influenced by ND vaccinations in the two villages because most of the chicks were never vaccinated as they were normally hatched when the vaccinations had already been done (mostly

done once a year), at the same time most of the laying chickens were never adequately covered to transfer sufficient maternal ND antibodies to the chicks.

5.6 Identification and ranking of constraints

In the present study diseases particularly ND were ranked as the most important constraint to indigenous chicken production. This agrees with the findings by Okitoi *et . al.,* (2006) and Siamba *et. al.,* (2002) in Kenya and Aboe *et. al.*, (2006) in Ghana. The low inputs as regards health care might have contributed to high occurrence of the diseases. Most of the farmers in the study villages resorted to the use of herbs, which they confessed never worked. Few farmers who vaccinated their birds against ND never followed the recommended vaccination regime making it difficult to control the disease (as discussed in section 5.5). Predation was ranked second most important constraint in the present study agreeing with the findings by Muchadeyi *et. al.*, (2004) in Zimbabwe and Ondwasy *et. al.,* (2006) in Kenya. Swai *et. al.,* (2007) in Tanzania ranked predation fourth after mortality, housing and ectoparasites. Predation could be an important issue in the present study due to the fact that the birds were freely moving during the day in search of food and were therefore exposed to predators. At the same time sugar cane plantations in Komolorume and bushes in Kawere were hiding places for the predators.

5.7 Flock structure

The average flock size for Komolorume and Kawere villages (20 and 18 respectively) is typical of smallholder indigenous chicken production system as found by other researchers. Siamba *et al* (2002) found an average flock size ranging from 10-21 birds per family in a different study site in Kenya. In Tanzania, Swai *et. al.*, (2007) reported a flock size ranging from 1-64 birds per family.

In Zimbabwe, Mapiye and Sibanda, (2005) and Muchadeyi *et. al.*, (2004) reported average flock sizes of 30 ± 6 and 17 chickens per household respectively. The average flock size reported in this present study was low due to high death rates from diseases and predations (especially of chicks) as discussed in section 5.10 and other losses due to theft and straying away. Low inputs as regards feeding, housing and health care contributed to the deaths, theft and straying away agreeing with findings of Nahamya *et. al.*, (2006) in Uganda.

5.8 Production aspects

The present study reported average clutch sizes (12.48 and 10.44 eggs for Komolorume and Kawere respectively) and egg sizes (48.22 and 45.5g for Komolorume and Kawere respectively) that are typical to the free-rage indigenous chicken production system as reported by other researchers including Siamba *et. al.*, (2002) in Kenya (clutch size of 11.1 eggs), Njenga, (2005) in Kenya (clutch and egg sizes of 13.9 eggs and 42.7 ± 4.94 g respectively), Mapiye and Sibanda, (2005) in Zimbabwe (clutch and egg sizes of 10 ± 2 eggs and 52 ± 2 g respectively) and Missohou *et. al.*, (2002) in Senegal (reported a lower egg size of 37.5 ± 2.9 g). The study findings revealed hatchability of 80.6% and 70.2% for Komolorume and Kawere respectively. The finding in Komolorume agrees with hatchability of 77% reported in Senegal by Missohou *et. al.*, (2002) and 84% and 84.6% reported by Siamba *et. al.*, (2002) and Njenga, (2005) respectively in Kenya. The hatchability rates as reported by this study could have been contributed by the high ratio of cocks to hens (2 cocks to 5 hens) observed in most households. The present study revealed that the average clutch size and hatchability rate were higher in Komolorume than in Kawere and this could be due to the fact that Komolorume farmers had better income and therefore maintained consistent feed supplementation to their chickens and

used more veterinary products compared to Kawere farmers. The overall adult male and female body weight (1539.05 and 2085.22 g respectively) is similar to 1348.0 ± 243.9 g and 1948.1± 380.3 g (adult female and male body weight respectively) reported by Mwalusanya, (1998) in Tanzania. The growth rate of the birds up to 10 weeks was very low about 4.5g/day and 4.01g/day for male and female chicks respectively; this rate is closed to 5g/day observed by Mwalusanya (1998). The observed productivity parameters in this study though typical to extensive management of indigenous chickens, they are lower than those observed in semi-intensive management system, where improved breeds and complete diets are used. In such an improved management system, one hen (cross breed) can produce in one year 160 to 180 eggs with an egg weighing more than 60 g and chick survival rate can be more than 60% (Sonaiya and Swan, 2004). The possible reason for low productivity as reported by this study could have been due to heavy losses from deaths and delayed maturity as a result of prevailing poor management practices particularly, lack of proper health care, poor nutrition and poor housing.

Poor health care and housing contributed to large number of deaths whereas poor feeding on the other hand resulted in slow growth thereby delaying maturity (Njue *at. el.,* 2001). A lot of production is usually lost during the extra time taken before maturity (Mandal *et. al.,* 2006) and during natural incubation and brooding as practiced in the study area (Ondwasy *et. al.*, 2006). Better feeding management contributes to about 30% chicken growth potential (Gondwe and Wolly, 2005).

