KENYA

POULTRY SECTOR REPORTS

The structure and importance of the commercial and village based poultry systems in Kenya

ECTAD\AGAP

Food and Agriculture Organization
Of
The United Nations

Prevention and Control Strategies of Highly Pathogenic Avian

Influenza (HPAI) in Eastern Africa

THE STRUCTURE, MARKETING AND IMPORTANCE OF THE COMMERCIAL AND

VILLAGE POULTRY INDUSTRY:

AN ANALYSIS OF THE POULTRY SECTOR IN KENYA

Marketing Indigenous chicken

Indigenous chicken at a slaughter house

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PREFACE

In May 1997 a virus of H5N1 subtype was isolated from a young man who died in Hong Kong and in December 1997 a virus of the same subtype was isolated from 18 people, and six of these died. The same H5N1 virus had been isolated from chickens in March of 1997 in Hong Kong and subsequent serology of poultry workers in live bird markets showed 10% sero-prevalence of antibodies to H5N1 but without clinical disease. In 2003, an H5N1 virus was isolated from a man and son who showed influenza-like illness. The man died later. Since December 2003 outbreaks of H5N1 infections in humans have subsequently been reported in Thailand and Vietnam (year 2004/5) and other countries in South East thereafter (e.g. Malaysia, Indonesia, Cambodia, China, Japan). Thousands of millions of birds have been affected and killed in attempts to contain the spread of the infection. However, the H5N1 Asian virus has since spread from China with wild birds to reach the Middle East, Europe and in Africa, outbreaks have been reported in Sudan, Djibouti, and west African countries of Nigeria, Niger, Cotre D'Ivoire, Cameroon, Ghana, and Togo with enormous economic and socio-cultural consequences. Further spread in Africa is very likely to occur.

This unprecedented spread of Highly Pathogenic Avian Influenza (HPAI) of subtype H5N1 further raises fundamental ecological, epidemiological and disease control questions. It is possible that the influenza problem in poultry production and human infections is linked to different agricultural and cultural practices; the different environmental factors and husbandry practices in both modern and traditional poultry production systems. Furthermore, the potential mechanism of transmission to humans is still not well understood. Thus, using concepts of disease transmission and the history of the human cases so far reported; very close contact with the fecal and respiratory secretions of infected poultry that normally contain very high virus concentrations and inhalation of virus laden dust or small droplets generated from infective fluids are likely to be possible sources of human infection.

Therefore, a good understanding of the production systems, the market chains, and all the relevant practices undertaken by poultry farmers and traders may indicate possible bio-security flaws and likely vulnerabilities in the livelihoods of the poultry farmers and consumers of poultry products; the possible routes through which birds may acquire avian influenza infections in non- infected countries and areas of potential exposure to humans.

The study would also help countries to develop appropriate control measures and improved bio-security. This report describes the structure, marketing and importance of commercial and village based poultry in Kenya. It is part of a series of Country Reports that are commissioned by the Animal Production Service (AGAP) of the Food and Agriculture Organisation of the United Nations (FAO) for the Socio-Economics and Policy Working Group of the Emergency Centre for Transboundary Animal Disease (ECTAD).

We hope this report will provide accurate and useful information to its readers and any feedback is welcome by the author, AGAP and the Socio-Economics and Policy Working Group.

EXECUTIVE SUMMARY

Due to the recent Highly Pathogenic Avian Influenza (HPAI) outbreaks in the Far East and the spread of the H5N1 virus to Africa, FAO commissioned a study to review the status and development of the poultry production systems in Kenya for the past five years with a view to recommend safe poultry production system in Kenya. The national consultant interviewed various stakeholders involved in the poultry industry and visited representative farms and other poultry operations in the four sectors.

Poultry Production in Kenya

All the four (4) poultry sectors as defined by the Food and Agriculture Organization are represented in Kenya. The study found that there was only one poultry farm that can be classified into sector one, while all the other chicken, turkey, duck and ostrich operations were placed in sector two. All the commercial broiler and layer farmers fitted into sector three and the indigenous farmers in the rural and urban areas fitted into sector four. The vertically integrated contract broiler farmers kept a minimum of 3000 and a maximum of 12,000 birds per farm. There were a few large scale commercial layer farmers keeping flocks of 1000 to 4000 birds per farm while the majority were smallholder commercial layer and broiler farmers who kept between 100-400 birds. The indigenous chickens were kept by 75% of all the smallholder households in the rural areas of the country and had on average 13 birds per farm.

There were very many chicken feed millers in Kenya and therefore there was adequate feed supply for the commercial production of layers and broiler, turkeys and ducks although the quality might vary. The total poultry population in Kenya is estimated at 30 million birds of which 20.7million are indigenous chicken, 6million are broilers, 2.6million are commercial layers while 0.7million are turkeys, ducks, geese and quails all put together.

Marketing

The marketing of poultry comprised farm gate sales, primary collectors at the village market, secondary collectors at the district level and then sales at the provincial municipal chicken markets. Some sales ended here, while other birds were transported to the wholesale chicken market in the capital city of Nairobi. Retailers in the city who bought birds from the wholesale city market had their chicken and egg kiosks located in all the city estates and they slaughtered the chickens on the spot in their kiosks. They also received birds directly from up-country collectors. Marketing of poultry was observed to lead to many bio-security flaws.

Genetic resources

A cockerel exchange programme of the 1980's and 90's had introduced exotic blood in indigenous chickens in 26 districts of Kenya. Currently, indigenous chickens can be obtained by farmers from the National Poultry Research Station at Naivasha. Ducks and turkeys are farmed by single farmers respectively using imported stock. The Duck and Turkey farmers sell their birds to meat processors in the city of Nairobi. There are local ducks and turkeys found in the rural and urban homes, particularly in informal settlements in the city. Commercial broiler and layer breeds are from imported stocks. Indigenous chickens are distributed throughout the country with about 75% of the households keeping some indigenous birds.

Slaughtering processes

Wet slaughtering is done at the Provincial municipal slaughtering houses and in all the satellite capital city "chicken and egg" kiosks whereas dry plucking is done in the indigenous chicken slaughterhouse in Makueni, the local collection market sites and the Burma Market in the capital city of Nairobi. Those who do home slaughter use wet plucking. This is done by all farmers in sector three for broilers and spent hens. Here the farmers would normally call in traders from the city to do the slaughtering. All slaughtering processes, whether wet or dry, pose severe bio-security flaws which need to be corrected to prevent spreading of diseases. There was government inspection of all chickens slaughtered in the municipal markets but minimal inspection in the city satellite kiosks. Waste disposal posed the greatest bio-security risk for the slaughtering processes everywhere. Isolation, movement of birds, personnel, bicycles, cages and personal hygiene pose bio-security risks during marketing and slaughter of the chickens in sectors three and four.

Sector one and two had secure bio-security protocols but there were some flaws, like wild bird contact, human traffic control, and waste disposal which needs to be reviewed.

Bio-security flaws are present in all sectors but in differing levels. Housing, personal hygiene, flock isolation to prevent disease spread, mixed ages and bird types may make it difficult to implement modern techniques of hygiene based on chemicals and commercial equipment. Farmer education to create disease awareness and to have simple procedures and processes, e.g. to start from clean to dirty and young to old flocks and prevent close contact of birds by visitors will go a long way to prevent spread of diseases in poultry and human infections in sectors three and four.

Impact of avian influenza

A recent socio-economic survey in Kenya showed that poultry play an important role in the livelihoods and food security of rural smallholder

communities and that an avian influenza scare in Kenya in the 2005/2006 period caused severe losses in jobs, poultry production and sales. There was decline in orders for broilers and layers and the contract farmers got delayed payments.

The losses were different for the broilers, layers and indigenous birds, depending on the period in the production cycle the birds were culled, for example layers were culled 5 months before due time. This factor may need to be considered when working out compensation protocols in the event of avian influenza outbreak in order to persuade different types of farmers to cooperate in a control programme.

Conclusions

- The chicken feed quality was generally good and the supply was adequate for the commercial poultry production. However, the feed quality varied and inadequate supplies of the imported premixes and other ingredients at times adversely affected the manufacturing of feeds.
- Only one farm could be classified into sector one and it had adequate sanitary bio-security measures but it still had some bio-security flaws to attend to. Production was going on well. However, there were import restrictions to obtain day old chickens from overseas countries where they used to import breeding stock from making it difficult to keep to the scheduled placement of breeders in the farms. The other hatchery operators who had been classified into sector 2 also experienced similar difficulties with import restrictions and they could not access day old chicks from their regular suppliers in England, France and India.

- There were no deficits of poultry eggs and meat in the country.
- There was only one turkey farm and one duck farm in Kenya both placed in sector two. Both used feed manufactured by a well established company and there were no feed quality complaints. Both production and sales were going on well.
- Ostriches were farmed as an emerging livestock and only one farm had a big thriving business. The business seemed to be declining with less and less persons being involved. Feed was made at the farms and loss due to diseases was still a challenge.
- The different sectors had differing protocols for poultry production, disease control and marketing systems. Sectors 3 and 4 had less usage of information and knowledge in their poultry production activities compared to the other two sectors.
- Bio-security flaws are present in all the sectors and all the food chain stages. Different strategies are therefore needed to deal with these flaws in the respective sectors.

- Marketing was not formalized into a countrywide cooperative or marketing board. This left each sector to arrange its own marketing channels. Both Marketing and slaughtering processes have many bio-security flaws which could lead to the spread of avian influenza and other infectious diseases into the food chain and thus needs urgent attention.
- One slaughterhouse for indigenous chickens was introduced following the avian influenza scare as a means to control the spreading of avian influenza through marketing of live birds. By processing birds at the source and selling packaged poultry products in a controlled manner this would reduce the traffic of live birds going to the capital city.
- Training and public education on good and safe poultry production and standard bio-security measures is needed in order to safeguard food security and to reduce possibilities of spreading diseases in poultry. This would further reduce the potential of human exposure to H5N1 HPAI for farmers in sectors three and four.

Recommendations

- A study on public education and training in safe poultry production and bio-security at the rural setting is needed and the training needs to be carried out urgently.
- A detailed study of the poultry marketing, its economic values at each stage and its impact on livelihoods be made.
- Sanitation protocols are needed at the slaughtering houses.
- Compensation should consider the disparate losses likely to be experienced by the different sectors.
- Comparisons of sector activities and trans-boundary collaboration across borders would add value to any control plans and activities in anyone country.
- Training in bio-security in sectors three and four needs to be done urgently.
- Kenya Bureau of Standards (KBS) ought to regularly check the quality of animal feeds. The establishment of a laboratory that would carry out feed quality analysis would assist the many feed manufacturers and the poultry farmers regarding the quality of poultry feeds to complement the efforts of KBS.
- A proper poultry census should be done in Kenya once every ten years so that planning is not being based on estimates of poultry. This can be coupled to the regular ten-year human census done in the country. Financing of a project to carry out a poultry census immediately would be a very welcome and worthwhile investment in the poultry industry of Kenya.

ABBREVIATIONS AND ACRONYMS

ABD	=	Agriculture Business Development.
ASAL	=	Arid and Semi Arid Lands.
AI	=	Avian Influenza
ASPS	=	Agriculture Sector Programme Support.
ATCs	=	Agricultural Training Centers
Bl Sh	=	Black Shavers.
CM	=	Case Management subcommittee.
DANIDA	=	Danish International Development Agency
DFID	=	Department of Foreign International Development
GDP	=	Gross domestic product
ES	=	Epidemiology and Surveillance subcommittees.
FAO	=	Food and Agriculture Organisation of the United Nations.
FTC	=	Farmers' Training Centers.
H5N1	=	Avian influenza of hemagglutinin subtype 5 and neuraminidase subtype 1
HPAI	=	Highly Pathogenic Avian Influenza.
IEC	=	Information, Education, Communication and Social Mobilisation.
IPC	=	Infection Prevention and Control subcommittee.
KAPP	=	Kenya Agricultural Productivity Project.
KARI	=	Kenya Agricultural Research Institute.
KEPOFA	=	Kenya Poultry Farmers Association.
KWS	=	Kenya Wildlife Services.
LR	=	Laboratory and Research Subcommittee.
MLFD	=	Ministry of Livestock and Fisheries Development.
MALD	=	Ministry of Agriculture and Livestock Development.
MT	=	Metric tons.
NALEP	=	National Agricultural Extension Programme
NPDP	=	National Poultry Development Programme.
RIR	=	Rhode Island Red.
SIDA	=	Swedish International Development Agency.
USAID	=	United States Agency for International Development.
WHO	=	World Health Organisation.

THE REPUBLIC OF KENYA COUNTRY PROFILE: GENERAL FACTS SHEET

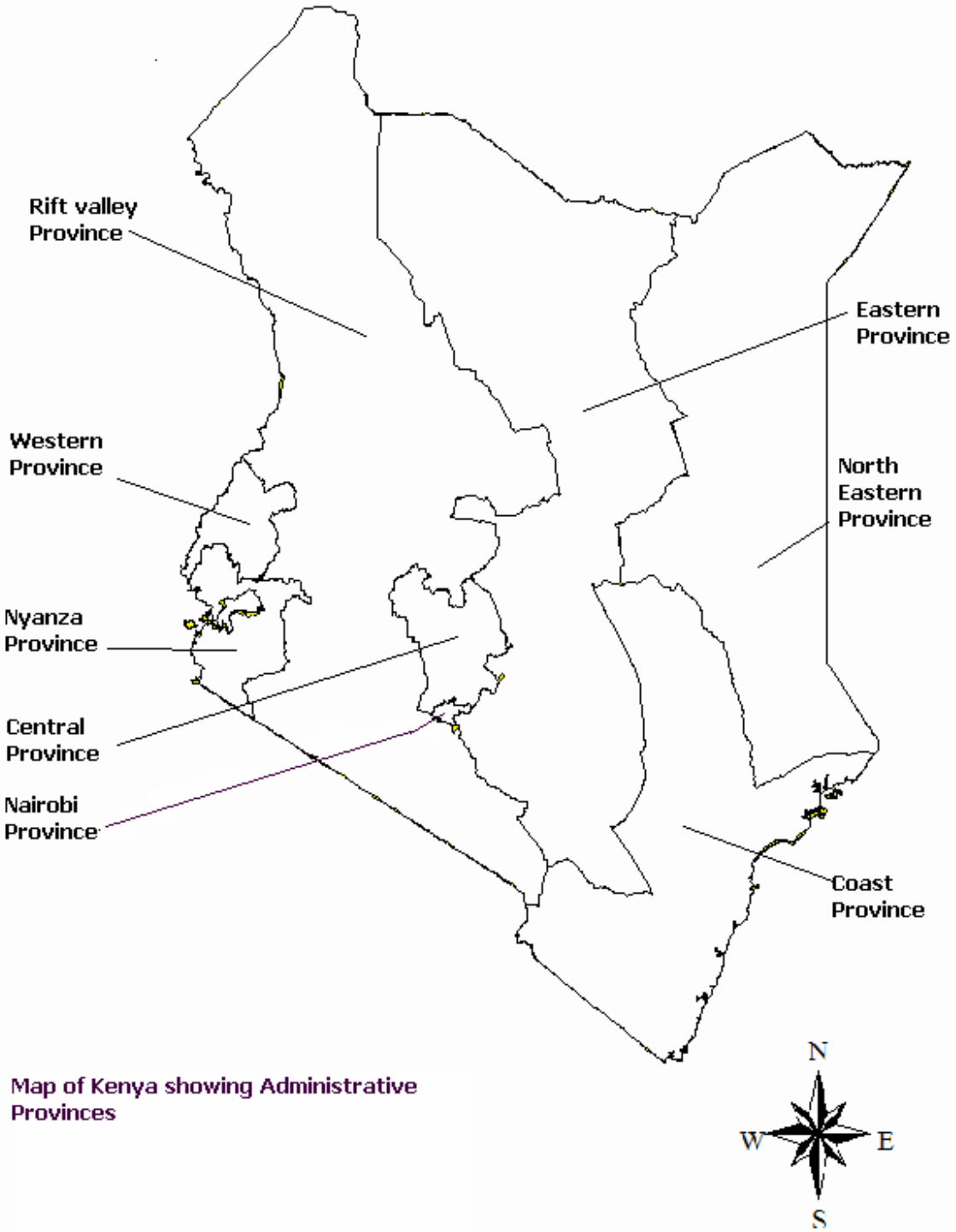
The Republic of Kenya National Statistics are given below:

1. Human Population : 32 million and Population Density of 51 persons/km^2.
2. Land area : 569,250 square kilometres
   Water surface : 13,400 square kilometres
   Total area : 582,650 square kilometres
3. Coast line : 536 km
4. Capital city: Nairobi
5. Poultry population estimates: 30m All poultry
   70% Indigenous
   28% Commercial
   2% Turkey, Ducks, Geese, Quails.

6. Agriculture contributes 26% of GDP with Livestock making 30% of that GDP
7. Administrative provinces in Kenya (see map):

Administrative Province	**Provincial capital**
Nairobi	Nairobi
Rift Valley	Nakuru
Coast	Mombasa
Western	Kakamega
Nyanza	Kisumu
Central	Nyeri
Eastern	Embu
North Eastern	Garissa

8. Government type = Democracy with Executive President, Elected Parliament and independent Judiciary.
9. Neighbouring Countries: Ethiopia, Somalia, Sudan, Tanzania and Uganda.
10. International water masses: Sea on the Indian Ocean; Lake Victoria shared with Uganda and Tanzania.
11. Official Languages: English, Kiswahili.
12. Currency: Kenya shilling (Ksh), 1 US Dollar = 65 Kshs (July 16, 2007)



Map of Kenya showing Administrative Provinces

1.0 INTRODUCTION

1.1 General Background

Kenya land mass covers a wide range of topographical and climatic zones from the tropical coastline to temperate highland areas and arid and semi-arid areas in the North and East of Kenya. There are seven agro-ecological zones.

Table 1.1 Types of agro-ecological zones in Kenya

Agro-ecological Zone	Climatic Description	Rainfall/evaporative potential
1	Humid (Central Province and parts of Eastern and Rift valley Provinces)	>80
2	Sub-humid (Western, Nyanza and part of eastern Provinces	65-80
3	Semi-humid (Nairobi, Rest of Eastern and part of Western	50-64
4	Transitional (Parts of Rift Valley and Parts of Coast Provinces)	40-49
5	Semi-arid (Parts of Eastern, Central, Coast Provinces)	25-39
6	Arid (Northern parts of Eastern, Rift valley Provinces)	15-24
7	Very arid (Northern parts of Eastern, Rift valley Provinces)	<15

While commercial poultry are kept in the first four ecological zones where climate is favourable, indigenous chickens are kept in all ecological zones except zone 7. Agriculture contributes 25-26% of GDP with poultry playing a major role, contributing 30% of the agriculture contribution to GDP. Most rural families in Kenya keep chicken and the proportion is estimated at 75%. Indigenous chickens contribute 71% of the total egg and poultry meat

produced in Kenya and therefore, impact significantly on the rural trade, welfare and food security of smallholder farmers. The average household is reported to keep 13 birds per flock. Commercial poultry are concentrated in the urban centres of Nairobi, Mombassa, Nakuru, Kisumu and Nyeri where ready markets are available. This has lead to the growth of commercial hatcheries located in the peri-urban areas, which sell hybrid broiler and layer chicks to commercial farmers.

With the indigenous birds having high returns yielded by low inputs, the farmers can keep the production at subsistence level. However, the introduction of hybrid egg layers in early 2002 in ASAL districts of Kitui, Kwale and Taita Taveta and the recent encouragement of poultry farmers in Makueni District to farm poultry as a business enterprise introduces a commercial angle to the keeping of indigenous chicken. This will include seeking extra financial inputs like housing, drugs and feed. In this regard, such chicken farmers will be more adversely affected by a disease outbreak than in the past when they left the chickens to fend for themselves.