5.9 Dynamics of the indigenous chickens

In the present study death from diseases and predation was the most important mode of exit across the various age groups of the indigenous chickens. Agreeing with most research findings on indigenous chickens including that of Ondwasy *et. al.*, (2006) and Siamba *et. al.*, (2002) in Kenya. The possible reasons for this high indigenous chicken mortality has been discussed in section 5.10 of this report. The chicken mortality (especially chick mortality) is a major constraint to indigenous chicken production and any strategy towards improving productivity should always aim at reducing the high chick mortality. The present study indicated that very few chickens and eggs were available for sales and home consumptions after the selections of chickens for breeding and eggs for incubation and this is typical of indigenous chicken production under free-range management (Siamba *et. al.*, 2002; Okitoi *et. al.*, 2006). This could be due to high chicken mortality forcing farmers to keep whatever live chickens they owned for breeding and eggs for hatching in order to maintain breeding flock (Siamba *et. al.*, 2002) as discussed in section 5.12 of this report. More chickens (across the age groups) exited through predation, theft and straying away in Komolorume than in Kawere. This was due to the fact that most part of Komolorume village was covered by sugar cane, providing good hiding place for predators (mostly mongooses) and thieves.

Hatchings were the main mode of chick entries whereas growers, hens and cocks entered mainly through purchases and gifts. This agrees with the findings by Okuthe, (1999) in western Kenya. This was because many farmers in the study area usually acted by purchasing, incubating eggs and receiving chickens as gifts in order to replace the breeding chickens that either died or got stolen. Majority of chickens brought in through purchases and gifts were growers (mostly

females) and hens in the present study. The work by Okuthe (1999) in western Kenya showed that purchases and entrustments brought in mainly chicks, growers and hens. This was because many farmers were able to build their chicken flocks from the females without having their own cocks as they used cocks from the neighbourhood to serve the female chickens since the birds moved freely.

5.10 Causes of mortality

This study indicated that the mortality rate in early life was high with only 10% of the chicks hatched surviving by the age of eight weeks. Of all the indigenous chicken deaths in this study, 75%, 15% and 10% were chicks, growers and adults respectively. Findings by Missohou *et. al.,* (2002) in Senegal indicated mortality rates of 43%, 16% and 3% for chicks, growers and adults respectively. Work by Mapiye and Sibanda (2005) in Zimbabwe showed that chick deaths were 63.3% of total indigenous chicken mortality. Mwalusanya, (1998) in Tanzania reported chick mortality to the age of 8 weeks of 40%. The mentioned findings agree with the present study in that the mortality was highest in chicks. This present study further indicated that high chick mortality occurred in wet seasons and was due to diseases (mainly ND) and predation agreeing with the findings by Njue *et. al.*, (2001) and Swai *et. al.,* (2007). The high chick mortality was probably due to the fact that chicks were made to compete with strong-bodied adults/growers in search of food under scavenging management system; this exposed them to starvation, extreme weather changes, predators and pathogens. Chicks are however known to have weak immune system and physical defence mechanism (Mapiye and Sibanda, 2005) coupled with poor health care associated with indigenous chicken management. High chick mortality rate in wet seasons was due to cold stress since chicks still have less developed feathers for body cover (Njue *et. al.*,

2001). The high number of chicks dying represents eggs, which would have otherwise been consumed and chickens that would have been available as replacement stock or for consumption and sale.

5.12 Utilization of the indigenous chicken products

The study showed that rural farmers used chickens as ready source of cash income, animal protein in terms of eggs and meat and for social purposes. The study finding is in line with reports by Njenga, (2005), Dwinger *et. al.*, (2001), Okuthe, (1999) and others. The present study revealed that it was easier for farmers to sell chickens for quick cash needs or to slaughter chickens to serve visitors than other species of livestock (such as cattle and small ruminants). Indigenous chickens were therefore the commonest livestock kept by most families in the study area (Table 4.3). It was observed in the study that rural people preferred poultry meat to eggs. That is why most of the eggs laid were incubated for hatching so as to increase flock size (Table 4.15). This agrees with the finding by Missohu *et. al.*,(2002) in Senegal who reported that most indigenous chicken farmers never consumed or sold eggs but incubated them for hatching. In the present study, consumption of poultry meat was one chicken in two months per family (82 chickens consumed by 40 households and 84 by 41 households in 2 months in Komolorume and Kawere respectively). This was lower than the findings in Tanzania by Mwalusanya (1998) who reported an average consumption of one chicken per month per family. This low consumption rate was due to unavailability of the birds as a result of high indigenous chicken mortality. The present study further revealed that higher proportion of cocks was consumed than sold in Kawere and vise versa in Komolorume. This could be explained by the fact that majority of the households with low income (in Kawere) usually depended on the indigenous chickens as protein