Now with the global spread of highly pathogenic avian influenza (HPAI) and its entrance into African countries, there is every reason to be concerned with how effective preventive measures can be instituted in all sectors of the poultry industry in Kenya. Although Kenya has not yet had any outbreak of HPAI, there was an avian influenza scare in the 2005/2006 period which had adverse impact on the poultry industry and the families dependent on poultry for their livelihoods. Therefore, there is a concerted effort by Government and the international community to understand the whole poultry sector. In this regard the FAO has initiated efforts to gather all available information which is relevant to this sector in Kenya.

Therefore a study was commissioned entitled, "**The Structure and Importance of Commercial and Village based Poultry in Kenya**." The collected information will then be used to make recommendations for safe poultry production and improved bio-security in Kenya and thus prevent HPAI and other disease outbreaks.

1.2 Scope and methodology

The study was a desk review with limited field visits to selected stakeholder facilities. The study covered a five year period, from 2003 until 2006/7. The study was conducted as a review of the relevant statistical data, reports, literature and all works relevant to the terms of reference and interviews with government personnel and the selected stakeholders. Field visits were made to study the market structure, production systems and the slaughtering process. Data was then compiled into the current report.

1.3 Data sources

The data were obtained from secondary sources. This included the annual reports of the Ministry of Livestock Fisheries Development, published and unpublished reports of all work on poultry in Kenya from the National Poultry Research Station, non-governmental organizations and Universities in Kenya. Farmers, traders, slaughter house attendants, government officials and poultry association officials were interviewed.

1.4 Limitations

It was found that except for works published in journals and technical reports, most data in the reports were estimates. Site visits could not be made to some key areas due to limitations of time and weather. However, in spite of those limitations, the report records very novel findings and makes a very significant basis for future studies on communicable infectious diseases in poultry in Kenya.

2.0 FEED AND POULTRY GENETIC RESOURCES IN COMMERCIAL AND VILLAGE BASED CHICKEN OPERATIONS

2.1 Genetic poultry resource types found in Kenya

2.1.1 Chicken types

In the 1960's pure breeds of chickens were introduced into the country and kept in small numbers. These were Rhode Island Red, Light Sussex, New Hampshire Red, Black Australorps and white leghorns. Later the Plymouth rock, the barred Rock and the buff rock were introduced. The period of keeping pure breeds was followed in the 1970's by the introduction of hybrid layer and broiler flocks that were hatched from imported eggs and later from imported breeding stocks grown in the country. A cockerel and pullet exchange programme (described later in section 2.2.) using Rhode Island Red and Black Shaver birds was introduced in 26 of the then 54 districts of Kenya and this has influenced the local genetic pool in the villages to some extent. The local Kenyan chicken is characterized by different sizes and plumage colour and is widely distributed throughout the country but since not many places were visited during the current study, it was not possible to find out if any local names were being used in the outlying areas that were not reached. The city poultry marketers did not have special names either. However, in one study carried out at the Coast Province of Kenya by Njenga, S.M (2005) some names were used to describe the phenotypes of the indigenous chickens at the coast and these are given below.

<u>The indigenous bird types are</u>:

frizzle feathered*
naked neck,*
barred feathered,
mauve feathered,
black feathered
dwarf size birds.*

Note * : Names used by Njenga

<u>Exotic breeds for egg production are:</u>

Shaver Starcross
ISA brown
Ross

<u>And for broiler production bird types are :</u>

Arbor Acres
Hybro
Cobb (United Kingdom)
Hypeco (Holland)

2.1.2 Turkey types

The local turkeys are kept by small scale farmers in the rural areas and they are bronze and buff. The commercial turkeys are white (imported from United Kingdom or USA) and buff (imported from United Kingdom).

2.1.3 Ducks

Locally adapted Muscovy ducks are kept throughout the country in small numbers but they are kept more around the city of Nairobi and along the coast in Mombasa. Exotic breeds of Muscovy ducks are kept in Nairobi and Naivasha for commercial production.

2.1.4 Geese

Geese are kept as ornamental birds, especially in Nairobi and central province.

2.1.5 Ostriches

The ostriches kept in Kenya are local breeds domesticated from the wild. Farmers are licensed by the Kenya Wildlife Services to keep ostriches that are being promoted by the Ministry of Livestock and Fisheries Development as an emerging livestock. They are farmed in Naiad and in the other rift valley districts.

2.1.6 Guinea fowls

Local Kenya guinea fowls are domesticated from the wild and are kept with the permission of the Kenya Wildlife Services. They are of the helmeted type. Some exotic guinea fowls have been imported from France and Sierra Leone in West Africa but only in small numbers and they are restricted to the coast area.

2.1.7 Quails

The people of Western Kenya have been keeping local quails as a local tradition for a long time. The birds are trapped from the wild and kept in the home to breed or consumed directly after trapping. One farmer is keeping Japanese quails in Nairobi and some are also hatched at the coast.

2.1.8 Pigeons

Local Kenya pigeons are kept throughout the country but only in small numbers. Some homing pigeons are to be found in the Nairobi and Mombasa city estates and around Mosques in Nairobi city where they are fed grains daily by volunteers (Fig. 2.1). Individual farmers do keep a few of the pigeons as a hobby.

Fig.2.1. Pigeons eating grains in a parking area in the city of Nairobi.

2.1.9 Peacocks

A peacock and a peahen may be found in the compounds of some of the hotels in esoteric locations in the national parks and in the city of Nairobi suburbs as pets.

2.1.10 Bantams

Two farmers (both located in Nairobi city) keep a breeding flock of Bantams for the annual Agricultural show and to sell to interested persons. The Bantams are usually kept as ornamental birds and not for egg or meat supply to the families.

2.1.11 Indigenous breeding stock

The Ministry of Livestock and Fisheries Development has had an extensive poultry programme in the last thirty years to improve the productivity of the indigenous chickens, study the feed requirements and productivity characteristics of the birds and recently also act as a source of breeding stock for farmers needing to start keeping indigenous chickens. The National Poultry Research Station located at Naivasha is now keeping some breeding stock for the production of indigenous birds for farmers wishing to keep local indigenous chicken as a business venture. In early July when a visit was made, they had a population of 150 breeding stock. The MLFD is now encouraging smallholder farmers to keep poultry as a business and has a pilot project in Makueni District for this purpose.

The National Poultry Research Station at Naivasha has been carrying out research on indigenous chickens for over three decades and maintains a breeding stock of indigenous chicken (Fig. 2.1). They have a modern hatchery with a capacity of 19200 eggs per setting. The station grows pullets and cockerel to 2-4 months of age for farmer associations and individual farmers on order. The birds are also used for on station research.

A B

Fig.2.2. Indigenous breeding stock (two views A and B in the same breeding house) in a Government Research Station at Naivasha.

2.2 Genetic upgrading through cockerel exchange (1976-1994)

The cockerel exchange programme started in 1976 initially in 12 districts and by 1980 another additional 9 districts were included. Later more districts were recruited into the programme and by 1993, there were 26 out of 54 districts involved in the programme. However, the districts have since been increased to 75. A hybrid cock was exchanged for the local cock and then all the local cocks were killed. For the pullet exchange, a farmer was required to keep 10-15 pullets. The total number of farmers recruited into the programme and the total number of birds placed are distributed widely in all the administrative provinces of Kenya (Table 2.1). The programme was terminated in 1994 after a period of 18 years of implementation.

There was a training component in the programme. Whereas more men than women attended the training sessions in the farmers training centers, it was the women who kept and took care of the birds at home with the help of children.

It can be taken that these farmers acted as foci for the spread of the cross-bred chickens with slightly improved production abilities within the districts through sales of their birds to the open markets where other farmers got access to the improved birds and that many would still be keeping indigenous chickens.

Table 2.1: Farms in different districts of Kenya where poultry were placed during the cockerel exchange programme that ended in 1994 and the subsequent genetic dilution using poultry population of year 2004).

WESTERN PROVINCE

District	Breed	Farmers	Pullets	Cockerel	Total birds	2004 bird numbers
Bungoma	RIR	566	292	625	917	701,900
Busia	RIR	299	575	548	1063	292,300
Kakamega	RIR	164	506	270	776	397,574
Vihiga	RIR	26	240	----	240	392,043
TOTAL		1055	1553	1443	**2996**	**1,783,817(0.17%)**

NYANZA PROVINCE

District	Breed	Farmers	Pullets	Cockerel	Total birds	2004 bird numbers
Homa Bay	RIR	99	---	312	312	440,600
Siaya	RIR	200	234	381	615	547,200
Migori	RIR	152	484	276	760	1,650,000
Kisumu	RIR	562	629	629	1258	288,000
Kisii	RIR	344	572	324	986	400,100
TOTAL		1357	1919	1922	**3841**	**1,675,900 (0.23 %)**

RIFT VALLEY PROVINCE

District	Breed	Farmers	Pullets	Cockerel	Total birds	2004 bird numbers
Bomet	RIR	306	281	287	571	318,000
Kericho	RIR	304	235	300	535	521,600
Elgeyo Marakwet	RIR	332	300	300	600	410,900
West Pokot	RIR+Bl Sh	668	321	663	984	453,500
Trans Nzoia	RIR	234	220	245	465	513,000
TOTAL		1845	1357	1195	**3135**	**2,217,000 (0.14%)**

EASTERN PROVINCE

District	Breed	Farmers	Pullets	Cockerel	Total birds	2004 bird numbers
Embu	RIR+Bl Sh	257	303	690	993	83,300
Kitui	RIR	509	736	700	1436	520,700
Meru	RIR	429	410	286	696	434,200
Machakos	RIR	24	303	---	303	936,100
Tharaka Nithi	Bl Sh	489	---	911	911	205,900
Makueni	RIR	243	---	353	353	668,400
TOTAL		1951	1752	2940	**4692**	**2,180,200 (0.22%)**

CENTRAL PROVINCE

District	Breed	Farmers	Pullets	Cockerel	Total birds	**2004 birds numbers**
Kiambu	RIR	754	526	714	1240	189,500
Nyeri	RIR	410	375	1020	1395	300,040
TOTAL		1164	561	1734	**2635**	**489,540(0.54%)**

COAST PROVINCE

District	Breed	Farmers	Pullets	Cockerel	Total birds	**2004 bird numbers**
Kwale	RIR	326	258	310	578	391,500
Lamu	RIR	630	620	655	1331	149,200
Taita Taveta	RIR	881	181	855	1016	293,400
TOTAL		1837	1059	1820	**2925**	**834,100 (0.35%)**
OVER ALL-TOTAL		***9208***	***8200***	***11,654***	***20,224***	***9,180,557(0.22%*)***

Source: Project report, National Poultry Development Programme (Arie Hakkesteegt, 1994). Note: * = Overall genetic dilution of the foreign genes introduced through the exchange programme in the indigenous chickens was 0.22% by year 2004.

Table 2.2 has the summarized data from Table 2.1 which shows that the greatest number of both cockerels and pullets were placed in Eastern, Western, Rift valley and Nyanza provinces in that order. Due to the prolonged exposure of the indigenous chicken to exotic genetic resources, the birds in these areas may have retained some residual blood from the exotic genes. However, the genetic dilution varies from one province to another.

Table 2.2 Summary of the Cockerel – Pullet Exchange placements in farms in different provinces (as of year 1993) and the ranks of genetic dilution as of year 2004 poultry population

Province	Farmers	Pullets	Cockerel	Total	Rank of totals	Genetic Dilution (%)
Nyanza	1055	1553	1443	2996	4	0.23
Western	1357	1919	1922	3841	2	0.17
Rift Valley	1844	1357	1795	3135	3	0.14
Eastern	1951	1751	2940	4692	1	0.22
Central	1164	561	1734	2635	6	0.54
Coast	1837	1059	1820	2925	5	0.35
TOTAL	9208	8200	11,654	20,224		

Source: Project report, National Poultry Development Programme (Arie Hakkesteegt, 1994).

No studies have been carried out to determine the extent and distribution of genetic types in the free range chickens in Kenya. However, when one looks at the birds being brought to the markets, it is fairly clear that there is some of

Rhode Island Red and Sussex blood in many of them but a study is required to determine what genetics comprise the free range indigenous chickens in Kenya and their distribution in the different regions. Studies carried out at the National Poultry Research Station have centered on nutritional requirements, housing and productivity.

2.3 Poultry production statistics

2.3.1 Commercial poultry production

The number of day old chicks produced by the four major commercial hatcheries is shown in Table 2.3 for the year 2004. There were other small capacity hatcheries producing small numbers of day old chicks. However, not all of the chicks produced are sold in the Kenyan markets since 42% of the chicks hatched are exported to the neighbouring countries. The prices of day old chicks and other poultry products is shown in Table 2.4 from which it is seen that only prices for eggs and cockerels remained unchanged for a long time while that for the other products changed markedly over the ten year period of 1997-2007. Tables 2.5 and 2.6 show the estimated production of eggs, meat and the monetary value accruing while Table 2.7 give the projections to year 2010.

Table 2.3 Day old chicks produced by the main hatcheries
(Year 2004 were the latest data available)

Hatchery	Layers	Broilers	TOTAL
Kenchic	2,900,000	10,100,000	13,000,000
Sigma	300,000	700,000	1,000,000
Kenbrid	780,000	312,000	1,092,000
Muguku	384,000	768,000	1,152,000
TOTAL	**4,364,000**	**11,880,000**	**16,244,000**

Source: MLFD annual report, 2004.

Table 2.4 Prices of eggs and poultry at different selling points (In K. shillings; USD 1 = Ksh 65.00)

Items sold	Year of recording		
	1996	1997	2007
Eggs at farm gate(per tray of 30)	140 – 150	150 - 160	150-180
Eggs at retail market (per tray of 30)	180 – 210	180 - 210	210
Mature local cock	200 – 300	250 - 350	600
Mature hybrid cock	300 – 350	300 - 350	700
Pullets (10-12 weeks old)	180 – 200	200 - 250	350
Pullets (at point of lay)	300 – 350	350 - 400	450
Day old layer chicks	59	59 - 65	80
Day old broiler chicks	39	39 - 50	55
Day old cockerels	8	08 - 10	10
Ducks - female	200 – 250	200 - 250	500
Ducks - male	280 – 320	280 - 350	500
Turkey - female	500 – 600	600 - 700	3500
Turkey - male	800 – 900	800-1000	3700

(Source: Ministry of Agriculture and Livestock Development annual report, 1997 together with interviews with stakeholders during the 2007 study).

Table 2.5 Estimated Egg Production (Year 2004)

Type of bird	Population(000's) (Mature Hens)	No of eggs produced(000's)	Estimated value (Ksh;
Indigenous Hens	9,406	564,375	2,821,875,000
Hybrid Layers	2,300	644,000	3,200,000,000
TOTAL	11,706	1,208,375	6,041,875,000

(Source: Ministry of Livestock and Fisheries Development annual report, 2004).

Table 2.6 Chicken meat production for all chicken in Kenya, 2004

Type of Birds	**No Slaughtered**	**Total meat(MTs)**	**Value(Ksh; USD)**
Indigenous	8,600,000	11,180.0	1,310,000,000
Broilers	4,731,399	7,097.1	1,206,506,740
Culled Layers	690,000	897.0	103,500,000
Total (000s)	**14,021,399**	**19,174**	**2,620,006,740**

(Source: Ministry of Livestock and Fisheries Development annual report, 2004).

Table 2.7 Production and demand projections for poultry meat and eggs (2004-2010)

		2004	2005	2006	2007	2008	2009	2010
Poultry Meat (Tonnes)	Production	23,196	23,784	24,371	24,908	25,604	26,244	26,900
	Demand	23,021	23,637	24,252	24,912	25,570	26,209	26,864
	Surplus	175	147	118	76	34	35	36
Eggs (millions)	Production	1,136	1,171	1,205	1,242	1,278	1,315	1,342
	Demand	1,010	1,040	1,070	1,104	1,138	1,171	1,240
	Surplus	126	131	135	138	140	144	152

Source: Ministry of Livestock and Fisheries Development annual report, 2004.

2.4 Chicken feed resources

Poultry feed contributes 60-70 percent of the total production costs and therefore most farmers pay close attention not only to the availability but also to the quality and the proper usage of poultry feeds. Any wastage leads to loss of revenue. Poor quality feeds lead to low growth performance in broilers and poor egg production in layers both leading to marked loss of revenue. There are now very many feed millers producing poultry feeds in Kenya (Table 2.7) and the quality cannot always be guaranteed like it used to be when only four millers were making the feeds and they were always taken to task for the quality of their feeds. However, good quality poultry feed is expensive and in the process of trying to save money some farmers purchase low quality feeds and put additional ingredients at home, for example they add maize or wheat bran, fish and bone meal and additional mineral-vitamin premixes.

Contamination of the feeds with aflatoxin was reported to be a problem. However, there was an efficient test kit and the farmers could access results in a short time. Millers have therefore been careful to avoid using wet grains in the feed manufacture.

Table 2.8 Showing the poultry feed millers in Kenya (year 2004)

Miller	Town	Miller	Town
Wawa Feeds	Maragwa	Unga Feeds	Nairobi, Nakuru, Kisumu
Tigoni Feeds	Limuru	ABC Feeds	Nakuru
Atta Millers	Mombasa	United Millers	Kisumu
Sigma Feeds	Nairobi	Milling Corporation	Nakuru
Care vet	Nairobi	Premium Feeds	Nairobi
Kisumuwalla	Mombasa	Farmers Choice	Nairobi
Muus	Thika	Maragua Feeds	Muranga
Meru co-operative	Meru	Superior Feeds	Nairobi
Arkay Feeds	Eldoret	Mutu Feeds	Thika
Diamond Feeds	Mombasa	TigoniMahiu Feeds	Kiambu
Pembe Feeds	Nairobi	Sangalo Millers	Bungoma
Faida Feeds	Kitale	Agrivet Millers	Eldoret
Will Feeds	Maragua	Kapsoit Millers	Kericho
Lens Feeds	Nakuru	Belfast Millers	Nairobi
Njuca Feeds	Thika	Dandora Millers	Nairobi
Hemco Feeds	Nairobi (Kariobangi)	Finn Feeds	Nairobi
Jubilee Feeds	Thika	Kibos Industries	Mombasa
Farm Feeds	Nairobi (Industrial)	Ruaraka Feeds	Nairobi
Ngecha Feeds	Kikuyu	Tam Feeds	Nairobi
Pwani Feeds	Mombasa	Anifema Feeds	Nakuru
Treasure Feeds	Ruiru	Modern Feeds	Nakuru
Waroro Feeds	Nairobi	Rift Feeds	Nakuru
Champion Feeds	Thika	Equator Feeds	Nakuru
May Feeds	Thika	Midland Millers	Sagana
Lake Feeds	Kisumu	Chania Feeds	Thika
Millenium Feeds	Kisumu		

Source: Ministry of Livestock and Fisheries Development annual report, 2004

Table 2.9 Showing the prices (in K.Shillings) of poultry feeds (2001-2007)

Feed type	**Year**						
	2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Chick/Duck Mash//70kg	1,150	1,150	1,150	1,150	1420	1450	1450
Growers Mash/70kg	840	840	840	840	1050	1080	1080
Growers mash/20kg	280	280	280	280	350	360	360
Layers Mash/70kg	950	950	950	950	1250	1250	1250
Layers mash/20kg	320	320	320	320	420	420	420
Broiler Starter/70kg	1,350	1,350	1,350	1,350	1600	1650	1650
Broiler starter/20kg	450	450	450	450	530	550	550
Broiler Finisher/70kg	1,100	1,100	1,100	1,100	1450	1450	1500
Broiler finisher/20kg	390	390	390	390	510	510	530

Source: Ministry of Livestock and Fisheries Development annual report, 2004 and stakeholder interviews during the 20007 study.

3.0 DISTRIBUTION OF POULTRY POPULATIONS IN THE PROVINCES OF KENYA

3.1. Poultry population in the capital city of Nairobi and its environs

Nairobi city is the final destination for poultry from the rest of the country and hence has the oldest slaughter facilities, particularly for indigenous birds. Nairobi is also the major entry point for poultry coming into the country and as a transit point for poultry destined to the neighbouring countries. Nonetheless, Nairobi has its own poultry population for farmers keeping birds in the urban and peri-urban areas (Table 3.1). It is clearly seen from Table 3.1 that poultry populations declined sharply in year 2006 in all the divisions of Nairobi. This is the period when there was an avian influenza scare in the country which had started in October of 2005 and did not abate until mid 2006. Nonetheless the distribution of poultry remained like in other years with Embakasi and Langata showing the largest numbers of birds. The highest drop was in Kasarani division with a whopping 80% decline. It is noteworthy that the media had splashed news of dead birds found in this division which must have had a direct impact in making the farmers refrain from keeping any poultry during this scare period.

Table 3.1 Population for all poultry by administrative divisions in the city of Nairobi (2001-2006)

Division	**Year**					
	2001	**2002**	**2003**	**2004**	**2005**	**2006**
Kasarani	59,874	132,127	89,223	75,938	721,195	122,475
Dagoretti	16,900	34,770	57,180	56,450	77,286	76,755
Langata	146,180	146,180	388,237	422,871	366,808	129,983
Makadara	7,000	5,665	5,620	9,356	10,360	14,645
Embakasi	89,020	16,824	295,385	416,700	418,750	398,930
Westlands	19,251	24,390	26,096	25,840	25,834	15,085
TOTALS	**338,225**	**359,956**	**861,741**	**1,007,149**	**1,620,233**	**759,417**

Source: Draft Annual Report, Nairobi Province Livestock Division, (personal communication, Nairobi Provincial Livestock Officer, 2007)

Table 3.2 shows that the decline was very drastic for broilers and turkeys and much less for layers. On the other hand, there was a slight increase in the number of indigenous poultry from year 2005 to year 2006. This may be explained in that these birds scavenged for food and were kept in the city homes for home consumption whereas broilers and layers needed expensive commercial feeds to keep them alive and they were kept for commercial purposes and hence marketing became a problem in the face of an avian influenza disease outbreak scare.

Table 3.2 Poultry population in the city of Nairobi by poultry type (Years 2003 – 2006)

	TYPE OF POULTRY						
Year	**Broilers**	**Layers**	**Local chickens**	**Turkeys**	**Geese**	**Ducks***	**TOTAL**
2003	761,510	56,233	31,371	628	467	1,462	861,741
2004	692,730	192,357	117,496	1,401	548	2,617	1,007,149
2005	1,063,200	428,292	117,496	2,478	3,610	5,109	1,620,233
2006	385,560	204,000	157,733	1,890	2,066	6,624	757,873

Source: Draft Annual Report, Nairobi Province Livestock Division, (Personal communication, Nairobi Provincial Livestock Officer, 2007). Note * = The figures for turkeys, geese and ducks are for both local and commercial birds in the city.

There were no imports or transit traffic in the year 2005 of any poultry or poultry products into Kenya. However, in 2006 there was importation of day old chicks, hatching eggs and some live birds (Table 3.3). These activities may have occurred later in the year 2006 after the ebbing of the effects of the avian influenza scare.

Table 3.3 Poultry traffic through the Nairobi International Airport

	Exports				Imports								Transit	
Year	Hatching Eggs	Turkey	Day old Chicks	Parrot	Pelicans	Parrots	Frozen Chicks	Ducklings	Guinea Fowls	Live Birds	Hatching Eggs	Day old Chicks	Hatching Eggs	Day old Chicks
2002	16,776	2	126,750	1	0	11	0	430	0	0	79,560	88,088	127,116	113,712
2003	0	0	54,302	1	1	2	870	Frozen 1,703	20	18	495,080	0	0	232,615
2004	0	0	145,492	4		20	0	0	0	0	5,986,865	116,614	733,000	78,700
2005	0	0	0	0	0	0	0	0	0		0	0	0	0
2006	0	0	47,700	0	0	0	0	0	0	5,374	407,880	78,340	0	11,500

Source: Draft Annual Report, Nairobi Province Livestock Division (personal communication, Nairobi Provincial Livestock Officer, 2007).

Poultry slaughtered in the city of Nairobi that originated from the whole country (Table 3.4) shows that poultry slaughtered declined sharply in the year 2005 except for ducks which increased slightly. The slaughter figures for year 2006 were not yet available at the time of this study.

Table3.4 Yearly distribution of slaughtered broiler chickens and ducks in licensed slaughter facilities in the city of Nairobi (2001-2005)

Name of Slaughter house	Type of poultry and the year data were reported									
	2001		2002		2003		2004		2005	
	Chicken	Ducks	Chicken	Ducks	Chicken	Ducks	Chicken	Ducks	Chicken	Ducks
Rosslyn*	47,452	-	-	-	-	-	-	-	-	-
Ruaraka	-	14,897	-	17,032	-	17,339	-	22,983		25,444
Hurlingham	-	-	12,044	-	17,289	-	25,887	-	26,483	-
Kariokor	12,340	-	23,528	-	27,801	-	27,678	-	12,948	-
Burma	19,972	-	25,657	-	31,913	-	36,699	-	36,878	-
TOTAL	**79,764**	**14,897**	**61,229**	**17,032**	**77,003**	**17,339**	**90,264**	**22,983**	**76,309**	**25,444**

Source: Draft Annual Report, Nairobi Province Livestock Division (Personal communication, Nairobi Provincial Livestock Officer, 2007).

Legend: * = This slaughter house had up until 2002, developed a contract system with Broiler farmers whereby it would provide day old chicks, feeds and veterinary services and then slaughter the birds when they attained the desired weight for spring chicken (500-900gm); grillers(1.2-1.5kg) and capons (1.6-2.2kg). The farm also kept broilers, ducks and turkeys in their own farm. Unfortunately, however, the farm closed business in year 2002 due to unforeseen circumstances that also closed the entire integrated system with the contract farmers.

3.2 Poultry population in administrative provinces of Kenya

3.2.1 Poultry populations in the provinces

Table 3.5 shows the annual total poultry population in Kenya for the years 2001 to 2005 and the projections to the year 2006 (marked by asterisk in the table) for the different types of poultry. Although the there seems to have been a decline in the number of broilers in year 2005, the overall trend shows an increase in the poultry populations over the five year period for both commercial and indigenous poultry. It was not clear from available data what type of poultry in the category, “Others” that made the figures for the year 2002 to be oddly on the high side.

Table 3.5 Estimated poultry population by year and types (2001-2006)

Year	Type of poultry				
	Layers	Broilers	Indigenous	Others	Total
2001	2,505,554	5,278,032	19,640,113	604,755	27,828,454
2002	2,073,706	5,653,537	19,999,693	1,571,980	29,298,916
2003	2,533,837	5,997,381	20,769,685	600,296	29,901,199
2004	2,266,162	4,731,399	21,492,850	700,994	29,191,405
2005	2,661,121	2,486,493	23,891,421	583,818	29,622,853
2006*	3,113,512	2,909,196	27,952,962	683,067	34,307,738

Source: Draft Annual Report, Nairobi Province Livestock Division (Personal communication, Nairobi Provincial Livestock Officer, 2007).
Note * = Figures were estimated from available data.

3.2.2 Poultry populations in the districts

Table 3.6 shows the location of poultry farms in sectors three (3) and four (4) in the various districts comprising the administrative provinces of Kenya. This table illustrates that most smallholder sector 4 farms in Kenya are found in Machakos, Nakuru, Bungoma, Rachuonyo, Makueni, Mwingi, Kilifi and Kitui districts in that decreasing order of numbers. The Arid and Semi Arid Lands districts of Mwingi, Kitui, Machakos, Makueni, Kwale and Kilifi are contiguous and between themselves carry the highest concentration of sector 4 poultry in Kenya. The other areas with large sector 4 farms are Bungoma, in Western Province and Rachuonyo in Nyanza Province.

On the other hand, farmers in Kiambu, Thika, Nairobi, Nakuru, Kisumu and Machakos, in that order, produce broilers in large numbers. In addition, commercial layer farmers are located in Thika, Kiambu, Maragua, Nakuru, Nairobi and Kilifi. All the high concentrations of commercial layer and broiler farmers are located near provincial urban centers and in the peri-urban areas of the city of Nairobi where access to markets is guaranteed.

Table 3.6 . Location of poultry farms by type of birds in sectors 3 and 4 (Refer to Annex 4 for non picture format)

LOCATION OF POULTRY FARMS IN KENYA BY ADMINISTRATIVE DISTRICTS AND PROVINCES

	DISTRICT	LAYERS	BROILERS	INDIGENOUS	OTHERS	TOTAL
RIFT VALLEY PROVINCE	**NAKURU**	711	555	55,487	142	56,895
	KOIBATEK	32	6	10,453	6	10,497
	BARINGO	35	4	22,957	7	23,003
	KEIYO	41	1	13,973	8	14,023
	U/GISHU	154	241	29,953	31	30,379
	T/NZOIA	377	38	34,200	75	34,690
	W/POKOT	18	0	30,233	4	30,255
	LAIKIPIA	85	10	15,233	17	15,345
	SAMBURU	2	0	6,760	0	6,762
	KERICHO	48	14	34,773	10	34,845
	BOMET	27	4	21,200	5	21,236
	NANDI NORTH	61	18	205,333	12	205,424
	NANDI SOUTH	16	14	9,687	3	9,720
	KAJIADO	188	206	11,780	38	12,212
	NAROK	23	2	18,533	5	18,563
	TURKANA	4	5	633	1	643
	MARAKWET	7	3	13,420	1	13,431
	T/MARA	3	0	14,467	1	14,471
	BURET	143	11	10,191	27	10,372
	TOTAL	**1,982**	**1,130**	**374,468**	**392**	**377,952**
COAST PROVINCE	**MALINDI**	75	158	33,820	15	34,068
	TAITA	65	40	19,550	13	19,677
	MOMBASA	267	321	1,967	53	2,607
	LAMU	13	5	9,947	3	9,967
	KWALE	285	131	26,100	57	26,573
	KILIFI	382	370	36,160	72	36,964
	TANARIVER	1	5	3,913		3,918
	TOTAL	**1,066**	**1,029**	**131,467**	**213**	**133,774**
WESTERN PROVINCE	**VIHIGA**	96	20	26,136	20	26,274
	KAKAMEGA	88	30	26,505	18	26,641
	BUNGOMA	167	34	48,793	33	47,028
	BUSIA	37	2	19,487	7	19,533
	TESO	7	0	13,984	1	13,992
	MT ELGON	3	0	8,040	1	8,044
	MALAVA/LUGALI	55	2	24,753	11	24,821
	BUTERE/MUMIA	70	0	9,207	14	9,291
	TOTAL	**525**	**88**	**174,905**	**105**	**175,623**
NYANZA PROVINCE	**KISUMU**	184	458	19,200	37	19,879
	SIAYA	29	2	26,480	6	26,517
	H/BAY	33	0	29,373	7	29,413
	KURIA	29	2	9,133	6	9,170
	MIGORI	152	0	11,000	30	11,182
	KISII	184	0	26,673	39	26,896
	NYAMIRA	105	0	23,099	21	23,225
	RACHUONYO	71	0	46,404	14	46,489
	SUBA	21	0	6,727	4	6,752
	BONDO	26	27	13,047	5	13,105
	NYANDO	120	150	20,400	24	20,694
	GUCHA	118	0	20,540	24	20,682
	TOTAL	**1,078**	**637**	**361,077**	**216**	**363,008**
						-
CENTRAL PROVINCE	**NYERI**	196	45	20,003	39	20,283
	KIRINYAGA	115	32	25,856	23	26,026
	NYANDARUA	109	22	20,867	22	21,020
	MURANGA	184	76	6,867	37	7,164
	MARAGUA	767	40	11,199	153	12,159
	THIKA	2,346	5,184	17,827	469	25,826
	KIAMBU	1,185	5,351	12,633	237	19,406
	TOTAL	**4,902**	**10,749**	**115,251**	**980**	**131,882**
EASTERN PROVINCE	**EMBU**	65	46	5,553	13	5,677
	MBEERE	44	0	11,940	9	11,993
	MERU SOUTH	36	13	4,953	7	5,009
	MERU NORTH	75	0	14,667	15	14,757
	MERU CENTRAL	99	14	9,327	20	9,460
	THARAKA	4	0	13,727	1	13,732
	MACHAKOS	413	484	62,407	83	63,387
	MAKUENI	0	0	44,560	-	44,560
	KITUI	15	0	34,713	3	34,731
	MWINGI	3	1	41,900	1	41,905
	ISIOLO	28	0	2,867	6	2,901
	MARSABIT	1	0	8,667	0	8,668
	MOYALE	0	0	0	0	0
	TOTAL	**782**	**557**	**255,280**	**158**	**256,777**
						0
NORTH EASTERN PROVINCE	**GARISSA**	0	0	2,333	0	2,333
	MANDERA	6	0	3,000	1	3,007
	WAJIR	0	0	1,687	0	1,687
	IJARA	0	0	2,473	0	2,473
	TOTAL	**6**	**0**	**9493**	**1**	9,500
						0
NAIROBI PROVINCE	**NAIROBI**	**962**	**9,464**	**7,833**	**192**	**18,451**
	GRAND TOTALS	***11,297***	***23,654***	***1,420,281***	***2,256***	***1,457,467***

4.0 POULTRY PRODUCTION SYSTEMS IN KENYA:

The FAO/OIE have defined four different sectors to describe poultry production systems worldwide based mainly on the bio-security status in the operations and the type and numbers of poultry kept. In Kenya the bio-security status was used as the main criterion to define the different poultry production systems which are described below.

4.1 SECTOR 1:

4.1.1 Description of one farming system in sector 1

4.1.1.1 Location of the company breeding farms

One poultry company (Kenchic) had operations that qualified it to be classified as a sector one farming system. It has six breeding farms with a total flock capacity of approximately 100,000 birds. The company headquarters is located in Libra house in the industrial area of the city of Nairobi, along the main road to the Jomo Kenyatta International Airport. The main hatchery and one breeding farm are located in Athi River, 40 kilometers from the city of Nairobi. There are six outlying breeding farms located along a 70 kilometer road towards Kajiado Town and they are separated by 10 - 15 kilometers from one another. There is one more hatchery in one of these breeding flocks and another one in Kisumu city 500 kilometers to the west of the city of Nairobi to supply the Western side of Kenya with broilers only. They also have offices in Mombasa, Nakuru, Nyeri and Kisii that ensure farmers get birds as near home as possible. All birds are kept indoors and very stringent bio-security procedures (see Fig.10.1) and good personal hygiene by poultry-personnel are observed at each of the breeder farms as described later. These biosecurity procedures include:

- Separating breeding farms physically by keeping them 10 -15 kilometers apart
- Cleaning and decontamination of all egg trays at the hatchery and once again at the breeding farm gate
- Vehicle decontamination at the farm gates and the hatchery gate
- Shower and change of clothes by all farm workers
- Quick safe disposal of any dead birds
- Written standard operating procedures at the various sites to be followed by workers.

4.1.1.2 Breeding farm flock houses

The flock houses have cement floors and stone walling up to half the height followed by chicken wire to the top of the walls while the roofs are of corrugated iron sheets. The wire netting would not allow birds or rodents to enter the houses. However, since the houses are in the open grasslands, birds may land in the open grounds, particularly if there was any spilled water that formed into pools. In each house there was a shower and changing room. And at the main gate there was a shower and changing room for personnel and a fumigation chamber for egg trays. Only service vehicles are

allowed to enter through the farm gate. All the other vehicles, including those belonging to the senior management are denied entry and are all packed outside the farm gate. A pump at the gate was used to spray disinfectant to the underside and the sides of the vehicle. The driver did the vehicle spraying and dipped his shoes into the disinfectant but it was not possible to establish whether he took any shower or changed clothes as he drove the vehicle into the premises. Nonetheless the very high and stringently strict bio-security procedures were observed in all the operations of the company.

4.1.1.3 Feed resources

The company does not manufacture it own feeds. Instead they contract feed manufacturers to supply feed on a regular basis to all their operations. The feed is made by Unga feed millers and produced on company specifications. It is delivered to the breeding farms and to the contract farm on specific orders. The feed quality is very good. In one farm house at the main hatchery, the feed is delivered in bulk and put into a silo for automatic feeding in a flock house carrying 20,000 birds.

4.1.1.4 Contract farmers

The company has a vertically integrated broiler contract operation with selected farmers who meet the selection criteria. Among the major inclusion criteria considered for recruitment into the contracting system is for the farm to be located within 50 km from the city of Nairobi and to have flock houses that can carry 3,000 birds per house. The farmers may keep as many flocks as they like in multiples of 3,000 birds per house. Thus, flock sizes in the contract farms range from 3000 -12,000 birds per farm.

The contract farmers are notified three weeks in advance of the placement date. They then clean and decontaminate the flock houses and prepare them to receive the day old chicks. The farmers are supplied with feeds, drugs, and veterinary services by a company veterinarian. All the broilers are taken to the slaughter house in one all in- all out operation. The Company processes the birds in their own abattoir, packages and sells the processed birds into the market. The abattoir is located at a place called Tigoni which is far away from any company or contractor chicken flocks and at least 30 kilometers from the laboratory or the head office. The laboratory is located in Westlands, one of the suburbs of the City of Nairobi and is separately located from any of the other company operations. It is used to monitor vaccination efficacy in the flocks, environmental samples from the houses during cleaning and routine disease diagnostic services.

4.1.1.5Technical services to company operations

All technical information is sourced from the company. The company has a diagnostic laboratory. The laboratory personnel take environmental samples from the surfaces of the houses in the breeding farms and the contract farms immediately after the houses are cleaned and later after fumigation has been done to check efficacy of cleaning and decontamination. The whole process of decontamination is repeated in failed houses. Blood samples are taken

weekly from each of the breeding flocks to test for common pathogens and vaccination responses. Government animal health officers have access to each flock to take samples but they also must observe stringent bio-security protocols. Feed microbial analysis is also done at the company laboratory but the feed quality is done at the feed manufacturer's operations and at the Kenya Bureau of Standards for external evaluation.

4.2 SECTOR 2:

This sector was defined to comprise all the other hatchery operations within Kenya where any poultry species are bred and hatched for commercial purposes. In this sector there is awareness and some reasonable level of bio-security is observed in their operations. The sector will comprise the following operations and each is described in full details subsequently in a separate section for each category as given below, namely:

4.2.1. Chicken hatcheries
4.2.2. Turkey hatcheries
4.2.3. Duck hatcheries
4.2.4. Mixed species hatchery (Guinea fowl, ducks, turkeys)
4.2.5. Ostrich hatcheries

4.2.1. Chicken hatchery operations in sector 2:

Each of the chicken hatcheries has between 10,000-12,000 layer breeding flocks and 10,000 to 18,000 broiler breeding flocks per year producing between 300,000 to 800,000 day old layer chicks and 750,000 to 1,200.000 day old broiler chicks per year.

These operations hatch day old layer and broiler chicks and sell to willing buyers on a non- integrated basis. Their hatchery operations have medium scale hygiene procedures. Some of them also keep cattle and sheep in their farm while some (Sigma Supplies) also make feed for sale to the general public and for use by their own flocks.

The names of the hatcheries and where they are located are as shown below:

HATCHERY OPERATION	LOCATION
• Muguku Poultry	– Kikuyu
• Sigma supplies	– Nairobi city
• Kenbrid	– Naivasha
• Western Kenya hatcheries	– Webuye
• Bixa	– North coast Mombasa
• Lake chick hatcheries	– Kisumu city

4.2.1.1 Chicken poultry houses in sector 2

Houses are of the open type with iron sheets making the bottom part of the walls and chicken wire mesh making the top half of the walls and iron sheets roofing. The houses are located close to each other and there are no general shower facilities for the entire farm nor for the respective separate flock houses. Hatchery houses are open to the farm workers though not open to the general public. The hatchery buildings are completely sealed except for the entry doors. They are ventilated artificially through fans. The hatchery houses are close to the main entrance and are not located far and separate like in the other hatchery classified as sector 1. In one hatchery (Muguku poultry) a stone wall perimeter fence surrounded all the flock houses to provide both security and hygiene. Their flock houses were of cement floors. Iron sheets rested on a short stone wall after which there was chicken wire for the rest of the chicken house walling. The roofs were all made of corrugated iron sheets. Table 2.3 shows the production capacities of these hatcheries

4.2.1.2 Waste management in sector 2 operations

Waste from the flock houses and the hatchery is disposed in the farm by burial, burning and selling of manure to willing buyers. The manure is not normally composted before selling. At the Muguku farm, there is grass coverage between houses and the space of land to the fence. Manure may be spread on this grass too. The grass cover plays a very significant role as a dumper for dust that may have gone to the houses. The investigator was informed that the cows present on the farm are there to mow the grass down and that they are not allowed to leave the premises.