source for the visitors and the family. Households with better income on the other hand (in Komolorume) could afford to buy other protein foodstuffs and therefore more chickens were available for sales. Households preferred either selling or consuming cocks as it fetched more cash when sold or provided more meat when slaughtered than any other category of the indigenous chickens. Section 4.2 of this report showed that income levels per households in Kawere were significantly lower than in Komolorume thereby supporting the above arguments. The study indicated readily available local market (neighbouring households and local market centres) for the sale of the indigenous chicken products and this agrees with many research findings on indigenous chickens including Siamba *et. al.*, (2002) and Okitoi *et. el.*, (2006). The reason for the local market availability was due to the preference of indigenous chicken products by the local community and traders. This agrees with the findings of Okuthe (1999) in west Kenya.

Chapter Six

6.0 Conclusions

Indigenous chicken production, which is practiced by almost every household, is an important undertaking in both Rongo and Rachuonyo districts in southern Nyanza. Indigenous chickens play a key socio-economic role and largely contribute to household income and alleviation protein malnutrition. The major production system was free-range whereby all age groups fed together during the day and were housed together at night in human dwellings. Most indigenous chicken owners attained low level of education and have poor knowledge on the indigenous chicken management. The productivity revealed by the study was low compared to that of the improved (commercial) chickens but was typical of that of indigenous chicken production.

Scavenging was the major feeding system although almost every household practised supplementary feeding that was irregular and inconsistent. Feeds and feeding systems are a potential area for intervention. Almost all the farmers practised supplementary feeding of which all the feeds were produced locally. Farmers that supplemented all the time yielded the highest clutch sizes and hatchability rates.

Women and children did most of the daily management activities related to indigenous chickens. At the same time most decision to dispose the chickens was done by women. Generally men considered indigenous chicken production as women affair. Since women dominated most of the activities around indigenous chicken production, it is important to have a gender approach in indigenous chicken improvement programmes.

The indigenous chicken production suffers from the constraints of disease (particularly ND and fowl typhoid), predation (mainly in chicks), insufficient feeding, lack of housing, knowledge and skills in the management of indigenous chickens amongst the farming community, poverty among the farmers and unavailability of reliable veterinary and extension services. Loss of the birds through predation can easily be minimized through housing of the chicks. Housing, feeding, health systems and extension are the opportunities for the improvement of indigenous chicken production in southern Nyanza.

The use of various approaches whereby informal (RRA) techniques, are followed by formal (cross-sectional and longitudinal study) methods works best in obtaining the relevant data for the formulation of improvement strategies of indigenous chicken productivity

Chapter Seven

7.0 Recommendations

- The study has shown that participatory research through practical collaboration amongst the stakeholders (farmers, extension agents and researchers) is useful in studies of indigenous chicken production. Links established during the study processes should be strengthened and used to facilitate any transfer of new technologies and available extension messages on poultry. Most farmers in the study areas were not informed of the basic management and disease control practices of the indigenous chickens and therefore capacity building of the farmers in this area would be useful.
- Farmer should first of all be advised to practise simple supplementation with cereal grains and household left over. Training on good feeding program that utilizes home-grown feeds should follow, and consider the timing and frequency of feeding, what and how to feed. This would ensure greater returns in terms of abundant eggs and enhanced fertility of the birds.
- Since women dominated most of the activities around indigenous chicken production, extension programmes targeting women should be developed and implemented. Such programs should provide required knowledge and skills on the recommended technologies related to feeding, housing, disease control and breeding of the indigenous chickens i.e. poultry management in general.

- Further evaluation of gender based control and access to chicken production resources and benefits should be done. This will validate the assumption that gender approach to indigenous chicken production would increase production efficiency.
- There is need for the government to support indigenous chicken farmers by providing:
    - Subsidized vaccinations against major diseases such as Newcastle, fowl typhoid, Gumboro and fowl pox that were listed by the farmers as important disease constraints to indigenous chicken production. The vaccines should be packed in small quantities (dosages) in order to take care of the interest of the small-scale indigenous chicken farmers.
    - Enhance access to micro-credit facilities to enable farmers to expand their indigenous chicken production.
    - Reliable and affordable Animal health services to the indigenous chicken farmers.
- The socio-economic impact of diseases such as Newcastle, fowl typhoid and fowl pox should be quantified. Such information would be useful in disease planning mitigation / intervention strategies.
- Since traditional medicine was widely used by farmers, studies under controlled conditions are needed to determine the efficacy and veterinary properties of ethno-veterinary medicine in indigenous chicken production.

- Strategy towards improving productivity of indigenous chickens should include enhancement of knowledge and skills of indigenous chicken farmers on technologies related to feeding, housing and disease control.
- Chicken housing should be improved for effective chicken protection from predation and theft. Chickens of different age groups and other poultry species should be housed separately to prevent transmission of diseases. All young chicks should be kept-indoors until they are able to notice the predators.

8.0 Reference

oe, P.A.T., Boa-Amponsem, K., Okantah, S.A., Butler, E.A., Dorward, P.T. and Bryant, M.J. (2006). Free-range village chickens on the Accra Plains, Ghana: Their Husbandry and Productivity. Tropical Animal Health and Production, 38 (3), Pp. 235-248.

ene, D F. and Oguntande, A.E. (2006). The structure and importance of the commercial and village based poultry Industry in Nigeria. FAO ECTAD/AGAP October 2006, Pp. 13-26.

bede, G.B., Teguia, A.and Manjeli, Y. (1995). Traditional poultry production in Cameroon. *Tropicultura*, 13 (1), Pp. 22-24.

bora, L.C., Mbuthia, P.G., Macharia, J.N., Mwaniki, G., Njagi L.W. and Nyaga, P.N. (2005). Appraisal of Village Chicken's Potential in Egg Production. Kenya Vetrinarian, 29, Pp. 10-13.

andari, B. B. (2003). Participatory rural appraisal (PRA). Institute for Global Environmental Strategies (IGES), 2003 Draft, Module 4, Pp 8-20.

tley, A., Okoth, S., Osman, J., Fison, T., Njiru, Z., Mwangi, J., Jones, B.A. and Leyland T.J. (2001). Participatory diagnosis of a chronic wasting disease in cattle in southern Sudan. Preventive Veterinary Medicine, 51 (4), Pp. 161-181.

tley, A., Osman, J., Mawien, C., Jones, B.A. and Leyland, T.J. (2002). Participatory analysis of seasonal incidences of diseases of cattle, disease vectors and rainfall in southern Sudan. Preventive Veterinary Medicine, 53 (4), Pp. 275-284.

ley, A. (2006). Use of participatory epidemiology to compare the clinical veterinary knowledge of pastoralists and veterinarians in East Africa. Tropical Animal Health and Production 38, Pp. 171-184

S. (1989). Ministry of Planning. 1989 Population and Housing census. Republic of Kenya. Population distribution by administration and urban centres. Republic of Kenya.

S. (1999). Ministry of Planning. 1999 Population and Housing census. Republic of Kenya. Population distribution by administration and urban centres. Republic of Kenya.

S. (2005). Ministry of Planning and National Development. Geographical dimensions of well being in Kenya. Who are the poor? A constituency level profile. Volume II.

Duguma, R. (2006). Phenotypic characterization of some indigenous chicken ecotypes of Ethiopia. Livestock Research for Rural Development, 18 (9) 2006. **http://www.cipav.org.co/lrrd/lrrd18/9/news1809.htm**

inger, R. H., Bell, G.J. and Permin, A, (2001). A program to improve Family Poultry Production in Africa. In: SADC planning workshop on Newcastle disease control in village chicken (PR 103, 2001), Pp. 129-132. Edited by R. G. Alders and P.B. Spradbrow. Published by Australian Centre International Agricultural Research (ACIAR).

Zubeir, E.A. (1997). Performance of village fowls in Sudan. In: PROCEEDINGS INFPD WORKSHOP, M'bour Senegal, Pp. 185-188.

Fayeye, T.R. and Oketoyin A.B. (2006). Characterization of the Fulani-ecotype chicken for thermoregulatory feather gene. Livestock Research for Rural Development, 18 (3) 2006. **http://www.cipav.org.co/lrrd/lrrd18/3/faye18045.htm**

French, N. (1999) Disease information for economic analysis. In: Economic assessment of livestock disease problems. Eds. R. M. Bennet and B. J. Marshall. Proceedings of a conference and workshops organised by the Department of Agricultural and Food Economics and the Centre for Agricultural Strategy, The University of Reading, held at the Town Hall, Reading on 2nd March 1999. Pp. 41-49

Gausi, J.C.K., Safalaoh, A.C.L., Banda, J.W. and Ng'ong'ola, D.H. (2004). Characterization of the smallholder poultry marketing systems in rural Malawi: A case study of Malingunde Extension Planning Area. Livestock Research for Rural Development, 16 (12) 2004. http://www.cipav.org.co/Irrd/Irrd16/12/gaus16097.htm

Ghirroti, M. (1993). Rapid appraisal: Benefiting from the experience and perspectives of livestock owners. World Animal Review, 77, Pp. 26-37.

GoK, (2002). Republic of Kenya. Migori District Development Plan, 2002 – 2008. Government Printer. Nairobi.

GoK, (1997). Republic of Kenya. Rachuonyo District Development Plan, 1997 – 2001. Government Printers. Nairobi.