4.2.1.3. Marketing in sector 2 operations

Farmers place their orders for day old layer and broiler chicks with the respective hatcheries and later collect the birds on the due dates. When smallholder farmers go to place orders for chicks, they may find a long waiting period and they usually may wait for two to four months before they can get the orders fulfilled. The hatcheries may also sell cockerels to willing buyers. The hatcheries sell un-settable eggs at the hatchery office to willing buyers. They also dispose their culled spent hens at the farms' office by selling single birds at a time to buyers who volunteer to go to the farm office and later to

buyers from the Nairobi city wholesale market dealers when the whole flock is to be disposed off. The manure is sold to ordinary farmers, coffee and flower farmers and at times to dairy cow owners, especially during the dry season. Since the manure is not composted in order to kill any microorganisms before disposal to buyers, in the event of a disease outbreak in the hatchery flocks, the disposed manure would pose a serious bio-security flaw by spreading disease to the farms that purchase the manure.

The marketing of broilers and eggs from the commercial farmers is dealt with in the respective chapters.

4.2.2. Turkey production operations

There is only one commercial Turkey farm in East Africa, the **Nyonjoro Nightingale Farm**. It is located in Naivasha on the slopes of a mountain range. The farm carries between 10,000-25,000 birds three times a year of broiler turkeys hatched from their own hatchery. The breeding stock are usually imported from United Kingdom.

Feeds come from outside the farm and are purchased from Unga Feeds and stored in a warehouse. Water is from a borehole on the farm and is treated before use.

4.2.2.1Turkey houses

The houses are roofed with corrugated iron sheets and the upper walls made of wire netting with the lower part made of iron sheets and cemented floors. There is free flow of air through the houses except during brooding when sacking material is hang over the wire netting to preserve heat. The houses are very close to one another, separated by approximately less than 20 metres. The space between the houses is planted with grass which reduces generation and spread of dust into the houses.

Feeders and drinkers are manually operated. Such equipment from the depopulated houses were still piled outside the empty houses when a visit was made to the enterprise. The equipment are cleaned on site outside the respective houses and disinfected using omnicide, a glutaraldehyde based disinfectant. Veterinary services are provided by an in-house veterinarian on a regular basis.

4.2.2.2 Waste disposal in the turkey farm

Litter is disposed by burial or burning on the farm. Feathers and blood from the slaughter house are composted for six months mixed together with cattle manure and litter and then used as manure on the farm.

4.2.2.3 Marketing turkeys

Birds are slaughtered when they reach either 4 or 11 kg dressed weight after 4 and 5-8 months, respectively according to orders from the processing plants. Ante-mortem and post-mortem inspection is done by qualified personnel. The dressed turkeys are sold on contract basis to Farmers Choice

(80%) and Kenchic (20%) meat processors who then process them further, package and sell the final products to target markets in supermarkets and hotels. Any birds with in between weights other than those mentioned above may be slaughtered but only on order.

4.2.2.4 Bio-security risks at the turkey farm

There is a disinfectant dip at the gate through which vehicles entering the farm would be decontaminated. However, the external body of the vehicles and the drivers would enter the farm without decontamination. In addition, the human traffic did not seem to have facilities to be decontaminated. Houses would be a source of bio-security breach between flock harvesting and decontamination as this did not seem to have been carried out immediately. Utensils and other rearing equipment were kept in the open air outside the turkey houses just as they had been used by birds without being cleaned as seen during the visit to the farm during the study period. Perhaps they were to be sun-heated to kill some microorganisms prior to cleaning. However, if there had been an outbreak of Avian Influenza, litter in the houses and the unwashed equipment kept outside in the open air would spread the disease quickly to neighbouring farms. Since the houses are open to the atmosphere any airborne infectious materials could enter the flocks and infect them. Moreover, the farm houses are surrounded by a forest which is likely to have local birds and may also host migratory birds. If any of these birds were infected then they would carry the disease to the turkey farm houses readily.

It was noted that the solitary location of the farm in the forest on the slopes of a hill was intended to be a good bio-security measure since there would be less human traffic to the farm and the forest would act as a bio-security wall. This would have been the case if each house had been separately surrounded by trees. As it is now, all the houses are in one open space and spread of disease from one house to the other would easily occur.

Slaughtering of turkeys is done on the farm where the waste from the slaughtering process including the feathers are buried. This poses a bio-security risk and potential disease spread from the farm to any other poultry establishment nearby. On the positive side, the farm uses a very effective disinfectant for decontaminating the hatchery and flock house operations and they observe strict vetting of persons entering the farm.

In case of an Avian Influenza outbreak decontamination and disposal of birds by burial or burning can be carried out comfortably on the farm since the farm is large and secluded from other poultry farms.

4.2.2.5 Other livestock on the turkey farm

The farm keeps dairy cattle that were seen grazing in the space between the poultry houses. However we were informed that the whey from the milk is fed to the turkeys for reasons not so clear.

4.2.3 Duck hatchery operations

Ruaraka duck farm has produced ducks for a long time for the market at their Ruaraka duck farm along the Thika road just before the Kamiti roundabout. However, they have since June 2006 relocated to Naivasha and continue to be the only commercial duck farm in the country. The ducks are slaughtered on the farm and the dressed carcasses transported to Nairobi for further processing by a meat processing and packing company. The premises were not visited due to exigencies of time.

4.2.4 Mixed species hatchery

The hatchery is located in north coast of Mombasa and hatches guinea fowls, quails and ducks and grows them to 6-8 weeks old or older depending upon the type of order. They supply guinea fowls to Nairobi. However due to flooding in the coastal area at the time of the study, the premises were not visited.

4.2. 5 Ostrich farming and hatchery operations

Ostrich farming was well developed in the 1970's and 80's where many farmers kept ostriches in many parts of Kenya. The ostriches are domesticated from the wild under license from the Kenya Wildlife Services. Although a list of those licensed to grow ostriches is long (Table 4.1) only one farm was economically viable and is currently in operation at the time of conducting this study. This is the Maasai Ostrich farm in Kajiado. The farm comprises a feed manufacturing facility and storage, a hatchery and different open pens for various ages of the birds. Feed is made at the farm and given to the birds. The birds nest in the open pens as they would in the wild environment. Eggs are collected, placed in the hatchery for incubation and the hatched chicks reared in the farm. Birds are slaughtered on site and any wastes disposed off by burial.

Table 4.1 Farms licensed to raise ostriches

FARM	LOCATION
Ostrich Farming	Naivasha
Ukunda Farm Park	Ukunda
Kedowa Ostrich Farm	Kericho
Maasai Ostrich Farm	Kajiado

The migratory and resident wild birds may land on open spaces in the premises in search of food and water and they could introduce disease in this way. Other bio-security risks would come from external visitors, equipment used and outside visits by workers should they go to infected premises.

4.3 SECTOR 3

This sector comprises small scale production systems with farms keeping layer flocks of 100 – 1,000 layers per farm or 300 – 2,000 broilers per farm for commercial purposes. Most of such farmers are not integrated with any

hatchery operation. Some farmers may keep up to 4,000 layers per farm. The total production for eggs and meat has been described in the production section.

4.3.1 Broiler farms

4.3.1.1 Source of broiler chicks and feeds

These farmers source day old chicks from any hatchery of their choice. They buy feeds from the ordinary feed shop and drugs from the nearest shop selling veterinary drugs and other chemicals used in agriculture such as, fertilizers and pesticides. These shops are called “Agrovet” shops. There are many feed millers so the farmers will not lack feed supply but the quality may vary from one source to another. Sometimes the farmers may add other ingredients into the commercial feeds, for example they add maize or wheat bran and fish meal into broiler feeds ostensibly to quicken the growth. The effect of such additions to the performance of the broilers has not been investigated.

4.3.1.2 Broiler houses

The houses usually have earth floors but half of the walls are wire netting while the bottom half is made of mud walls, wooden planks, iron sheets or stone walling depending on the financial ability of the farmer. Corrugated iron sheets are normally used for the roofing. Wood shavings are used for the deep litter and water is supplied in commercial drinkers or home made drinkers both manually filled with water. Feeders are wooden troughs, plastic or metal commercial feeders placed conveniently in the poultry house.

4.3.1.3 Slaughter and marketing of broilers

All these farmers are independent of any integrated operations and since there is no cooperative for selling either eggs or poultry meat, they are on their own when it comes to marketing of the final products. Slaughtering of broilers is done at home. For farmers in urban and peri-urban areas, a Government meat inspector comes to inspect the carcasses and issues a certificate and a movement permit to facilitate transportation to the markets. Thus for broilers once processed they are packed and transported to the market direct. Some farmers may have deep freezers where they keep the processed birds until they deliver orders to the target market. Some of these farmers with freezers may buy broilers from neighbours and store in freezers until sold. Broilers are always sold dressed whether by the smallholder farmers or the commercial producers but not as live birds. This is perhaps because they would lose weight quickly if not sold within two or three days of getting to the market in which case the seller would be under a big loss. Only spent broiler layers and cocks may be seen being sold alive at the Burma and city market.

The litter, feathers and offals are all disposed in the farm by burial within the farm although some of the farmers may heap the waste material to compost it until it is used in the farm as manure or sold. However, the wood shavings

from broiler operations are not completely decomposed by the time of disposing the birds unlike the case for layers where the litter completely turns into dust. Whether or not a farmer composts the manure depends upon how much the farmer knows regarding personal hygiene and bio-security issues. Houses may or may not be cleaned or disinfected before the next intake depending upon the hygiene awareness of the farmer. At times the cobwebs and dust are brushed off with a broom. Where good hygiene awareness is high, water, detergent and disinfectants are used to clean and decontaminate the poultry house before restocking is done.

4.3.1.4 Biosecurity risks in broiler farms

Houses are open and infection can get into the flocks through wind-borne route. Movement of personnel close to the flock houses is not restricted and poultry workers use home clothes and shoes while in the poultry house. Only in few farms are poultry workers provided with gumboots and overalls if hygiene awareness is high. Movement between farms is not restricted and neighbours usually visit one another even during disease outbreaks to enquire what to do when they experience disease problems, thus spreading disease from one farm to another. There are no footbaths for disinfectants in most farms. Feeding and water equipment and empty feed bags all pose disease risk if they are not decontaminated properly. The poultry manure and slaughter waste are disposed off in the farm and at times the manure is sold out to be used by neighbours as fertilizer. The manure is normally sold out to outside buyers or spread on own farms but not composted within the farm prior to the sales.

4.3.2 Layer farms

4.3.2.1 Source of layer chicks and feeds

The farmers obtain day old layer chicks and feeds from the same sources as the broilers. Some progressive farmers make their own feeds at the farm.

4.3.2.2 Layer flock houses

Commercial layer farmers may also keep broilers but the majority only keep layers. The farms are not integrated with any hatchery and are therefore managed on a freelance basis. They source their day old chicks from any hatchery of their choice and they will look for a market for their eggs. The houses need to accommodate flocks of sizes from 200 to 4000 birds. Those with the higher numbers observe more hygiene measures and may make the poultry houses of timber or stone walls and they are found either in Thika and Kiambu districts or the peri-urban areas of Nairobi city. Most farmers keeping layers have flock sizes of 400-600 birds.

The general structure of the layer houses are the same as for the broilers except that laying boxes are now provided and that there is more space per square foot per bird for the layer houses compared to the broilers houses. The houses usually have earth floors, the bottom half of the walls is made of stone, iron sheets or wooden planks while the top half is wire netting and the

roofs are iron sheets. Some houses have two floors, one ground floor and an upper floor. Where the land size is small the two floor houses maximally use the available space effectively. Drinkers and feeders may be home made for those farmers with small size flocks and are made from cut out 20 liter jerry cans for drinkers and wooden troughs for feeders. Those with larger layer flocks may have commercial plastic drinkers and feeders. All the layer flock houses have wood shavings deep litter beddings. The wood shavings usually decay to powdery manure by the time the layers stop laying and are to be depopulated at the age of 18-24 months.

4.3.2.3 Growing layer birds

Brooding is usually done for up to four weeks and then there is a period when the pullets grow up to five months (24-26 weeks) at which time the first egg drops. At this time the birds which have not grown well are culled away or kept in a separate pen and given additional feed and multivitamins until they start laying. In this regard they will have a well formed comb, which is shiny and red; bright eyes; a good body trunk and a vent size which can accommodate three fingers. These are the signs of a good layer. If the farmer gave good feed to the chickens faithfully according to the recommended protocol, most birds will have attained well formed bodies and only a few will be culled at this time. The vaccinations are also given as recommended by the veterinary department depending upon the disease challenge in the country.

When the egg production drops to below 45 percent the birds are depopulated which may be at between 18-24 months of age. All along though, unproductive birds are culled and removed from the flock.

4.3.2.4 Marketing in layer flocks.

Eggs are collected daily and cumulated to the number of trays that are on order. Freelance farmers, on the other hand, just pack the eggs in tray of 30 eggs per tray and go to the local market and display the eggs waiting for any buyer to come along and purchase. Any eggs that are not purchased and the empty trays are returned home to wait for the next market day.

Disposal of culled birds and spent layers becomes a bio-security risk in that there is no organized market for such birds where farmers with large flocks can sell their birds quickly. Birds are transported live on top of buses or in open pickups modified to carry three layers of birds per pick and, if infected with any viral disease they will be freely shedding virus along the transport route to the city of Nairobi, Kariokor or Burma markets or the municipal chicken markets in each provincial capital city. The litter has now become very good manure and is sold to willing buyers who come to the farm in a lorry or pick up. The farmer may also use some of the manure if the farm is big and there are crops grown on the farm. The entire marketing system is illustrated in Fig.4.5.

4.3.2.5 Biosecurity risks in layer farms

Improper cleaning and decontamination of houses and the social-cultural behaviour of farmers of showing off their well kept flocks expose the birds to potential infection. Poor personal hygiene particularly lack of regular washing of hands, the wearing of home clothes in the poultry house, not wearing gum boots and not wearing head covers leads to potential entry of disease in the flocks. There are no footbaths in most of these farms. Disposal of litter in the farm and selling litter to neighbors or to far off farmers creates another bio-security risk where disease can be readily spread the litter is not composted before disposal

During marketing of eggs, the eggs are packed thirty in a tray. The trays are then stacked one on top of the other and transported by bicycle, personal vehicles or the public transport to the nearest local market where they are displayed in the open market just like any other commodity for sale. Farmers who are able to secure contacts to supply restaurant and hotels may take eggs directly to the places without going to the local market. Any eggs that are not bought are returned home and taken to the market on the next market day. The empty trays are taken home and re-used. The same vehicle that transported eggs to the market may be used to go to the hatchery to pick day old chicks without any prior cleaning or go and pick chicken feeds from the shopping center. The visits to the markets and to the restaurants are likely to bring back home, disease agents on the farmer's clothing, shoes, egg trays and the vehicle. Trays are not decontaminated before reuse and may directly introduce disease into the poultry flocks. The trays that are retrieved from restaurants by farmers and brought home for re-use may bring disease to the farmer's flocks. Slaughter of spent hens and the disposal of offals are likely to pose bio-security issues as well.

4.4. SECTOR 4

This sector comprises indigenous chicken, ducks and turkeys and other poultry types kept in the rural areas and in the urban informal settlements by smallholder households. The numbers kept in the home for each species vary depending upon the family interests, and the region where the birds are found.

4.4.1 Indigenous chicken

The indigenous chicken are estimated to be 21.0Million of which 50% are assumed to be immature. The hen: cock ratio is 7:1. Indigenous hens produce 60 eggs per year. In addition, 40% of the indigenous birds that are reared each year are slaughtered at an average dressed weight of 1.5kg per bird (MLFD, annual report, 2004).

4.4.1.1 Source of birds and feeds

It is estimated that 75% of the households in Kenya keep indigenous chickens. They obtain the initial breeding hens and cock as gifts from friends or neighbours or they purchase the birds from the local live markets. Thereafter the breeding stock is selected from the growers in the home. The birds scavenge for feed in the home environment and at times they may be given home food left-overs or they are given supplementary feed like maize grains, cassava, sweet potatoes or commercial feed for the very few farmers who can afford this source of feed.

4.4.1.2 Housing in the indigenous poultry farms

In most areas of Kenya, indigenous chickens are kept in a separate house which is located very near the main house for security purposes or in some other communities the chicken are kept in the family house during the night. Where housing is provided, the houses are elevated above the ground and have the floor and walls made of wood planks and roofs are grass thatched. Some more advanced ones may have iron sheets for the roofs. In other places the houses are not elevated and here the floor is earth with mud walls and thatched roofs. Some of the elevated houses are made of intertwined thin sticks for the flooring and walls. They are usually elevated a metre or so above the ground to avoid predators (Fig.4.1). Other chicken houses are made by simply surrounding the lower part of the granary with chicken wire leaving a door for the chicken to enter. Most of the chicken houses described here have small doors and at times only young children may be able to enter through the doors. It will be difficult for the adults to clean the inside of them (Figure 4.1).

A=Wooden sided

B= Horizontal wood planks

C= Twisted twines on the sides

D= Elevated with twisted Twigs on the sides. E=Granary-mud walled sides. F= Granary with wire Netting.

Figure 4.1 (A-F). Illustrating the different types of chicken houses in sector four where indigenous chickens are kept. Notice the various construction materials and the difficulties in cleaning and decontaminating these houses. Disease can easily spread from one bird to another in such houses.

4.4.1.3 Growing indigenous poultry

Once the initial hens and cock are brought home and they reach mature age, estimated by Upton (2004) to be 225 days, fertile eggs are laid by the hens in nests which the owners make in the chicken house or in the family house. They lay up to an average of 20 eggs per clutch. In one year the average production is estimated at 60 eggs per hen (MLFD, 2004) with a hatchability of 90% (Upton, 2004). The hens turn broody and sit on the eggs for a period of 21 days when the eggs hatch. They brood the hatched chicks for four to six weeks and then wean them off. They then resume laying eggs once again. Three to four such cycles may be repeated per hen in one year. The indigenous chickens may usually time the hatching of their chicks to the time when there is abundant scavenging feed resources in the environment. One farmer visited during the study period used the broody hens as an incubator whereby once the hen hatched all the eggs in one clutch, the chicks were taken away and replaced immediately with fresh eggs while the hen was still broody and sitting on the eggs. This way the hen would hatch two to three batches of eggs before she could be allowed to brood the hatched chicks.

4.4.1.4 Marketing of indigenous poultry

Most indigenous chickens are kept for home consumption and for sale (Kimani, 2006). Fifty percent of the eggs produced are eaten or sold (Upton, 2004). The sale of eggs is done at the farm gate or the local market. On the other hand growing pullets and cocks of between four to six months that weigh 1.5kg to 2.0kg are sold at the farm gate or at the local market and subsequently at the primary collection point. The birds are transported to reach the Provincial Municipal sales and licensed slaughter houses as shown for one municipal slaughter house in Thika (Fig. 4.2.) and later reach the Nairobi wholesale city market. Individual birds may be sold here or at retail

satellite chicken and egg kiosks distributed in all city housing estates as seen in Fig.4.3. The whole marketing process of indigenous chickens is shown in Fig. 4.4.