Gnakari, D., Grah, B.M.A. and Aduoko, A.E. (2007). Comparison of body growth and organoleptic quality of broiler and African chickens and their crossbreds in Cote d'Ivoire. Livestock

Research for Rural Development, 19 (5) 2007. http://www.cipav.org.co./Irrd/Irrd19/5news1905.htm

Gondwe, T.N. and Wollny, C.B. A. (2005). Evaluation of Growth Potential of Local chickens in Malawi. International Journal of Poultry Science, 4 (2), Pp. 64-70.

Gonomela, E.H., Kwakkel, R.P., Verstegen, M.W.A. and Katule, A.M. (2006). Strategies to optimise the use scavenge able feed resource base by smallholder in traditional poultry production system in Africa. A review. African journal of Agricultural Research, 1, Pp. 91-100.

Gueye, E.F. (2002a). Employment and income generation through family poultry in low-income food deficit countries. World Poultry Science Journal, 58 (4), Pp 541-557.

Gueye, E.F. (2002b). Newcastle disease in family poultry: Prospects for its control through ethnoveterinary medicine. Livestock Research for Rural Development. http://www.cipav.org.co/Irrd/Irrd14/5/guey145.htm.

IDS (1996). The power of participation. Institute for Development Studies Policy Briefing. Issue7: August 1996.

Jaetzold, R and Schmid, H. (1983). Natural conditions and farm management information. *Farm management handbook of Kenya.* Volume II. Part B, Central Kenya, Ministry of Agriculture, Nairobi: Pp 510.Nairobi. Ministry of Agriculture.

KARI. (1998). National Poultry Research Programme. Mini-workshop on Rural poultry Production Regional Research Centre, Kakamega, Kenya. 3-7, 1998.

Kingori, A.M., Tuitoek, J.K., Muiruri, H.K., Wachira, A.M. and Birech, E.K. (2007). Protein intake of Growing Indigenous chickens on Free-Range and response to Supplementation. International Journal of Poultry Science, 6 (9), Pp. 617-621.

KNBS, (2008). Economic survey for 2008. Ministry for State for Planning, Natioal Development and Vision 2030.

Leyland, T. (1991). Participation the 80s and 90s: Who asks the questions in livestock development. Msc. Dissertation, University of Edinburg, UK.

Mandal, M.K., Khandekar, N. and Khandekar, P. (2006). Backyard poultry farming in Bareilly district of Uttar Pradesh, India: an analysis. Livestock Research for Rural Development, 18 (7) 2006. http://www.cipav.org.co/lrrd/lrrd18/7/mand18101.htm

Mapiye C. and Sibanda. S. (2005). Constraints and opportunities of village chicken production system in the smallholder sector of Rushinga district of Zimbabwe. Livestock Research for Rural Development, 17 (10) 2005. http://www.cipav.org.co/lrrd/lrrd17/10/mapi17115.htm

Martin, S.W., Meek, A.H. and Willeberg, P. (1987). Veterinary Epidemiology. Principals and Methods. Iowa State University Press/ Ames.

Missohou, A., Dieye, P.N. and Talaki, E. (2002). Rural poultry production and productivity in Southern Senegal. Livestock Research for Rural development, 14 (2) 2002. http://www.cipav.org.co/lrrd/lrrd14/2/miss 142.htm.

Mohammed, M.D., Abdalsalam, Y.I., Kheir, A.M., Jin-yu, W. and Hussein, M.H. (2005). Comparison of the Egg Characteristics of Different Sudanese Indigenous chicken types. International Journal of Poultry Science, 4 (7), Pp. 455- 457.

MA, (2007). Ministry of Agriculture. Annual report for the year, 2007.

MLFD, (2007). Ministry of livestock and Fishery Development. Annual report 2007

MLFD. (2006). District livestock production officer Rachuonyo district. Annual report for 2006.

MLFD. (2006). District livestock production officer Rongo district. Annual report for 2006.

MLFD. (2006). Distrct veterinary officer Rachuonyo district. Annual report for 2006.

MLFD. (2006). District veterinary officer Rongo district. Annua report for 2006.

Mogesse, H.H. (2007). Phenotypic and genetic characterization of indigenous chicken populations in Northwest Ethopia. PhD Thesis. University of the Free State, Bloemfontein, South Africa.

Msami, H.M., Tounkara, K., Kavuria, F.M. and Minga, U.M. (2002). An assessment of impact of selected intervention on the production of family poultry in Tanzania. In: The Third Research Co-ordination Meeting of the FAO/IAEA Co-ordinated Research Programme (CRP) on village poultry production held in conjunction with DANIDA in Quatre Bornes, Mauritius in 6-10 May, 2002.