4.4.2 Indigenous turkey and duck flocks

In many homes found in the peri-urban areas of Nairobi City, and in the rural homes of Central, Nyanza, Coast and Eastern there are households with two to six turkeys. A similar number of ducks may be kept also. However, there are more ducks in the informal settlements in the urban areas. Most of the turkeys and ducks are not kept for commercial purposes but rather as hobbies although they may be sold whenever need arises. At times the turkeys and ducks are taken to the Annual Agriculture Shows in the Provincial Headquarters or in the city of Nairobi. The turkeys are kept in mixed flocks with chicken or together with chicken and ducks. It is estimated that 30,000 turkeys were kept annually during the period 2001 to 2006. In the event of any avian influenza outbreaks, such birds would be a very effective H5N1 multiplier system. The turkeys produce four to six poults once or twice a year depending upon the quality of feeds, the presence of a turkey tom and husbandry practices at the farm. Only minimal biosecurity measures are carried out in these farms.

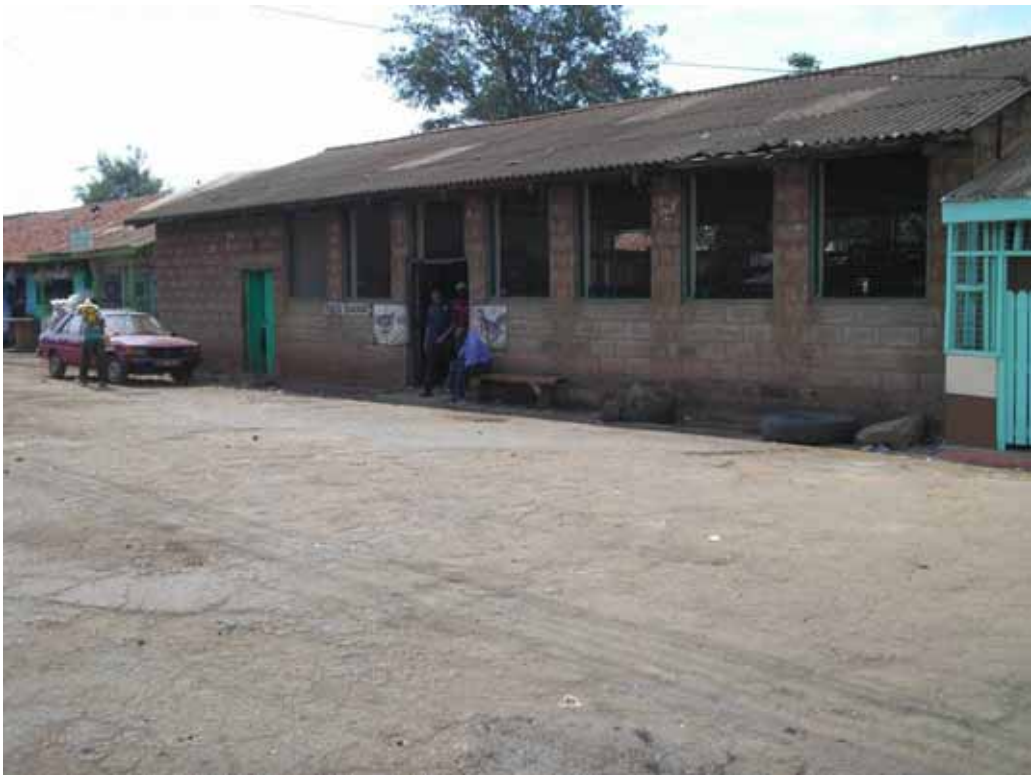


Fig. 4.2 An example of a municipal poultry sales center and slaughter house, Thika.

A B C

Fig. 4.3 Transportation indigenous birds by handcart (A) and bicycle(B); and transport of spent hens by vehicle (C) to retail markets.

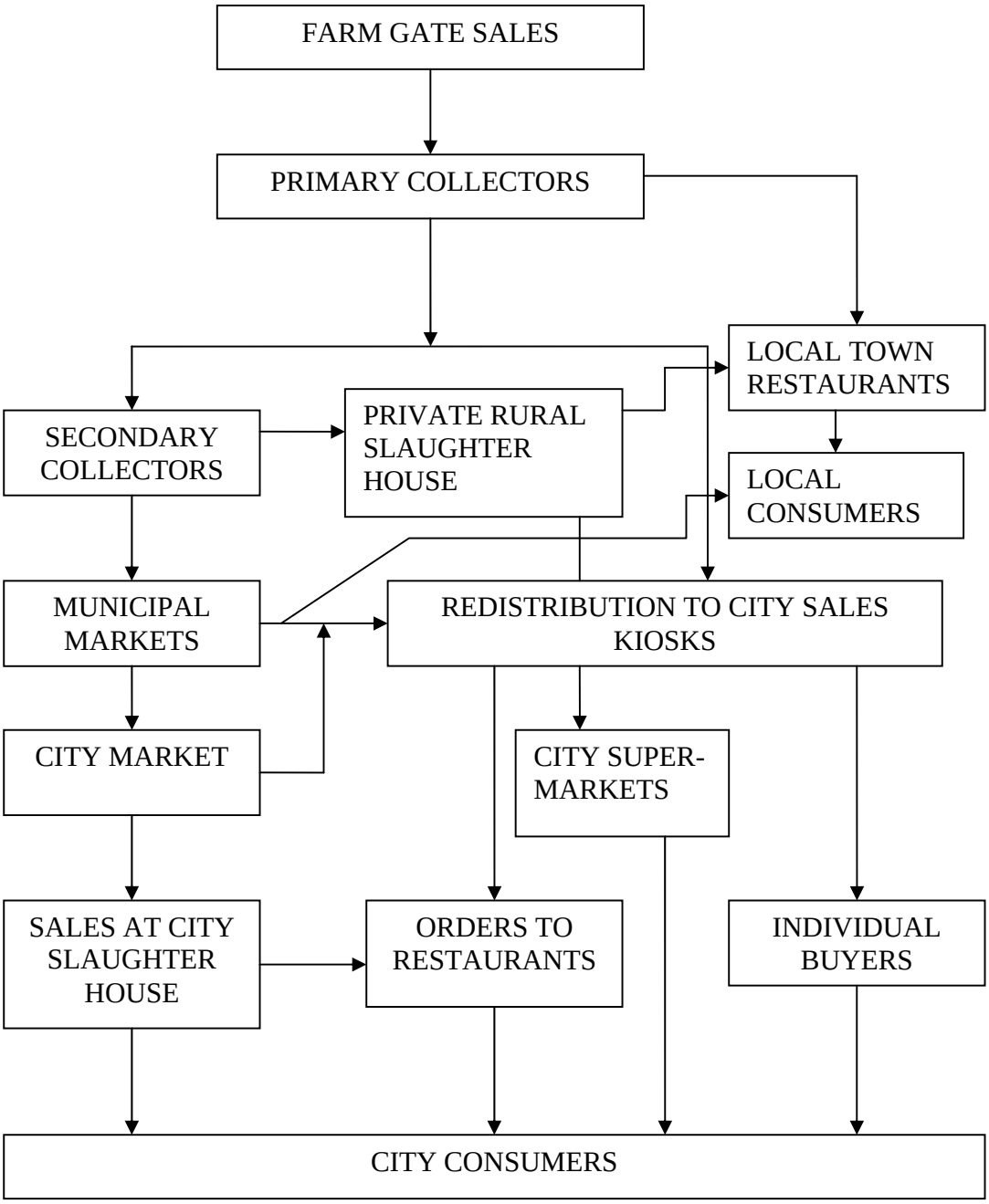


Figure 4.4. Flow of birds in the marketing chain of indigenous chickens.

MARKETING CHAIN FOR COMMERCIAL AND VILLAGE POULTRY PRODUCTS

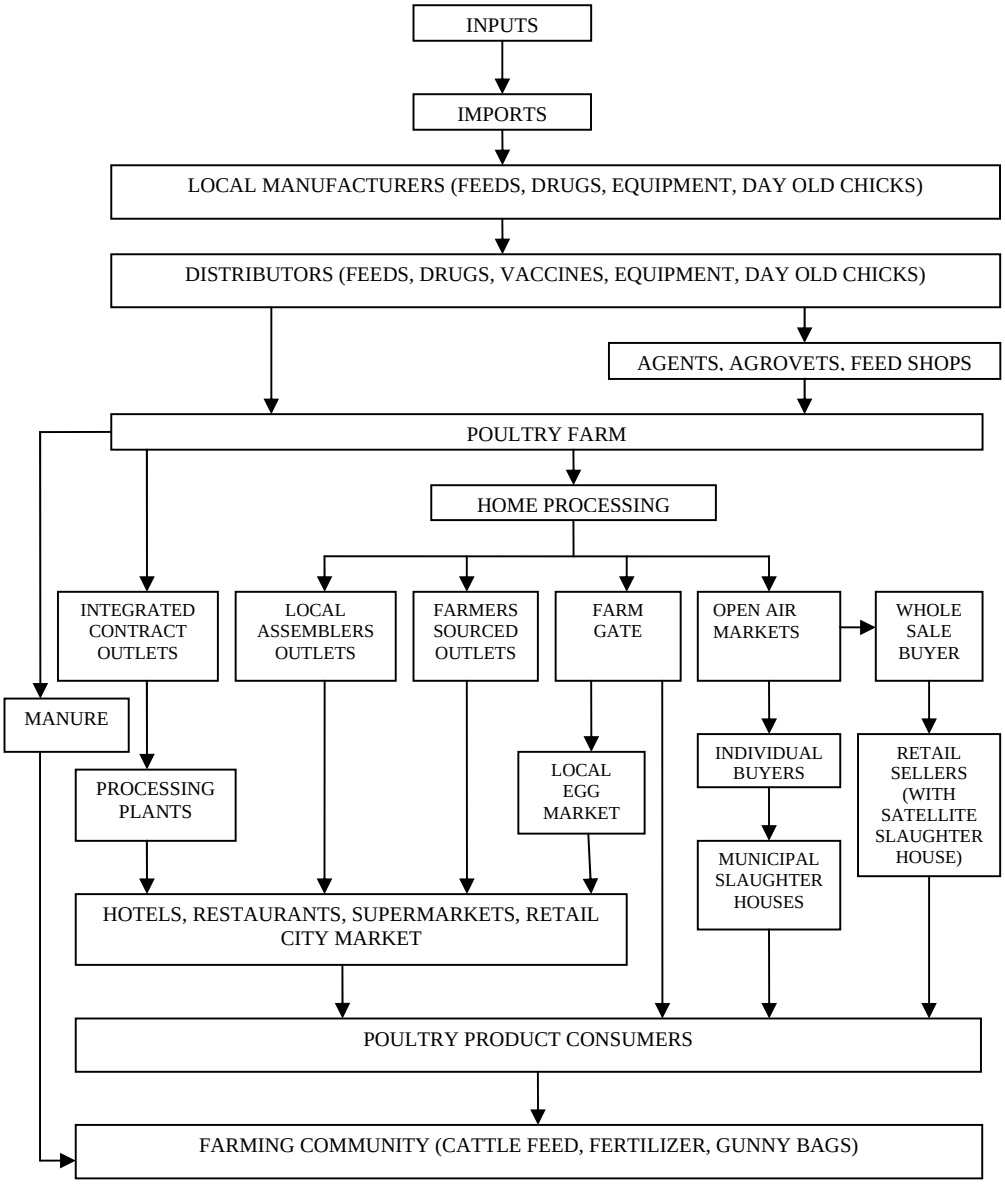


Figure 4.5. Combined marketing chain for commercial and indigenous poultry production systems.

The overall marketing of poultry and their products is summarised in Table 5.1.

Table 5.1 Summary of poultry marketing channels

Market level	Poultry sector			
	Sector 1	Sector 2	Sector 3	Sector 4
Farm gate	-	+[a]	+	+
Village market	-	-	-	+
Local Village market	-	-	-	+
District / Municipal market	-	+	-	+
City market	-	+	+	+
Selected slaughter house	+	-	-[b]	+
Supermarkets	+	+	+	+[c]
Restaurant	+	-	+	+[d]
Franchised outlets	+	-	-	-

Legend: a = Spent breeder flocks
b = Broilers slaughtered at home
c = Makueni Styles slaughter house selling to local and city hotels
d = Local district hotels and restaurants, and some city restaurants.

5. 0 GENDER ISSUES

During the cockerel and pullet exchange programme more men went to the training sessions in the farmer training centres but it is the women who kept the chickens at home assisted by the children. In sector 1, the work at the gates of the breeding farms and the hatcheries and the work in the poultry houses and the hatchery are all assigned to men. However, in sector 2 the work in the chicken hatcheries was done by women. In most households of sector three, it was the women who owned and fed the layer chicken and it was mostly the women who went to the markets to sell eggs. Some men, however, might be seen carrying eggs to the market on bicycles and in some private cars when delivering orders to restaurants. Men also do sell boiled eggs at bus stops but women are also involved.

For broilers, it is the women who keep and feed the birds together with an employed poultry farmhand who is usually a man. When there are no employees, the women feed both broilers and layers while the men are away at work. In smallholder households, ownership of broiler flocks is split half and half between men and women. However, gender issues do not apply when it comes to the decision to sell for the integrated contract farmers' broilers since slaughtering is carried out on a scheduled regular roster drawn by the

contracting hatchery company personnel. However, in most of the non-integrated broiler farmers, while the women grow the birds, it is the men who go to look for the market outlets and also arrange for the slaughtering. Similarly, spent layers are sold by the men.

The ducks and turkeys present a very different gender picture. While it is the women who keep and own ducks and local turkeys, both men and women may sell these birds at the farm gate. However, the subsequent marketing is entirely a men affair. It is the men who sell ducks, geese and turkeys on the roadside open markets and women rarely get involved.

During slaughtering of broilers and ducks and turkeys by commercial processors, men catch the birds from the pen houses and do the stunning, killing, scalding and evisceration while the women do the chilling, portioning and packaging,

In the case of indigenous chicken women do sell both eggs and live chicken at the farm gates to buyers who are usually men. It is men who act as primary and secondary collectors and also sales persons at the municipal slaughter houses. Here only the men are involved in the entire slaughtering process. However, meat inspectors can be either men or women. In the satellite chicken and egg sales kiosks and the main live bird market found in the capital city of Nairobi, most sellers were men. However, a number of women were owners of the satellite kiosks but they would also employ a young man to assist with the slaughtering.

6.0 POULTRY SLAUGHTERING SYSTEMS IN KENYA

6.1 The impact of poultry slaughtering in the community

The slaughtering process is the terminal stage for the marketing of poultry and breaches in bio-security are likely to occur here more often. These breaks in bio-security will need special attention in view of the threat of avian influenza disease outbreak. Farmers and sellers have also become very innovative and it is worth noting what they have introduced in the processes of selling and slaughtering poultry in the entire food chain since there may arise health issues to consider and business concerns to take into account. We shall consider the entire system from those who slaughter one bird to eat at home, to those who slaughter broilers at home for sale to the slaughter of many birds at the abattoirs.

6.2. Home slaughter of indigenous poultry

The home slaughter of one or two chickens for home use is carried out in the home whereby the chicken is killed and immersed in hot water and defeathered. The internal organs and the feathers may be buried or left for consumption by the home dog. It is the boys, or the mother who do the

slaughtering in most cases. This is done for all poultry types whether it is the indigenous birds or broilers or spent hens killed for home consumption. The feathers and the other waste from the slaughtering process are dumped in the home garden or buried posing bio-security flaws that the farmer needs to be aware of and attend to.

6.3. Home slaughter of broilers and spent hens

Broiler farmers with a few birds may slaughter them on their own, whereas when 100 or more birds are involved, the farmer would usually call traders from the city market who come and do the slaughtering. The farmers may also recruit other persons to do the home slaughter. In all these situations, water is used to scald the birds and the defeathering is done at the farm. Feathers, waste water and the offals are disposed at by burial. Spent hens are usually sold to middlemen who may decide to slaughter the birds at the home of the farmers or take the spent hens to the city for sale.
The method of disposal of manure and slaughter wastes, the uncontrolled influx of visitors and traders, farmer's visits to the market for egg sales or to the city market to call in traders to come for the birds and wild birds are potential bio-security flaws here. Presence of rodents due to there being feeds and involvement with non chicken work would bring bio-security flaws.

6.4. Slaughter at the municipal slaughter houses

The process of slaughtering at the municipal is common in all the municipalities in the country. The process is described below as an example.

6.4.1 Thika municipal slaughter house for indigenous chickens

All the birds are kept in cages (Fig. 6.1). Birds are killed, put in a bucket and taken outside where they are dipped in a drum with hot water and turned around for about 5 minutes then they are removed, put in a wheelbarrow and wheel barrowed back into the abattoir and defeathered by hand. Defeathered birds are washed clean in running water and placed on concrete slab tables for evisceration, by cutting one side of the abdomen and extracting all the viscera. The cloacal end is also cut to remove the intestines. The bird is turned to face the operator and the skin is sliced over the crop. The crop and the oesophagus and trachea are eased from their attachments for easy removal. The neck is severed near the head end and the head cut off and kept together with the intestines (Fig. 6.1). The liver and gizzard are washed and stuffed back into the bird or kept separately if the owner does not want them in the carcass. The bird is washed again and water drained by holding the bird in one hand.

A: Birds in cages

B: Birds ready for defeathering

C: Washing deafethered bird.

D: Inspected birds; note the stamp mark

E: Inspected birds packaged in plastic bags

F: Offals awaiting disposal.

Figure 6.1 Stages in the slaughtering of indigenous chickens at a municipal slaughter house, Thika.

The bird is kept on the bench for inspection and stamping with the official inspection stamp and thereafter put in plastic bags for the customer (Fig 6.1 D & E). If the birds are many they are put in a clean plastic sack for transportation to the destination targeted.

6.4.1.1 Biosecurity issues at the municipal slaughter house

a. Slaughter room: Table tops not impervious to water on one side, the other side has enamel tiles on the walls and table tops have solid surface which keeps water away and are easily cleanable. Floor is rough although it is of concrete and wet feathers are strewn all over the floor. Water runs on the floor and out into general municipal drainage. This could be a source of spreading disease to the outside.

b. Feathers: They are strained free from water and put in the municipal dump collection tank where the rest of the market wastes are also put and collected by the municipal council vehicles just like any dirt and deposited where the rest of municipal wastes are dumped. Disease could easily get to spread from the dumpsite to food chain and humans via wild birds and other vermins accessing the dump site.

c. Offals: Legs, heads, intestines and livers are collected, pooled and sold for soup preparation to willing buyers. It would not be possible to trace persons who have bought any of these items in the event of a disease out break. Virus could spread to birds and humans via the sale and consumption of the offals.

d. Cages and the slaughter house room:
    - Dusty
    - Personal effects kept on top shelves and these may carry disease to homes
    - Have padlocks for bird safety which is good.
    - Wild birds would not enter the slaughter slab to spread or pick disease agents

e. Veterinary inspection certification:
    - Process well done and effective.
    - Meat inspector always present and has good rapport with sellers and slaughtering personnel.

f. Personnel:
    - Meat inspector is from the veterinary department
    - Sellers are on individual basis since there is no cooperative. There was no protective gear worn whatsoever like coats, boots or caps.
    - Each owner was slaughtering his own chicken. Hence creating a lot of human traffic movements at the premises.

g. Source of birds: Neighboring districts/divisions of Thika and Murang'a

h. Location of slaughter facility: Next to a beef butchery, a drug store and a trader selling other goods. This is likely to pose several bio-security issues to those nearby.

i. There is no isolation of traffic or adequate sanitary measures for the workers and the entire premises which would occasion flaws in bio-security.

6.4.1.2 Recommendations:

1. Provide slaughter house workers with protective gear. Provide special passes to control the people allowed to enter into the slaughtering premises and recover the costs from the proceeds per bird.
2. Make floor of solid surface washable and drainable. Feathers be collected more often and create a conveyor process. The floor and the table tops are to be disinfected appropriately.
3. Clean and disinfect cages more often.
    - Take away chicken waste more often
    - Remove personal effects to a separate place in the slaughter slab.
4. Paint the inside of the building with water resistant paint so it is washable.
5. Scalding be done in better facilities
6. Disinfect the floor at the end of each day and all the equipment used for slaughtering.
7. Dispose feathers after decontamination or take them to a separate location where they can be composted effectively in a controlled manner away from the other municipal waste.
8. May be the practice used at the slaughter house to dispose feathers whereby all the feathers for the day were mixed with the general municipal waste in the dump tank might have been supplying the required microbes to decompose the feathers. However, it is not done in a controlled manner and the infected wastes would be a good source to spread disease from.

6.4.2 Slaughtering at the rural indigenous chicken Makueni Styles slaughter house

6.4.2.1 Sourcing of birds

In order to encourage rural households to improve their livelihoods, local poultry producers' association were formed in village settings in Makueni District. Two slaughter houses were then established as private sector linkage to assist the association as a poultry marketing outlet. One is located at Makueni, the **Makueni Styles slaughter house (K) Limited** and the other at Sultan Hamud, the **Farm to Plate (K) Limited Slaughter House**. The Makueni slaughter house is described here and it is located on a plot all on its own away from all other buildings. Makueni Styles slaughter house has a well established marketing system where they regularly purchase birds from farmers each day through their appropriate agents who buy birds from collectors at local markets on a fixed schedule (Table 6.1).

Table 6.1 Weekly schedule of chicken purchasing for Makueni Styles (K) Ltd

Day	Local Township Market	No. of Agents	Expected Avg. No. of birds	Day birds arrived at slaughter house	Remarks
Saturday	Kalawa	4	100	Monday	Transport problem
Monday	Kilala	3	80	Monday	Competition from Nairobi buyers
Tuesday	Kathonzweni	3	150	Tuesday	
Wednesday	Mbumbuni	1	70	Wednesday	Competition from Nairobi buyers
Thursday	Kathiani	1	100	Thursday	
”	Nthungu	1	80	Friday	
Friday	Mavindini	4	150	Saturday	Birds stay overnight due to transport problems
”	Wote	2	100	”	Competition from Nairobi buyers
Sunday	Mukuyuni	1	60	Sunday	
		20	**890**		

Due to transport problems some birds stay overnight or for two days before they are delivered to the slaughter house depending on the township. The collector agent is paid cash per kilogram live weight. The birds are inspected ante-mortem upon arrival at the slaughter house (Fig 6.1). Any sick bird is rejected. The birds are kept in the preliminary holding house and later transferred to the smaller holding house adjacent to the slaughter room.

6.4.2.2 The slaughtering process

Birds are taken from the ante-mortem inspection room and hang upside down in a bucket funnel (Figure 6.1) where the necks are severed and the blood let to drain through to the outside. A bucket is used to collect all the blood for the entire slaughtered batch. The blood is then dried, heated and the powder mixed to make home made chicken feed. Birds are dry-plucked to remove all the feathers. The gut system is teased cut nicely and from the neck tissues and cut at the cloacae and then gently removed without spilling any intestinal contents on to the carcass. The inside of the carcass is cleared with a cloth dipped in warm water and the excess squeezed out. The carcasses are then inspected and a permit issued for the transportation to the market.

A=Outside of the slaughter house

B=Blood draining inverted buckets

C = Benches, buckets and floor
After chicken slaughtering.

D = Pit for burning feathers

Fig. 6.1 Showing the outside of the slaughter house(A); the bucket drain funnels before birds are put inside and after cleaning(B); the bucket funnels during slaughter (C); and the disposal of feathers by burning in a pit (D). Note that there is no water used during the slaughtering since the defeathering is by dry plucking. However, the premises is cleaned very thoroughly with water following slaughter. Carcasses are packed in polythene bags and transported to a deep freezer located in a shop 500 metres away in down town Makueni. Table 6.2 shows the actual birds recorded on a typical day while table 6.3 shows the output from the slaughter house since inception.

Table 6.2: Sample of actual chicken purchased and respective weight on a typical day

Date	Local Township	No. of Chicken per batch	Total Weight (Kg)
10/7/07	Kalawa	14	25
“	“	59	99
9/7/07	Kalawa	24	43
	“	21	37
	“	13	25
	“	3	8.3
	“	8	11
	“	5	11.5
	Mavindini	33	51
	Wote	4	5.5

Table 6.3. Sale of processed and live birds by month for Makueni Styles Slaughter House since inception in June 2006

Period of Operation		**Chicken Sold Out**		**Remarks**
Year	**Month**	**Processed Birds**	**Live Birds**	
2006	June	25	70	First month of operations
	July	281	400	
	August	853	206	
	September	30	150	
	October	434	950	
	November	40	630	
	December	258	0	Local demand too high so no selling outside Makueni
2007	January	229	400	
	February	0	165	
	March	280	259	
	April	170	552	
	May	90	800	

6.4.2.3 Waste disposal at the Makueni slaughter house

All the feathers are collected and burned in a concrete pit on one corner of the plot. The floor and slaughtering equipment are washed and the water directed through cemented open channels to two soak pits which are filled alternately. Once full an exhauster drains the waste and disposes just like any other liquid municipal waste. We were not made aware how and where this municipal waste is disposed. The internal organs and the heads and shanks are put in a digester disposal pit.

6.4.2.4 Biosecurity risks at the Makueni slaughter house

Possibility of disease spread starts when the birds are collected at the local markets. Transport to the slaughter house is by bicycle or small buses. No birds are transported by hand to the slaughter house but by bicycle or public transport. The overnight stay at the collection markets creates a focus where disease organisms can accumulate and clean birds become infected. The holding house at the slaughter house is easy to clean and disinfected. However, if there were H5N1 avian influenza infected birds, the attendants would be exposed to a very high concentration of viruses in the droplets and aerosols generated by the birds in the slaughter house holding house. While we stood at one of the open windows one could feel the chicken dust plumes flowing from the inside the house. The exposure would be heavy for the period inside. In addition, the dry plucking method generates a lot of dry feathers falling all over the floor (Figure 6.1.) and these feathers would be a good formite source for human infection during the cleaning process. Nonetheless, the slaughter house cleaning seemed to be very thoroughly and effectively done. The workers had good gumboots and overalls, all very clean.

Water is hauled into the slaughter house compound by a water tanker and pumped into a reservoir. The water is used only to clean the slaughter house after the slaughtering is finished.

6.4.3 Satellite "chicken and egg" slaughter facilities in the city of Nairobi

Once the birds get to Nairobi they are collected at the whole sale markets in Kariokor or Barma markets. From here retail traders buy birds for retail sale at their *Chicken and egg* satellite kiosks. These kiosks are licensed to sell indigenous chicken and eggs (Fig 6.2). Bio-security flaws are many here. They do wet slaughtering and have difficulties disposing feather and waste water and offal. At times the offals are sold out for soup. There is neither isolation nor control since the birds are in the open cages and the traders go to the city market on a daily basis to purchase birds and that sanitation and personal hygiene leave a lot to be desired. Buyers move freely close to the kiosk to select the birds of their choice and they would be exposed to disease agents in the event of avian influenza outbreak.

A= Two cocks in an open air market kiosk.

B= Chicken and egg kiosk in the city

C=Traditional baskets used to carry chicken.

D= Two adjacent satellite sales kiosk

E= Mobile chicken kiosk

F= A three layered kiosk

Fig. 6.2. Showing birds in a single kiosk in a vegetable and fruits retail market; a satellite kiosk and adjacent room for slaughter; Birds at the wholesale Barma market; another satellite kiosk; a mobile kiosk; and a well labeled satellite kiosk with three tiers of bird cages, eggs and a slaughter room at the extreme right side.

6.4.4 Slaughter in the local open village collection points

During the collection at the village local markets there may be slaughtering going on. This is dry slaughter and feathers are spread all over the place which would pose several bio-security flaws as seen in fig.6.3.

Fig. 6.3 Local market collection site and dry plucking slaughtering by two attendants. Feathers spread all over the market area and there is no place to dispose the offals properly.

7.0 GOVERNMENT SUPPORT PROGRAMMES FOR THE POULTRY INDUSTRY

(i) The Avian Influenza Preparedness National Task Force funded by the Government of Kenya, USAID, FAO, and DFID.

(ii) National Agricultural Extension Programme (NALEP) funded by the Swedish International Development Agency (SIDA).

(iii) Early Detection, Prevention and Control of Avian Influenza in Kenya funded by DFID

(iv) The Government has since independence considered poultry as an important aspect of farming and essential part of household livelihoods and therefore appointed extension officers to assist farmers in their operations. There is a livestock production officer down to the district and division level.

(v) Strengthening of Agricultural Training Centers (ATCs), formerly the Farmers' Training Centers (FTC) funded by the Government of Kenya.

(vi) The cockerel and pullet exchange programme of the 1970's and 90's used the FTCs to train in poultry farmers. It had been supported by The Netherlands Government and was then referred to as the National Poultry Development Programme (NPDP).

(vii) The Kenya Agricultural Research Institute (KARI) supports research in poultry diseases at Muguga Research Centre. There is extensive research in breeding, productivity, feed requirements, housing and hatchability for indigenous chickens at the Naivasha National Poultry Research Station.

(viii) The Agricultural Sector Programme Support (ASPS) funded by the Danish International Development Agency (DANIDA) has supported a poultry improvement programme in four ASAL districts of Kitui, Kilifi, Kwale and Taita Taveta.The programme has facilitated creation of a very good marketing structure for indigenous poultry including the only two rural slaughter houses in Kenya specifically dealing with indigenous chickens. The activities for one of these slaughter houses (The Makueni Styles Limited slaughter house) are described elsewhere in this report.

(ix) Other nongovernmental organizations support poultry production as part of improving the health of rural communities and alleviating poverty for rural households, e.g. World vision International, CARE International, Oxfarm, to mention just a few.

8.0 ROLE OF POULTRY IN HOUSEHOLD FOOD SECURITY

Agriculture supports 80% of Kenya's population with the sector providing raw materials to the manufacturing sector and ready market for the service sector.

The agriculture sector which is dominated by the smallholder formed 37% of the GDP in the early years of independence but this slowly declined to about 25% by year 2001 where the livestock sector contributes 10% of the total GDP.

Poultry production is a major source of livelihoods for many Kenyans. In a recent study of smallholder families in Kenya farmers ranked poultry keeping as the most important household occupation affecting their livelihoods in several ways (Kimani, et al, 2006.). The poultry eggs and meat were used for home consumption where they contributed much to the nutrition in the family. Income from the sale of eggs and live birds was used to obtain inputs for crops and to purchase replacement livestock as well as animal health products for the other livestock. Income from sale of manure was also put into crops thus adding great value to the whole complement of household food security when poultry eggs and meat are consumed at home, the legume and grain protein sources can be sold to bring in more income into the household.

Chicken are livestock that are easier and cheaper to start rearing than other types of livestock which require a large capital outlay. This is particularly so in the rural areas where chickens scavenge for food during the day and only need some shelter for the night to escape predators. This is therefore a low input high return enterprise for the farmer and anything that would impact adversely on the chickens would immediately and directly affect the livelihoods of the farmer. Thus, any disease outbreak, drought or predators that may reduce the number of chickens in a homestead directly impact food security of the farmer. Therefore, removing poultry from the home livestock creates great vulnerability, and food insecurity for the home and the community.

In the household study carried out by Kimani et al, (2006) farmers in sectors 3 and 4 were asked to give the enterprises that they were engaged in and then rank them according to the economic satisfaction the farmer got from each enterprise. The farmers listed poultry as the most important enterprise, followed by crops, sheep and goats, cattle, employment, pigs, rabbits and bee keeping in that order. Thus, poultry seemed to provide the highest economic satisfaction to the households in all the districts surveyed indicating that poultry played a very significant part in their livelihoods.

Poultry not only play a significant role in food security for farmers and rural communities but also for urban dwellers. Here while some urban dwellers consume the usual poultry cuts, others use the legs, heads and intestines to make the significance of poultry in food security for urban dwellers.

In this regard, an understanding of the structure, production systems and marketing of poultry in Kenya would help planners to assist farmers develop sustainable livelihood options at the farm level and along the food chain all the way up to the final consumer of poultry products. This became evident during the recent avian influenza scare when the supply of poultry into the market declined and also people feared consuming poultry or their products for fear to contract disease. Many families that could afford changed to alternative sources of protein like fish or beef which are very expensive. Those who could not afford had to do without animal protein source in their diets for a period of six to eight months.

9.0 IMPACT OF AVIAN INFLUENZA DISEASE SCARE ON COMMUNITIES AND THE POULTRY INDUSTRY IN KENYA

9.1 General assessment of the effects of recent avian influenza threat in Kenya

In late November, 2005, high mortality was reported in commercial layer birds and wild birds located in different parts of the country. The public announcement through radio and print media report highlighted these outbreaks. This spread fear and panic throughout the country in year 2006 in the months of January to March. These uncomplimentary remarks led to severe drop in demand for poultry meat and eggs, drop in purchase of day old chicks for broiler and commercial layers and boycott of any poultry products from fast food restaurants. The prices of poultry, poultry meats and eggs fell severely. Many homes removed poultry from home menus.

The panic was enhanced by the outbreak of Avian Influenza in Southern Sudan. Ban on imports of poultry and poultry products were imposed. Subsequently a consignment of powdered eggs from China was impounded and refused entry into the country and a consignment of poultry soup from Egypt was also rejected at the port of call in Mombasa.

As a measure to control potential spread of avian influenza, local slaughter of indigenous poultry was encouraged in Makueni District by establishing two local poultry houses to prevent live birds from being transported to the city.

There was severe loss of revenue by the prime day old chicken hatchery who reported a loss of Ksh.40 million over a period of 2 months – November to December 2005 with loss of business orders over the Christmas period when they usually have peak orders. Jobs were lost in poultry related industries.

The veterinary department made frantic efforts to send surveillance missions to the border with Southern Sudan and rapid response teams were sent to the sites reported to have high mortalities of domestic or wild birds. Fortunately, the results from samples taken from all these missions proved negative for Avian Influenza.

The surveillance activities need to be strengthened and laboratory diagnostic capacity for quick detection and confirmation of avian influenza H5NI needs to be developed urgently.

If these reactions arose just from the fear of entry of H5N1 HPAI avian influenza, should the actual disease occur, the damage and impact will be very extensive and many livelihoods will be affected. Fortunes turned positive for the consumption of poultry products when Rift Valley Fever outbreak occurred in Kenya when beef and goat meat were not available and families and restaurant patrons turned to poultry meat as alternatives to red meat.

9.2 Results of an impact assessment study in Kenya for avian influenza

9.2.1 Socio-economic role of indigenous poultry

In a recent survey (Kimani et al., 2006) farmers were asked to state and rank the roles played by poultry in their livelihoods. The results showed sources of income, house consumption and manure for the farm as the most important roles played by poultry. There were also some non-market values (e.g. socio-cultural and medicinal roles) which are difficult to put monetary values on. Such roles may be quite dear to some communities and could make them refuse to volunteer birds for disposal in an avian influenza outbreak.

Thus, reasons for keeping poultry revolved around household food security, income generation, cultural values and provision of manure for the farm. However, regions differed on priorities on why they kept poultry, some (Kakamega) ranked live birds for sale first followed by meat for home consumption, while others (Nairobi, Kiambu, Taita Taveta) did not seem to value poultry as a source of meat, but for revenue generation.

9.2.2 Impact of avian influenza on the farming communities

All sectors of poultry in Kenya were reported to be affected by the avian influenza scare that ran from November 2005 to May 2006. The effects were highest for broiler farmers, followed by layer farmers and indigenous farmers were modestly affected. There were four major areas of impact, namely:

a) Changes in flock sizes leading to reduced value for poultry
b) Forgone or reduced revenue and loss of livelihood due to panic or premature selling.
c) Reduced and forgone revenue or loss of livelihood due to cancellation reduced or postponed booking of day old chicks.
d) Reduced revenue due to product price changes.

These changes are described below as reported by Kimani et al, (2006).

9.2.2.1 Impact due to flock size reduction

Farmers in Kiambu, Mombasa, Nakuru had the most reduction in broilers, attributed to adverse media reports of dead birds in Kasarani, Nakuru and Nairobi. Other areas did not report declines.

Although the data in the tables indicated a slight increase in the indigenous chickens in year 2005 (Table 3.2), a survey carried out in year 2006 (Kimani et al, 2006) showed that in that year, there were decreases in indigenous flock sizes in all the surveyed districts, while most decline for layers was recorded in Taita Taveta, Machakos, Kakamega, Kiambu and Mombasa. It is noted that flock sizes of all types of poultry declined in all surveyed areas only differing by numbers reported, including farmers keeping ducks, Turkey and geese (Kimani et al, 2006).

The reasons farmers gave for the decline for broilers ranged from fear of avian influenza, lack of markets for their products, to low prices of broilers. For layers and indigenous birds decline was attributed to deaths from

disease, fear of avian influenza and sale of live birds. Apparently, for farmers keeping turkeys, geese and ducks, poultry sales was the most reason for decline followed by fear of avian influenza. In one district (Taita Taveta), the birds were consumed at home to reduce the number at risk.

9.2.2.2 Losses due to panic or premature selling

The highest number of farmers who reported panic culling were those with indigenous chickens closely followed by those with layer chickens and the least were farmers keeping turkey, duck and geese. Chicken layers were culled at approximately 5 months earlier than expected cull date leading to loss of production potential of five months. Prices per bird dropped drastically, and the average figures were: Turkeys (Kshs 163), indigenous chickens (Kshs 59) and layers (Kshs 41), respectively.

Layer farmers lost three times the revenue compared to indigenous farmers even without considering the forgone production. Broiler farmers with a guaranteed market experienced decreased slaughter but not complete loss. The losses were experienced by the company that processed and sold finished broiler.

Since farmers faced different losses depending on the prices of products compensation planners should carefully consider these different losses when calculating the compensation values per bird.

9.2.2.3 Loss due to postponement, cancellation or reduced bookings of day old chicks

This loss affected sector one and two mainly since they are the ones owning hatcheries. Figures showed that in all the surveyed areas combined, 72% and 52% of the broiler and layer farmers cancelled or reduced their bookings, respectively. This mainly affected the farmers in areas keeping broiler and layer flocks in Nairobi, Nakuru, Uasin Gishu and Kiambu.

Broiler farmers were more affected than layer farmers since broiler markets are more sensitive and broilers in the farm are consuming feed with no market outlets for mature birds. However, forgone average earnings per bird for broilers was considered to be Kshs 25 per bird while that of a layer was considered to be Kshs 248. Thus when countries make plans for compensation, there is need to take into account differential returns per bird accruing to the farmers if the farmers are going to be persuaded to cooperate fully in the control of avian influenza outbreaks.

9.2.2.4 Impact of legal enforcement activities

The restriction of movement added to the cost of transportation, since traders now had to move to designated slaughter sites or the meat inspector had to be transported to and away from the home slaughter. New levies for transport permits and slaughter and inspection fees were all new costs that added to increase cost of doing business. Due to restriction of importation of eggs from neighbouring countries cost of eggs increased in the Kenyan districts near the

borders. Furthermore, hatchery operators in sector 2 could not access sources of day breeding stock since the countries from which they obtained the chicks previously had been put on the banned imports list list. Thus business operations affected included hatcheries, supermarkets, live poultry markets, restaurants, animal feed manufacturers, Agro-vet shops and egg traders.

9.2.2.5 Loss due to changes in product prices

Market stagnation occurred where demand decreased and finished products had to be held longer than usual. Whenever this occurred, price changes were experienced with the most affected being indigenous chickens followed by broilers. However, those broiler farmers with guaranteed markets through contract farming or reliable outlets in restaurants or institutions did not report price changes. Market stagnation was reported by layer farmers with layer birds as well.

The average price changes reported in the surveyed districts for different poultry and poultry products (Table 9.1) show that different poultry farmers would have disparate price concerns in the face of an outbreak.