Msoffe, P.L.M., Mtambo, M.M.A., Minga, U.M., Gwakisa, P.S., Mdegela, R.H and Olsen, J.E. (2002). Productivity and Natural Disease Resistant Potential of Free-range Local chicken Ecotypes in Tanga in Tanzania. Livestock Research for Rural Development 14 (3) 2002. http://www.cipav.org.co/lrrd/lrrd14/3/msof143.htm of 31/03/2007

Muchadeyi, F.C., Sibanda, S, Kusina, N.T., Kusina, J and Makuza, S. (2004). The village chicken production system in Rusinga District of Zimbabwe. Livestock Research for Rural Development, 16 (4) 2004. http://www.cipav.org.co/lrrd/lrrd16/6/much16040.htm, 14/02/2008

Mungube, E.O., Bauni, S.M., Tenhagen, B.A., Wamae, L.W., Nzioka, S.M., Muhammed, L. and Nginyi, J.N. (2007). Prevalence of parasite of the local scavenging chickens in a selected semi-arid zone of eastern Kenya. Tropical Animal health and Production, 40:2, Pp. 101-109.

Mwalusanya, N.A. (1998). Productivity and Nutritional status of local chickens under village management conditions. MSc. Thesis, The Royal and Agricultural University (KVL), DENMARK.

Nahamya, F.H., Mukiibi-Muka, G., Nasinyama, G.W. and Kabasa, J.D. (2006). Assessment of the cost effective of vaccinating free-range poultry against Newcastle disease in Bussedde Sub-county, Jinja district, Uganda. Livestock Research for Rural Development, 18 (11) 2006.

Ndegwa, J. M., Tchome, P., Kabuage, L., Mukiibi-Muka, G. and Kosgey, I.S. (1998). Improvement of indigenous poultry production in sub-Saharan Africa. *Paper presented at the International Course on Intensive Poultry Production held at Centre for International Agricultural Development Co-operation (CINADCO). Tel-Aviv Israel. 4th March 1998 to April 1998.*

Njenga S K. (2005). Productivity and socio-cultural aspects of local poultry phenotypes in coastal Kenya. MSc. Thesis, The Royal and Agricultural University (KVL), DENMARK.

Njue, S.W., Kasiiti, J.L., Macharia, J.M., Gacheru, S.G. and Mbugwa, H.C.W. (2001). A survey of the disease status of village chicken in Kenya. In: Livestock community and Environment. Proceedings of the 10th conference of the Association of Institutions for Tropical Veterinary Medicine, Denmark, 2001.

Noordhuizen, J.P.T.M., Frankena, C.M., Van der Hoofd, C.M. and Graant, E.A.M. (1999). Application of quantitative of Quantitative methods in Veterinary Epidemiology. Wagenigen Pp. 101-132.

NPDP (1985-1986) National Poultry Development Programme, Phase 3, Publication No.7. Ministry of Agriculture and Livestock Development, Government of Kenya.

Okitoi, L.O., Linyonyi, A., Ondwasy, H., Mudeheri, M., Mulamula, H., Otieno, K., Wanambacha, J., Murekefu, F., Soita, Ndege, Kahai, Rotich, D., Wekesa, A.and Obali, M. (1997). A survey report on indigenous poultry production in RRC-Kakamega mandate, Pp 22.

Okitoi, L.O., Ondwasy, H.O., Obali, M., Linyonyi, A., Mulamula, H., Otieno, K., Murekefu, F., Soita, J., Ndege, J., Kahai, R., Rotich, D. and Wekesa, A. (2002). An appraisal of local poultry production in Western Kenya. In: Testing Livestock Technologies on smallholder mixed farms in Kenya. Edited by de Jong, R. and Mukisira, E.A. Published by KARI, 2002, Pp. 157-178.

Okitoi L.O, Udo, H.M.J, Mukisira, R., de Jong, Kwakkel, R.P. (2006). Evaluation of low-input interventions for improved productivity of Indigenous chickens in Western Kenya. Agri-Tropica et Subt. 39(3), Pp. 179-182.

Okitoi, L.O., Ondwasy, H.O., Siamba, D.N. and Nkurumah, D. (2007). Traditional herbal preparation for indigenous poultry health in Western Kenya. Livestock Research for Rural Development, 19 (5) 2007.

Okuthe, S.O. (1999). Participatory epidemiology assessment of livestock production constraints in the Western Kenya Highlands. PhD Thesis. University of Reading.Reading, United Kingdom.

Okuthe, S.O., Mcleod, A., Otte, J.M. and Buyu, G.E. (2003). Use of rapid rural appraisal and cross-sectional studies in the assessment of constraints in smallholder cattle production system in western Kenya highlands. Onderstepoort Veterinary Research, 70, Pp. 237-242.

Okuthe, S.O., Costagi, R., Omer Osman, I., Nur Haji, A., Abdulle, M.H., Matete, G.M. and Muuse, M. (2005). Qualitative epidemiological assessment of Somali livestock diseases. In ISVEE-Australia, 2005.

Ondwasy, H., Wesonga, H. and Okitoi, L.O. (2006). Indigenous chicken production manual. In: KARI Technical Note No. 18, February 2006.

Schwabe, C.W., Riemann, H.P. and Franti, C.E. (1977). *Epidemiology in veterinary practice*. Philadelphia: Lea and Febiger.