Table 9.1 Impact of an avian influenza scare in Kenya on prices (Ksh and USD) of poultry and their products

PRODUCT TYPE	AI EFFECT ON PRICES	
	BEFORE AI SCARE	AFTER AI SCARE
Broilers (Kshs/Kg)	223(USD3.43)	192(USD2.95)
Indigenous eggs (Kshs/Tray)	169(USD2.6)	149(USD2.29)
Commercial eggs (Kshs/Tray)	154(USD2.37)	132(USD2.03)
Indigenous chickens (Kshs/Kg)	198(USD3.05)	144(USD2.22)
Spent Layers (Kshs/Kg)	147(USD2.26)	109(USD1.68)
Turkeys (Kshs/Kg)	512(USD7.88)	375(USD5.77)
Duck	*	*
Geese	*	*

Source: Calculated from figures in Kimani at al, 2006. (* = No report made in these two species).

9.2.2.6 Impact on avian influenza awareness in the general public

The most important impact of the avian influenza threat was on peoples' attitudes to disease in poultry. The general public and those in poultry business industry became aware that an outbreak of avian influenza would cause a devastating effect on the poultry and associated industries that would lead to a significant threat to livelihoods of many people. They also got to know that avian influenza is a real threat to human life. It was also learned that the press badly handled the initial announcements but together with the

electronic media they were later instrumental in creating better public awareness and understanding of the disease in a very commendable manner. The lesson learned here is that the media are key in the management of any avian influenza preparedness or real outbreak situation.

9.3 High risk areas for avian influenza transmission in Kenya

The following areas are considered high risk areas regarding the occurrence of avian influenza outbreaks. Risk factors considered in identifying the high risk areas were as follows:

A= Migratory birds flyways and ports of entry for goods and persons;
B=Wetlands and homing sites for migratory birds
C=High human and poultry population density areas
D=Free range poultry/Commercial poultry;
E=Low hygienic standards
F =Trade (Internal or cross border, import and export)

Table 9.2 Locations of high risk areas for avian influenza transmission in Kenya

	Region on Migratory Birds Flyways	**Population Concentration**		**Hygiene Standards**	**Risk level**	**Special Remarks**
		Human	**Poultry**			
1	North West	Low	Low	Neutral	Low	Region is very arid and populations are sparsely distributed.
2	Western	High	High	Low	High	Culture promotes close contact with chickens
3	Central Rift	High	Medium	High	High	High potential for interaction between migratory & resident wild/domestic birds
4	Nairobi & Central Highlands	High	High	Mixed	High	Dense population with low hygiene in slums & high concentration of commercial poultry farms and open air bird markets
5	Tsavo	Low	Low	Low	Low	High potential for interaction between migratory & resident wild birds
6	Amboseli	Low	Low	Low	Low	Potential for introduction of HPAI from Tanzania
7	Coast	High	Low	High	High	High humidity favours transmission of respiratory infections in humans and animals & open bird markets

Source: Kenya National Avian influenza Task Force Action Plan, 2006

10.0 BIOSECURITY RISKS IN THE DIFFERENT POULTRY SECTORS

10.1 Definition **of biosecurity**

In order to have a common understanding on the issues at hand when dealing with questions of bio-security in the different poultry production systems and also when dealing with the human aspects of the avian influenza outbreaks a discussion on the definition would be a good starting point. **Bio-security** refers to the ***implementation*** of **policies** and **practices** that **prevent** the **introduction** and **spread** of disease.

In Kenya viral, bacterial, fungal and parasitic infectious disease affect poultry in each of the sectors. The major viral diseases in order of importance are: Newcastle disease; infectious bursal disease; fowl pox; Marek's disease; avian leucosis; epidemic tremour, while the bacterial diseases are fowl typhoid, colibacillosis, Salmonellosis; infectious corrhyza and mycoplasmosis are common in all sectors. Coccidiosis is very common in sector 2 and 3 and to some extent in sector 4. When Newcastle disease is eliminated from a flock through vaccination, other diseases seem to appear in the indigenous poultry. Infectious bursal disease prevalence is fairly high in sectors three and 4.

There are three biosecurity principles that are involved in the management and control to prevent the entry of disease into a flock or the spread of disease from infected premises, namely:

- **Isolation** of premises and poultry from sources of infection.
- **Controlling traffic** flow in and out of susceptible areas to limit exposure. This would include fencing, gates, notifying the visitors are not allowed into poultry premises; controlling vehicle traffic into the farm.
- **Sanitation** of equipment and housing and sustaining personal hygiene to destroy disease agents.
- Overall the intention of bio-security measures is to ensure both **bio-exclusion and bio-containment** of the infectious agents to prevent infection of clean flocks and prevent spread of disease from infected premises respectively.

10.2. **Biosecurity in Sector one and two systems**

10.2.1. Hatcheries and farms in sector one

In the one poultry company that was considered to be in sector one, they have a very elaborate biosecurity system at the hatchery. The gates are secured and locked. No vehicles, except those going to deliver eggs or equipment to the hatchery are allowed in. Vehicles entering the premises are disinfected on the outside including the under carriage and the wheels and the tops of the vehicles (Fig.10.1).

Egg trays and their carrying crates are fumigated at the hatchery then re-fumigated at the gate in the breeding farm gate and then at the breeding farm house before the eggs are loaded onto them.

The flaws in bio-security noted were, which included presence of wild birds, earth roads, unrestricted human (worker) movement and high possibilities of re-contamination of egg trays.

10.2.2 Slaughtering process for the contract farmers

Birds from all the contract farms are carried to the same slaughtering plant at Tigoni and hence the transport vehicles could be a source of bio-security breach.

A= Trays on the left and fumigation (arrows) Chamber on the right at the gate

B= undercarriage spray nozzles before the entry gate

C= Quarantine warning at the

D= Delivery lorry being sprayed on right side

E= Vehicle in D above being sprayed on opposite side

F= Hatchery gate locked

Figure 10.1 Showing sector 1 bio-security operations: Under-carriage spray facility (A, B); Quarantine warning sign(C); Vehicle being sprayed and a secured gate (D, E, F) illustrate good isolation, traffic control and sanitation principles of bio-security at the Kenchic main hatchery. Note the fumigation chambers for the trays located at the gate and the under-carriage vehicle spray nozzles just inside the outer gate.

10.3. Bio-security in sector three operations

The houses are usually of mud walls and earth floors in most cases except for the few where poultry floors are cemented. The roofs are iron sheets and these may be decontaminated easily. Sanitation is minimal at the farms. There is free human movement. Egg trays are re-used without disinfection. Mode of transport expose poultry and products to contamination and infection as well as spread of disease in infected. Manure is not composted before using it as fertilizer. Disposal of offals is not hygienically done.

In summary one should look for bio-security flaws in the following areas in sector three:

10.4 Bio-security in sector four operations

In summary there are biosecurity breaches in the following areas of sector four

a) Growing Period – Housing and source of birds
b) Social visits
c) Open compounds – close contact with humans, other birds and wild animals
d) Marketing and transport
e) Slaughter – wet and dry feathers
f) Contacts – wild birds and animals
g) During scavenging the chicken can contract disease anywhere in the farm

11.0 OFFICIAL RESPONSE FOR THE CONTROL OF AVIAN INFLUENZA

(i). In October 2005, the Government of Kenya set up a multi-sectoral National Avian Influenza Task Force to deliberate and advise on the way forward in dealing with the threat of avian influenza. The task force comprises the experts from the animal and human health ministries and all stakeholders in the poultry industry, the National museums of Kenya, the Kenya Wildlife Services, bilateral and multilateral development partners, the media, civil society and the law enforcement departments. It is co-chaired by the Directors of Medical Services and Veterinary Services.

(ii) The National Action Plan:

- Is drawn along the guidelines of FAO and WHO
- Covers both animal and human aspects of prevention and measures to counter the disease should it occur.
- Contains necessary emergency preparedness measures
- Was prepared along activities of the sub-committees
- The strategy takes a 2-pronged approach targeting both animal and human health.
- For animal heath: – prevention, control and eradication, i.e. based on preventing the disease from entering the country; and institution of control and eradication measures should an outbreak occur.
- For Human health: – prevention, control and response, i.e. prevention is the fundamental strategy and if this fails then control and response is adopted

.

(iii) The task force is divided into the following sub-committees:

- Epidemiology and Surveillance (ES)
- Laboratory and Research (LR)
- Infection Prevention and Control (IPC)
- Case Management (CM)
- Information, Education, Communication and Social Mobilisation (IEC)
- Co-ordination & Resource Mobilisation (CRM)

(iv) The various subcommittees have been working in their respective jurisdictions. The Laboratory subcommittee has been dealing with laboratory capacity building and monitoring the processing of samples taken by the surveillance groups. The Epidemiology and surveillance subcommittee has been carrying out both passive and active surveillance from selected risk areas of Kenya.

(v) All surveillance samples taken from dead and healthy birds have so far been negative for H5N1 HPAI from results of local and reference laboratories.

(vi) The FAO and the Government of Kenya are implementing the Early Detection of Avian Influenza project and the project on The Structure and Importance of Commercial and Village Based Poultry in Kenya, both supported by the FAO.

12.0 CONCLUSIONS AND RECOMENDATIONS

The following were the conclusions made from the review:

- All the four poultry sectors were represented in Kenya.
- Poultry feeds were available and the quality is generally good.
- Projected production figures may not have been reached for year 2006 due to the effects of the avian influenza scare that affected the hatcheries breeding programmes.
- Only one farm could be classified into sector one and it had adequate sanitary bio-security measures but it still had some bio-security flaws to attend to.
- There was only one turkey farm and one duck farm in Kenya both placed in sector two.
- Ostriches were farmed as an emerging livestock and only one farm had a big thriving business.
- The different sectors had differing protocols for disease control.
- Bio-security flaws are present in all sectors and different strategies are needed to deal with these flaws in each of the sectors.
- Marketing is not organized into a cooperative which inhibits full access to the poultry markets. Both the marketing and the slaughtering processes have many bio-security flaws which could lead to the spread of avian influenza.
- One slaughterhouse for indigenous chickens was introduced following the avian influenza scare as a means to control the spread of avian influenza through marketing of live birds. By processing birds at the source and selling packaged poultry products in a controlled manner this would reduce the traffic of live birds going to the capital city.
- Training and public education on safe poultry production and bio-security measures is needed to reduce spread of disease in poultry and to reduce potential human exposure to H5N1 HPAI for farmers in sectors three and four.

The following recommendations are made from the observations in the review:

- Improvement in husbandry methods in all sectors is needed so as to produce safe poultry products for human consumption.
- A study on public education and training in safe poultry production and good bio-security at the rural setting is needed and the training needs to be carried out as soon as possible.
- Measures to reduce possible spread of disease through marketing and slaughter me made
- A more detailed study of the marketing and its impact on livelihoods be carried out.
- Sanitation protocols are needed at the slaughtering houses and in sector four operations.
- Compensation proposals should consider the disparate losses likely to be experienced by farmers in the different sectors.
- Comparisons of sector activities and trans-boundary collaboration between countries would add value to any control plans and control activities in anyone country.
- A proper poultry census should be done once every ten years so that planning is not being based on estimates of poultry. This can be coupled to the regular ten-year human census done in the country. Financing of an immediate census in a project would therefore be a very welcome.
- Training in bio-security in sectors three and four be done urgently.

13.0 References

Ahonobadha, Rhonda A. (1979). Effects of simple processing on improving the accessibility and nutrient utilization value of lupins (*Lupinus albus*) in chick starter feeds. MSc Thesis. University of Nairobi

Augusta Njoki Abate, (1979). The value of substituting Finger Millet (*Eleusive coracara*) and Bull rush millet (*Pennisetum typhoides*) for maize in broiler feeds. MSc Thesis. University of Nairobi.

Bebora L. C. (1979). A study of the occurrence of avian Salmonellosis in some farms and a slaughter house in Kenya. MSc Thesis. University of Nairobi.

Bebora, L.C, and Nyaga, P.N. (1989). Antibiotic resistance in *Salmonella gallinarum* isolates recovered from Kenya. Bull. Anim. Hlth. Prod. Afric. Special Issue.115-119.

Bebora**,** L.C., Nyaga, P.N. and Kimoro, C.O. (1998). Comparison of immune responses of two *Salmonella gallinarum* strains viewed as possible vaccines for fowl typhoid in Kenya. Onderspoort Journal of Vet. Res. Vol. 65.67-73.

Bebora, L.C., Mbuthia, P.G., Macharia, J.N., Mwaniki, G., Njagi, L.W. , Nyaga, P.N.,(2005). Appraisal of Village Chicken's Potential in Egg Production. The Kenya Veterinarian Vol. 29: 10-13.

Bizimenyera, Edmund S., (1986). A new approach to hatchery sanitation: Isolation and control of pathogenic bacteria associated with deaths in hatching chicks. MSc Thesis. University of Nairobi.

Bizimenyera, E.S. Nyaga, P.N. and Oloya, J.O. (2001): Multiple bacterial resistance against commonly used disinfectants for bacteria isolated from poultry hatcheries in Kenya. Presented at the Tanzania Veterinary Conference: Arusha, Tanzania .6th - 9th Dec. 2001.

Bizimenyera, E.S, Nyaga, P.N. and Oloya, J.O. (2004): In-vitro disinfectant Sensitivity tests on bacteria isolated from commercial poultry hatcheries in Kenya. Bull. Hlth. Prod. Afri. 52: 271-274.

Carol Cardona, David A. Bunn, Daniel Beltrain – Alcrudo, Walter M. Boyce, David A. Halvorson, Warner, T. Hudson, Christian, Sandrock, Deanna Clifford, Sandy Shanks (2007): Avian Flu School Course Guide, Module 4. The Regents of the University of California, Davis Campus.

Gathumbi, Kinuthia (1993). A survey of mycotoxigenic fungi and mycotoxins in poultry feed. MSc Thesis. University of Nairobi.

Gitao C.G. (1996). The main health problems of poultry in the peri-urban area of Nairobi, Kenya. “Livestock production and disease in the tropics. Livestock production and human welfare.” Proceedings of the 8th International Conference of Institutions of Tropical Medicine, 25th to 29th September, (1995). Berlin, Germany. Deutsche Stifting fur Internationale Entwicklung (DSF), Zentralstelle fur Ernahrung und Landwirtschaft, Feldafing, Germany, 175-179.

Goje, Zakari, (1993). Comparative pathogenesis and pathology of *Aspergillus fumigatus* In domestic chicken and the wild bird Kori bastard. MSc Thesis.University of Nairobi.

Kabuage, Lucy W., (1988). Effect of dietary treatment on body fat level in broiler chicken. MSc Thesis.University of Nairobi.

Kabuage, Lucy W., (1996). Nutritive evaluation of grain amaranth (*Amaranthus* spp.) in broiler chicken diets. PhD Thesis. University of Nairobi.

Kahiri, George K., (1991). Cotton seed cake for broiler chicken. MSc Thesis. University of Nairobi.

Kailikia, P. W. (1982). The structure and conduct of animal feeds industry in Kenya: The case of the situation in Kiambu District and Nairobi Province. MSc Thesis. University of Nairobi

Kaminjolo, J.S., Wamukoya, J.P.O. and Nyaga P.N (1977): A preliminary report on the occurrence of a disease in broilers in Kenya. Bull. Anim. Hlth. Prod. Afri. Vol. 25, 1977: 431-434.

Kantengwa, Juliana M., (1990). Bacteriological quality of drinking water for poultry in some poultry farms in Kenya. MSc Thesis. University of Nairobi.

Karanja, Margaret W., (1998). Isolation characteristic and pathogenicity testing of *Escherichia coli* occurring in poultry in some parts of Kenya. MSc Thesis. University of Nairobi.

Kasiti, J.L. (2000). Isolation of avian paramyxoviruses from village chickens and wild birds in Kenya. MSc Thesis, University of Nairobi.

Kanyongo, S.B. (1996). Poultry waste as means of improving the utilization of Fibrous agriculture by products. PhD Thesis. University of Nairobi. Posthumous award.

Kimani, T., Obwayo, N., Muthui, L. and Wahome, W. (2006): Avian Flu

Threat: Socio-economic assessment of the impacts on the poultry-related livelihoods in selected districts in Kenya. A draft report of the Pan African Programme for the Control of Epizootic Diseases (PACE).

King'ori, A.M., (2004). The protein and energy requirements of indigenous chickens (*Gallus domesticus*) of Kenya. PhD Thesis. Egerton University.

King'ori, A.M., Tuitoek, J.K., Muiruri, H.K. and Wachira, A.M. Effect of protein supplementation on the performance of growing scavenging indigenous chickens.Manuscript in Press. The South African Journal of Animal Science.

King'ori, A.M., Tuitoek, J.K., Muiruri, H.K. and Wachira, A.M (2007). Influence of dietary protein Level on egg production, hatchability and post hatch offspring performance of indigenous chicken. Manuscript in Press. The South African Journal of Animal Science.

King'ori, A.M., Tuitoek, J.K., Muiruri, H.K. and Wachira, A.M. Protein requirements of growing indigenous chickens during the 14-21 weeks growing period. The South African Journal of Animal Science Vol. 33:78-81.

Maiga, Gilbert (1992). The role of myofibrillar ATPase and thyroid hormones in the development of thermoregulation in the domestic fowl (*Gallus domesticus*). MSc Thesis. University of Nairobi

Maina, Jane N. A study of prevalence, bacterial and management factors associated with mortality in the young domestic broiler chicken up to one month old in Central Province Kenya. MSc Thesis. University of Nairobi.

Martin Upton, (2000). The Livestock Revolution – Implications for Smallholder Agriculture: A Case of milk and Poultry Production in Kenya. FAO Livestock Policy Discussion Paper No. 1.

Mary Mercy W. Munene, (2007). Unpublished Progress Report – Pilot project on Private Sector Partnership in Promotion of Free-Range Poultry Production in Makueni. Agricultural Business Development pilot project, Makueni District ABD Coordinator, report, June 2007. Government of Kenya Danish Government collaborative project, on Agricultural Sector Programme Support.

Mbugua, J.K., (1995). The effects of sorghum type and inclusion level, protein level, and pelleting, on the feeding value of sorghum-based broiler chicken rations. MSc Thesis. Egerton University.

Mbuthia, P.G. (2004). *Pasteurella multocida* in indigenous chickens and ducks in Kenya: A study of carrier status, susceptibility, molecular diagnosis and pathogenesis.
PhD Thesis. University of Nairobi.

Mbuthia, P.G., Njagi, L.W, Bebora, L.C., Nyaga, P.N., Mugera, G.M., Kamundia, J., Minga, U. and J.E. Olsen, (2005) Comparison of the carrier status of *Pasteurella multocida* between farm and live market indigeneous birds. The Kenya Veterinarian Vol. (29): 45-47.

Mbuthia, P.G., Njagi, L.W, Bebora, L.C., Nyaga, P.N., Mugera, G.M. , Kamundia, J., Minga, U. and J.E. Olsen, (2005). Comparison between Fluorescent *in situ* hybridization (FISH) and culture method in the detection of *Pasteurella multocida* in organs of indigenous birds, (2005). The Kenya Veterinarian Vol. (29): 53-56.

Mbuthia, P.G., Njagi, L.W, Bebora, L.C., Nyaga, P.N., Mugera, G.M., Kamundia, J., Minga, U. and J.E. Olsen. (2005). Indigenous ducks are better reservoirs of *P. multocida* than indigenous chickens. The Kenya Veterinarian Vol. (29): 104-106.

MALD & KARI (1993). Farming systems in Agro-ecological Zones of Kenya, No1. Embu District, No2.Murang'a District, No3 Kilifi District, No4 Kwale District, No5 Nandi District, No6 Kakamega District. Ministry of Agriculture, Livestock Development and Marketing and the Kenya Agricultural Research Institute Government of Kenya, Nairobi Kenya.

Mugambi, J. M. (1986). Studies on the occurrence and sources of organochlorine pesticide residues in eggs from Embu and Meru Districts. MSc University of Nairobi.

Mugo, James T. (1995). Household food security and nutritional status of tobacco and non-tobacco growers in marginal areas of Embu District. MSc Thesis. University of Nairobi

Muinga, R.W. and Kayongo, S. B., (1987). Quantification of excreta voided by Various chickens. East Africa Agric. For. Jour. 53:71-73.

Muinga, R.W. and Mbugua, P.N., (1991). The feeding value of Cocoyam (*Colocasia esculenta*) meal as a substitute for traditional energy sources in broilers. Bull Anim. Health Prod. Africa: vol. 39:355-360.

Muriithi, Nyawira C. (1979). Factors influencing farm income in marginal areas of the lower cotton zone in Eastern Kenya: Machakos, Kitui, Mbeere and Embu. MSc Thesis. University of Nairobi.

Murotho, Silas M., (1981). The effect of poultry housing systems on egg production and egg quality. MSc Thesis. University of Nairobi..

Musiime, J. T. (1991). The poultry industry in Kenya with particular reference to the Newcastle disease problem. In: Spradbrow, P.B. (ED.), Newcastle disease in village chickens. Control with thermostable oral vaccines. Proceedings, International workshop held in Kuala Lumpur, Malaysia, 6-10 October 1991. Australian Centre for International Agricultural Research (ACIAR); Canberra, 39: 171-173.

Mwangi, Gichiku J., (1991). Effects of biotin supplementation on performance of chicken broiler. MSc Thesis.University of Nairobi.

Ngige, Rahab W., (1981). The feeding of cocoyan (*Colocasis esculenta*) meal as a substitute for traditional energy source in broiler starter diets and estimation of its metabolisable energy value. MSc Thesis. University of Nairobi.

Nambi, Josephine, (1981). Studies on the nutritional evaluation of pigeon peas (*Cajanus cajan*) as a protein supplement in broiler starter feeds. MSc Thesis.University of Nairobi.

Nambi, Josephine, (1987). The nutritional evaluation of dried poultry waste as a feed ingredient for broiler chickens, PhD Thesis. University of Nairobi.

Ndanyi, M.R. 2005. A study to determine causes of mortality and the effect of infectious Bursal disease (IBD) Vaccination in village chickens in Taita Taveta district of Kenya. MSc. Thesis. The Royal Veterinary and Agricultural University, Denmark.

Ndeda J.O., (1980). Economics of egg production in Coast Province, Kenya. MSc Thesis.University of Nairobi.

Ndegwa, J.M., Mead, R., Norrish, P., Kimani, C.W. and Wachira, A.M. (2002). Hatching characteristics of eggs from six reciprocal crosses of indigenous Kenyan chickens artificially incubated. Tropical Agriculture (Trinidad) Vol. 80:1-5.

Ndegwa, J.M., Mead, R., Norrish, P., Kimani, C.W. and Wachira, A.M. (2001). The performance of indigenous Kenyan chicken fed diets containing different protein levels during rearing.Trop.Animal Health Prod. 33: 441-448.

Ndegwa, J.M., Norrish, P., Mead, R., Kimani, C.W., and Wachira, A.M., (2000). A Research Process and Methodology Focusing on Indigenous Kenya Chicken. Proc. 21st World Poultry Cong.Montreal, pp 3-12.

Ngigi M.W. (1988). Structure, Conduct and performance of egg marketing between Kiambu and Nairobi. MSc Thesis. University of Nairobi.

Nigel Horrox, (2007). Do we take biosecurity seriously? International hatchery Practice, Vol.21(5): 20-23, Positive Action Publications.

Njagi, L.W. (2003). Carrier status, antibiotic sensitivity and disinfectant sensitivity patterns of Listeria monocytogenes and other aerobic bacteria in scavenging chickens and ducks. MSc. Thesis. University of Nairobi.

Njagi, L.W., Mbuthia, P.G., Bebora, L.C., Nyaga, P.N., Minga, U. and J.E. Olsen (2004). Carrier status for *Listeria monocytogenes* and other *listeria* species in free range farm and market healthy indigenous chickens and ducks. East African Medical Journal, Vol (81): 529-533.

Njagi, L.W, Mbuthia, P.G., Bebora, L.C., Nyaga, P.N., Minga, U. and J.E. Olsen, (2004). Sensitivity of *Listeria* Species, recovered from indigenous chickens to antibiotics and disinfectants. East African Medical Journal, Vol (81): 534-537.

Njagi, L.W, Mbuthia, P.G., Bebora, L.C., Nyaga, P.N., Minga, U. and J.E. Olsen, (2005). A Study on Effectiveness of Seven Disinfectants against Possible Bacteria Contaminants of Coops and Premises Inhabited by Indigenous Chickens and Ducks. The Kenya Veterinarian. Vol. 29:113-118.

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

Njue, Sophycate Wanjiru (1997). An epidemiological study of ascites in broiler birds in the peri-urban areas of Nairobi, Kenya. MSc Thesis, University Of Nairobi.

Njue, S. W., Kasiti, J.L., Macharia, M.J., Gacheru, S.G. and Mbugua H.C.W. (2002). Health and management improvements of family poultry production in Africa – survey results from Kenya. P.39-45. In characteristics and parameters of family poultry production in Africa. IAEA. Vienna. Austria.

Njue, S.W., Kasiiti, J.L., Macharia, J.M., Gacheru, S.G., Mbugua, H.C.W., (2001). A Survey of Disease Status of Village Chicken in Kenya. Proc. AIMVT conf. Copenhagen. pp 36.

Njue, Sophycate W., (1997). An epidemiological study of Ascites in broiler birds in the peri-urban areas of Nairobi. MSc Thesis. University of Nairobi..

Nkhonjera, Lydia P. (1979). Effects of stocking density and energy level on growth and age of slaughter of broilers. MSc Thesis. University of Nairobi

Nyaga, J.M. (1982). Studies of Newcastle disease and some associated local virus strains in Kenya. MSc Thesis, University of Nairobi.

Nyaga, J.M., Nyaga, P.N. and Kariuki, D.P. (1985). Epidemiology of Newcastle disease in Kenya. Bulletin of Animal Health Production, 33: 249-251.

Nyaga, P.N., Bebora, L.C. and Kaminjolo, J.S. (1985): Occurence of *Shigella dysenteriae* - 3 in the domestic chicken (*Gallus domesticus*) in Kenya. Bull. Anim. Hlth. Prod. Afri.33: 173-174.

Nyaga, P.N. (2007): Avian influenza rapid appraisal and pro-poor livelihoods consultation on lessons learned. Kenya country report. International Livestock Research Institute (ILRI).

Nyaga, P.N., Kaminjolo, J.S., Mutiga, E.R. and L.C. Bebora (1979): Occurrence of atypical fowlpox in poultry farms in Kenya. Avian Dis. Vol. 23 (31): 745-752.

Nyaga, P.N., Njagi, L.W., Bebora, L.C., Mbuthia, P.G., Mlozi, M.R.S., Minga, U.M. and Olsen, J.E, (2002). Productivity of local scavenging ducks under village conditions in Kenya. Paper presented in the Biennial Conference, University of Nairobi, Faculty of Veterinary Medicine.

Nyakalo, Simeon (1991). Effects of feeding poultry waste based diets on milk production from Galla goats. MSc Thesis. University of Nairobi.

Nyange, R. K., Smallholder Poultry production in Kenya (2000). In, "Possibilities for smallholder poultry projects in Eastern and Southern Africa," Proceedings of a workshop, Morogoro, Tanzania, 22-25 May 2000. Ed Gorm Pedersen, Anders Permin and Uswege M. Minga: Pg 31

Odweso, Florence A., (1993). Grain sorghum as an energy source in broiler chicken diets. MSc Thesis. University of Nairobi.

Okitoi, L.O., Mukisira, E.A., (2001). Improved Management of indigenous Chicken. KARI Technical note series, No.8.

Omija, Benedict, (1991). Determination of oxytetracycline residue levels in eggs and meat of chicken using microbiological assessments. MSc Thesis. University of Nairobi.

Omore, Amos, (2007): Responses to the Threat of Avian Flu in Developing Countries: Preliminary Assessment of Lessons learned on Control and Protecting Livelihoods. Consolidated summary of responses by thematic and national experts to selected questions from an International Food Policy Research Institute(IFPRI)/ International

Livestock Research Institute(ILRI) hosted consultation to identify the *Research Community's Response to Avian Influenza, with Special Reference to the Needs of Developing Countries,* held in Nairobi from 14 -16 June, 2006.

Onchere S.M., (1976). Structure and performance of agricultural product and input markets in the Northern Division, Machakos District. MSc Thesis. University of Nairobi.

Ongiro Orwa, (1979). Marketing of eggs and poultry meat in Mombasa Metropolitan urban area. MSc University of Nairobi.

Owango, Mark O. (1978). The bio-availability of betacarotene in some processed Kenyan legumes to starting chicks. MSc Thesis. University of Nairobi.

Panshin A., Shihmanter,E., WeismanY., Orvell,C., Kydyrmanov, A Sayatov , M Asanov, N., Nyaga, P.N., Kasiiti, J.L., Macharia.M.J., and Lipkind, M (2001): Comparative antigenic characterization of Newcastle disease virus strains isolated in Kenya and Kazakhstan. Comp. Immun.Microbiol.Infect. Dis.24(1) 21-37

Tava Enterprises, (2006). Unpublished final report on, " Initiation of a Poultry Association and Awareness Creation on Benefits of Vaccination at Uvuluni Village, Mbimbini Sub-Location, Kako Location in Makueni District.

Tewoldererham, Berhe (1976). The meat retailing system in Nairobi. MSc Thesis. University of Nairobi.

Turkson, Paa K. (1985). Domestic animal reservoirs of *Campylobactor jejumi*, *Campylobactor coli* and *Yersinia enterocolitica* as possible sources of human infection. MSc Thesis.University of Nairobi.

14.0 ANNEXES

ANNEX 1.0

DESCRIPTIONS OF EACH OF THE FOUR POULTRY SECTORS IDENTIFIED BY FAO/OIE

Sector 1: Large scale commercial system {Raise Commercial Grand Parents and parent stock (Breeder farms) and manufacture poultry feeds}. Size per enterprise can be more than 500,000. Size may however vary depending on the country, industrialized or developing country. In developing countries are usually much less than 500,000.

Management standards and Biosecurity are very high. Intensive system (housed and indoors) and no contact with other domestic or wild animals. May use own commercial feeds. Will have own veterinarian and animal husbandry experts. Source of technical information is from the company and associates. Farm outputs are processed and/or packed for export and for urban markets. Highly dependent on market for inputs, including medicines and vaccines and dependent on good roads usually located near capital and major cities. Owners are wealthy.

Sector 2: Medium scale commercial production system (Raise commercial poultry – layers and/or broilers and may be parent stock as well or only parent stock or commercial poultry). Flock size varies from more than 500,000 in industrialized countries to much less e.g. 5,000 as is the case in Indonesia or even 100 to 2,000 like in Vietnam. Management standards and Bio-security levels are moderate to high. Intensive system of husbandry and hence kept indoors and hence no contact with other domestic and wild animals. Market outs are processed and /or packed for urban and in some cases rural markets. Dependent on market for inputs including medicines and vaccines and depend on good roads. Source of technical information is from sellers of inputs and/or veterinarian. Usually located near capital and major cities. Use commercial feeds. Have own animal husbandry expert and use and pays for veterinary services or have own veterinarian. Owners are wealthy.

Sector 3: Small scale commercial production system (Raise commercial poultry only – layers and/or broilers). Resembles Sector 2 but management standards and bio-security levels are low. Under intensive husbandry system or may have a run. Dependent on market for inputs and dependent on good roads. Contact with other domestic and wild animals does occur. Use commercial feeds. Usually found in the developing countries and owners

have relatively moderate capital. Flock sizes vary from 50 in Vietnam to up to 10,000 in Indonesia. Farms are located in urban, peri-urban and also in rural areas. Market outputs are in form of live birds and sold in urban or even rural areas. Use and pay for veterinary services regularly. Source of medicines and vaccines is the market. Technical information is from sellers of inputs or veterinarian. Owners are of middle income and enterprise may the major source of income and/or supplement income from other sources, usually salaries. Sector 3 may be divided further into two (A and B). Thus: Sector 3A: Small scale commercial production system consisting of chicken layers or broilers, ducks, turkeys, geese or quails. Sector 3B: This refers to Organic farming systems. It is an integrated production system with free ranging animals in large outdoor runs.

Sector 4: Small scale Village or backyard system. Practice free unselected breeding, flocks are multi age and mixed species (other birds or small ruminants and pigs). Flock sizes are small averaging 10 indigenous birds per flock. Management standards and bio-security levels are usually poor. It is an extensive system with no or little restriction of movement and birds are out most of the day but normally kept inside at night. Birds come in contact with other domestic and wild animals all the time. Market outputs are for rural as well as urban markets. There no or low dependence on markets for inputs or on good roads. Are located in many types of places but mainly in rural areas, but also in peri-urban and urban areas. Usually do not use animal husbandry and veterinary services. May use Government veterinary and other extension services if available. Predominantly found in rural areas. Are free ranging with little supplementary feeding. In some rare cases, e.g. Egypt, may be confined and fed commercial feeds. Are managed and in many cases owned by women and children. The income of such households is normally low and food security varies from adequate to poor.

Sector 4 may be divided further into two, thus:
Sector 4 A: Is a mixed farming system and includes crop production.
Raise indigenous local birds for meat production usually and not for eggs.
Sector 4B: Raise improved breeds or crosses. Have more improved management. Use animal husbandry and veterinary services on a regular or irregular basis and may vaccinate and treat their flocks. This is the case in the backyard poultry practices in Egypt.

ANNEX 2.

TERMS OF REFERENCE

Job description

Under the technical supervision of the Chief of the FAO Animal Production Service (AGAP) and the operational supervision of TCEO as well as close collaboration with the Regional ECTAD Coordinator, the national consultant will prepare a desk review of the poultry sector in Kenya. This review will be used for further investigations on the epidemiology of Avian Influenza and/or other poultry diseases and/or socio-economic impact.

Based on statistical and available data in the country, reports, literature information and, if required interviews with key stakeholders, the report will provide a 5-year overview of developments in the poultry sector, including a review of the different poultry production systems, evolving marketing chains, the role of poultry on rural livelihoods and household food security, and policy/economic factors which have contributed to changes in the sector.

The main focus of this review should be on the status and developments during the past five years, historic information should only be included as far as they are required to understand the present situation. The National consultant will, where possible, present the information disaggregated by gender.

Compile all the data that are existing in the country. If some data are not available the consultant will then highlight what are the gaps to be filed in a later stage.The length of the paper should be 4500-5000 words and the content, in agreement with the responsible FAO officers (AGAH/AGAP/AGAL), in a format suitable for publication by FAO. The paper would be provided in electronic format (MS Word).

AGAP/FAO will provide to the National consultants available documents that could assist the compilation like the country reports of the State of the world on Animal Genetic Resources, FAO stats of the country and the poultry sector definition (FAO, 2004).

An International consultant will compile National Poultry reviews into a Regional Poultry Review for East Africa. The International consultant will provide the National Consultant an outline of the national report, this is to facilitate and harmonize the work. The International consultant will be in contact with National Consultants (involved in countries in East Africa)

Working title of the Review Report:

The structure and importance of the commercial and village based poultry industry in Kenya.

Guidelines for the report (based on existing data in the country):

Knowing that partial information will be available in the country the report should include relative information on the following points:

1. Description of poultry numbers, level of production for all relevant poultry species during the past five years. Analysis of the information with respect to numbers and production in the main administrative units (Provinces/Regions) and the various production systems or sectors (according to the FAO classification into the sectors 1-4 see Appendix). This should include detailed information on location and type of production systems, size of operators, types of poultry species. Maps/tables should be provided which easily portray location and size of holdings and regional densities of poultry flocks. If maps are not available, tables will be provided so the maps will be done at a later stage in FAO H.Q. It is important to provide species and numbers by production systems/sectors at level of districts if possible.
2. Information about the numbers of poultry operations in the different sectors. Number of farms or estimates of numbers of families keeping the different poultry species.
3. Description of the main characteristics of the different production systems/sectors with respect to husbandry practices, animal health measures, gender roles and marketing channels. Identify flaws in poultry management and in bio-security for each sector and suggest improvements in view of the AI threat and other diseases.
4. The role that poultry plays in household food security and income should be discussed and income. This should draw from reviews of household expenditure surveys which have been undertaken in the country.
5. Description of Government support programmes for the poultry sector, community based development activities for sectors 3 and 4, and any donor development activities related to poultry.
6. An overview of the marketing structure for poultry over the period should be provided, focusing on the different types of supply chains which have evolved in response to growth in demand. Provide an overview of the market players, the number and location of formal abattoirs, the mechanisms on how poultry is produced and transported in the formal/informal sector. A review of prices developments over the past 5 years should be presented, including monthly retail/wholesale prices over the period.
7. Provide an informal assessment of consumer responses to recent animal disease outbreaks and recent producer responses to animal disease outbreaks.
8. Review and description of official regulations and interventions to control poultry animal health (in particular AI measures) and to support the development of the poultry sector.
9. Preparation of a comprehensive bibliography including all relevant publications and reports that describe the level and type of production and the production systems.
10. Information on the ownership of poultry at household level segregated by gender and by sector.

Duration: Four weeks from the signature of the contract, the final paper has to be finalised before mid-June 2007. The review report to be prepared in the home country

of the consultant but with possibilities to travel to Regions /Provinces if necessary. Before undertaking travels outside place of domicile to undertake FAO consultancy duties, the national consultant shall prepare and submit a travel plan including the purpose of the trip(s) and duration, for clearance before the commencement of mission (s).

Qualifications: Animal Production Sciences or veterinary sciences expert with at least 8 years of field experiences in poultry production (backyard smallholders and commercial), farming systems and marketing and development programmes. The consultant will have to be able to respect working timeframe allocated to the job and the deadlines set.

Place: Kenya the working place of the consultant.

Language : English.

ANNEX 3

PROPOSED DEFINITION OF BACKYARD AND INDIGENOUS POULTRY

Many authors describing poultry farming systems in small numbers in the urban setting and in the rural areas use the terms "Backyard" and "indigenous" interchangeably. This does not clearly bring out the real description of birds that are found in the rural areas nor those kept in the urban areas for hobbies or occasional consumption. It would be useful to separate the two categories since they refer to different types of birds. Confusion arises when indigenous birds are also referred to as backyard chicken. In the rural areas they are not backyard chicken but are the focus and form part of the daily occupation of the farmer. They also roam all over the farm, scavenging for food and in some homesteads the birds may be nesting in the free range environment near the living quarters of the owner.

It is proposed that the term " ***Backyard poultry*** " be used to refer to any poultry, irrespective of the genotype, that are kept in small numbers in an urban or peri-urban built environment for commercial or hobby purposes. The birds could be layers, broilers or indigenous chickens, ducks, turkey, geese, quail or guinea fowls. The birds may be kept in enclosures or in free range but in the night they are housed indoors. Indigenous birds may be kept in a city homestead as backyard poultry, just like any other poultry. Usually the poultry are housed separately and not in the same house as the owner. The number of birds may range from as few as six to as many as 100 or more and the different types of poultry may be kept separately or in mixed flocks. The houses may be made of

On the other hand, it is propose that the term ***"Indigenous poultry"*** be used to refer to chicken, ducks or other types of birds that have been breeding freely in the rural or urban areas and are kept in many household environments and whose genetic source has a high proportion of free range Kenyan chicken blood. They are characterized by scavenging activities, broodiness, varied multi-colouring of plumage and do not possess a complete full set of known typical characteristics of any known poultry pure breed or known commercial hybrid poultry. The term ***" Family poultry "*** can be used interchangeably with
" Indigenous poultry ". The other terms that are more recently used to mean nearly the same are: " ***Village poultry "; " Rural poultry "; " Local poultry " ;*** "***Scavenging poultry";*** and ***"Free Range Scavenging Poultry ".***

In this regard the term **, *" Indigenous chickens "*** has been used to refer to birds in the rural areas in Kenya that fit the above definition. This will include the chickens that may have some blood and traits of pure breed birds originating from the cockerel and pullet exchange programme of the 1970's and 1990's and those birds that may be purely from the local stock and have not had any foreign genes introduced in them. However, the foreign genes may by now have been very highly diluted whenever they were introduced.