Sekeroglu, A. and Aksimsek, S.D. (2009). Village chicken production in Turkey: Tokat province example. Tropical Animal Health and Production 41, Pp.103-108. DOI 10.1007/s11250-008-9163-0

Sonaiya, E.B. and Swan, S.E.J. (2004). Small-scale poultry production technical guide. FAO animal production and health manual.

Siamba D.N, Ndegwa, J.M., Kimani, C.W, Nampasa, J., Ole Sinkeet, S.N. and de Jong, R. (2002). Rural Poultry Production. Efforts to improve production and contribution to household economy. In: Testing Livestock Technologies on smallholder mixed farms in Kenya. Edited by de Jong, R. and Mukisira, E.A. Published by KARI, 2002, Pp. 141 –156.

Swai, E.S., Karimuribo, E.D., Kyakaisho, P.F. and Mtui, P.F. (2007). Free-range village chickens on the humid coastal belt of Tanga, Tanzania: Their roles, husbandry and health status. Livestock Research for Rural Development, 19 (8) 2007. http://www.cipav.org.co/lrrd/lrrd19/8/swai19104.htm

Tadelle,D., Million, T., Allemu, Y. and Peters, K.J. (2003).Village chicken production systems in Ethiopia: 1. Flock characterization and performance. Livestock Research for Rural Development, 15 (1) 2003.

Toma, B., Dufour, B., Sanaa, M., Benet, J.J., Moutou, F., Louza, A. and Ellis, P. (1999). APPLIED VETERINARY EPIDEMIOLOGY and the control of disease in populations. ISBN92-9044-487-8, 1999. Pp. 89-92.

Townsley, P. (1996). Rapid rural appraisal, participatory rural appraisal and aquaculture, FAO Fisheries technical paper. No. 358. Rome, FAO, 1996. Pp. 109.

Appendices

Appendix 1 Indigenous chicken baseline data assessment

QUESTIONNAIRE

Baseline Data

Enumerator		
Household number		
Date		
Village		
Sub location		
Location		
Division		
GPS reading	**Latitude**	
	Longitude	

1. Background information

1)	Farmers name	
2)	Sex of farmer	
3)	Respondent	
4)	Sex of respondent	
5)	Total number in family	
6)	Number in school	
7)	Number in college	
8)	Address	
9)	Telephone	
10)	Education level	

11)	Employment	
12)	Farm size	
13)	Total income from farming	
14)	Income from indigenous poultry	

2) **Management practices**

Chicken population

	Chicks	Growers	Hens	Cocks
Number				

Who is responsible for the following activities?

Responsibility	
Rearing (feeding)	
Decision to treat	
Decision to dispose	

Production system .....

Farmers experience in indigenous chicken production (years) .....

3) **Productivity Constraints To Indigenous Chicken Production and Ranks**

Constraints	Rank	Reason(s)

4) **Ranking of indigenous chicken diseases**

Disease constraints	**Rank**	**Reason(s)**

5) Has any bird suffered from any disease condition? Yes or No

If yes which disease tentatively.

Disease	ND	Fowl typhoid	Fowl/pox	Coccidiosis	Helminthosis	Others
Numbers						
Adults						
Growers						
Chicks						

6) List disease control measures undertaken in the farm.....

.....

.....

.....

7) Has any vaccination been done? Yes or No

If yes state which ones.

Vaccination	ND	Fowl Typhoid	Fowl pox	Others
Numbers				
Cost/bird				

8) Has any treatment been done? Yes or No

If yes give one.

Treatment	Fowl Typhoid	Helminthosis	Coccidiosis	Indigenous	ND	Fowl pox
Number						
Cost /bird						

9) What was the tentative cause of deaths?

	ND	Fowl typhoid	Fowl pox	Helminthosis	Coccidiosis	Predation	Others
Chicks							
Growers							
Adults							

10) Are other species of livestock present? Yes or No

If Yes, which one(s)? Quantify

Species	Cattle	Sheep	Ducks	Turkeys	Geese	Doves	Others

11) Were any birds sold? Yes or No

Type	Growers	Cocks	Hens	Ducks	Turkeys	Geese

12) Feed Inputs

Feeds used				
Type	Quantity	Origin	Time of feeding	Price if purchased

13) Veterinary and other Inputs

Veterinary drugs			Other input purchased		
Type	Quantity	Price	Type	Quantity	Price

14) Number of hens laying/sitting on eggs and looking after chicks.

Number of			
Hens in lay	Hens sitting on eggs	Hens looking after chick	Idle hens

15) Number of eggs in nests and the number of eggs being incubated

NUMBER OF	
Eggs in nests	Eggs being Incubated

16) Entries (sources)

Entries	

17 Exits

Exits	

18) Type of housing. Tick the appropriate box.

☐ Raised (timber walls, iron roofed)

☐ Raised (timber walls, grass thatched)

☐ Raised (mud walls, iron roofed)

☐ Raised (mud walls, grass thatched)

☐ Deep litter (mud walls, iron roofed)

☐ No housing (nights in the kitchen)

☐ Others (indicate type) ----------

19) Any comments in relation to indigenous chicken production

Appendix 2 Indigenous chicken heath and productivity monitoring

QUESTIONNAIRE

ENUMERATOR .....

FARMER .....

FARM NO .....

DATE OF VISIT A .....

DATE OF VISIT B .....

1. Chicken population

	Chicks	**Growers**	**Hens**	**Cocks**
Previous recording				
Sold				
Gifted out				
Consumed				
Died				
Lost				
Entrusted out				
Transferred out				
Purchased				
Gifted in				
Entrusted in				
Transferred in				
Visit A				
Sold				
Gifted out				
Consumed				
Died				
Lost				

Entrusted out				
Transferred out				
Purchased				
Gifted in				
Entrusted in				
Transferred in				
Visit B				

2. Has any bird suffered from any disease condition? Yes □ or No □. If yes which disease tentatively.

Disease	ND	Fowl typhoid	Fowl pox	Coccidiosis	Helminthosis	Others
Numbers						
Adults						
Growers						
Chicks						
Visit A total						
Numbers						
Adults						
Growers						
Chicks						
Visit B total						

3. Has any vaccination been done? Yes □or no □. If yes which one

Vaccination	ND	Fowl typhoid fowl pox	
Visit A numbers			
Cost/bird			
Visit B numbers			
Cost/bird			

4. Has any treatment been done? Yes □ or no□ .If yes which one

Treatment	Fowl typhoid	Helminthosis	Coccidiosis	Indigenous	ND	Fowl pox
Visit A numbers						
Cost/bird						
Visit B numbers						
Cost/birds						

1. What were the tentative causes of deaths?

	ND	Fowl T	Fowl P	Helminthosis	Coccidiosis	Predation	Others
Chicks							
Growers							
Adults							
Visit A total							
Chicks							
growers							

Adults							
Visit B total							

6. Are other species of poultry present Yes□ or No□. If yes which one?

Species	Ducks	Turkeys	Geese	Doves
Visit A total				
Visit B total				

7. Were any birds sold. Yes □ or No□. If yes what was the average price

Type	Growers	Cocks	Hens	Ducks	Turkeys	Geese
Price						
Visit A number						
Price						
Visit B number						

8. Feed inputs since last visit

	Feed used			
	Type	Quantity	Origin	Price If purchased
Visit A				
Visit B				

9. Veterinary and other inputs since last visit.

	Veterinary medicine purchased			Other inputs purchased		
	Type	Quantity	Price	Type	Quantity	Price
Visit A						
Visit B						

10. Number of hens that have laid eggs since the last visit. Number of hens currently sitting on eggs and looking after chicks.

	Number of			
	Hens in lay	Hens sitting on eggs	Hens looking after chicks	Idle hens
Visit A				
Visit B				

11. Number of eggs in nests and the number of eggs being incubated. Check the number of eggs sold, eaten, and wasted since the last visit.

	Number of	
	Eggs in nests	Eggs being incubated
Previous visit		
Consumed		
Sold		
Hatched		
Wasted		
Laid		
Begun incubation		

Number of visit A		
Consumed		
Sold		
Hatched		
Wasted		
Laid		
Begun incubation		
Number of visit B		

12. Type of housing. Tick the appropriate box.

□ Raised (timber walls, iron roofed)

□ Raised (timber walls, grass thatched)

□ Raised (mud walls, iron roofed

□ Raised (mud walls, grass thatched)

□ Deep litter (mud walls, iron roofed)

□ No housing (nights in the kitchen)

□ Others (indicate type).....

Appendix 3 Check lists

A Community group interviews:-

1. Why do you keep chickens?
2. What are the indigenous chicken production constraints in the area?
3. Rank the constraints
4. What are the indigenous chicken diseases in the area? Quantify.
5. Rank the diseases
6. Why do you perceive the above-mentioned diseases to be important?
7. Do you treat your chickens? When and why?
8. Is there any problem with animal health service delivery?
9. Which drugs do you usually use?
10. Why do you prefer the above-mentioned drugs?
11. How do you administer the drugs?
12. Where do you get your chickens?
13. Where do you sell the chicken?
14. Venn diagrams? Relationship between institutions?

B **DVO/VO/LO and AHA**

1. What is the general indigenous chicken production situation in the area?
2. List and rank indigenous chicken production constraints
3. List and rank diseases
4. What are the commonly used drugs and why?
5. Any other significant issue in reference to indigenous chicken farming?
6. Any other comment.

C **Agro-veterinary shop owner**

1. What are the commonly bought poultry drugs?
2. Who buys the drug, Vet, farmer or both?
3. Incase the farmer buys, who makes the prescription?
4. Any other significant issue between you and the farmer