HPAI PRO-POOR HPAI RISK REDUCTION

A Collaborative Research Project Funded by:

DFID Department for International Development

Implemented by:

FAO

RVC Royal Veterinary College University of London

IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

Pro-Poor HPAI Risk Reduction Strategies in Nigeria —Background Paper

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Africa/Indonesia Team Working Paper No. 5

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Preface

Since its re-emergence, HPAI H5N1 has attracted considerable public and media attention because the viruses involved have been shown to be capable of producing fatal disease in humans. While there is fear that the virus may mutate into a strain capable of sustained human-to-human transmission, the greatest impact to date has been on the highly diverse poultry industries in affected countries. In response to this, HPAI control measures have so far focused on implementing prevention and eradication measures in poultry populations, with more than 175 million birds culled in Southeast Asia alone.

Until now, significantly less emphasis has been placed on assessing the efficacy of risk reduction measures, including their effects on the livelihoods of smallholder farmers and their families. In order to improve local and global capacity for evidence-based decision making on the control of HPAI (and other diseases with epidemic potential), which inevitably has major social and economic impacts, the UK Department for International Development (DFID) has agreed to fund a collaborative, multidisciplinary HPAI research project for Southeast Asia and Africa.

The specific purpose of the project is to aid decision makers in developing evidence-based, pro-poor HPAI control measures at national and international levels. These control measures should not only be cost-effective and efficient in reducing disease risk, but also protect and enhance livelihoods, particularly those of smallholder producers in developing countries, who are and will remain the majority of livestock producers in these countries for some time to come.

This report is the first step of the project which has compiled and assessed the current state of knowledge of poultry systems and their place in the larger economy of the study country, the current HPAI situation and its evolution, and institutional experiences with its control (or, where it has not taken place, contingency places should it arise). This information has been written by a multidisciplinary national team in the study country highlighting the current knowledge and knowledge gaps related to the interface of poultry, HPAI, and institutional response as a crucial first step to the analytical research outputs to be generated in the course of this project. In the process of writing the background paper a variety of country-specific data and information sources on poultry systems, HPAI, and mitigation/control efforts, including published and grey literature, national statistics, journal articles, and reports from other research efforts that are ongoing in the country have been complied into a data base located at the project web site http://www.hpai-research.net/index.html.

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Disclaimer

Acknowledgements

We acknowledge the valuable contributions of all colleagues who reviewed and made suggestions to the manuscript, and are grateful to DFID for funding this project.

More information

For more information about the project please refer to www.hpai-research.net.

Executive Summary

The objective of this background paper is to document available information on the poultry sector and Highly Pathogenic Avian Influenza (HPAI) in Nigeria. It is hoped that this will help identify the gaps that would help focus the planned study on Pro-Poor HPAI risk reduction strategies for the country. This document contains Nigeria's country vital statistics including aspects of geography, population trends, poverty state and trends and the place of the poultry sector in the national economy. The executive summary has sections on socioeconomics, disease risk, institutional mechanisms, and identified research gaps.

Summary of socioeconomic findings

The poultry sub-sector in Nigeria was growing until the appearance of HPAI in 2006. Since then, a significant reduction in the poultry trading activities (imports and exports) could be observed. This has redirected government efforts towards disease surveillance and control. Such effort needs to be strengthened in order to receive collaborations from neighbouring countries where Nigeria imports products of animal origin.

Regardless of the definition of poverty and the data used, there is no doubt that poverty in Nigeria is highly correlated with living in a rural area and tilted towards the north. Most of the poor are found in rural areas and much of the rural population is poor. Keeping poultry is part of life in Nigeria. At national level, commercial and backyard (intensive) poultry production is higher in the south-west than in any other zone. Women in the south and men in the north are mostly responsible for decision making concerning free-range poultry. Children in most cases assist in husbandry. Although the available evidences indicate that household subsistence poultry keeping is more practised in the south, various limitations identified suggest that the number of households engaged in rural free-range poultry keeping could be higher in the north.

The study generally reveals the following data deficiencies:

i. there is no data at national level on the intra-household dynamics of village extensive poultry production;

ii. no panel or cross-sectional data is available on the contribution of poultry to household total income across the six geopolitical zones;

iii. there is lack of gendered data on poultry management and bird ownership among household members;

iv. there is absence of any robust data on the contribution of poultry meat and eggs to household micronutrients consumption levels.

These data are important for the analysis of livelihood impacts of HPAI and its control policies in Nigeria. Even though price of poultry in urban areas is higher than national averages, poultry products are relatively more affordable by urban poor. It was found that seasonality is a significant determinant of poultry price in the country.

Poultry is an important instrument for alleviating problems associated with poverty in Nigeria (food security and malnutrition). It contributes significantly to women's income and helps meet some levels of household protein need. While it is clear that HPAI impact reduction policy in Nigeria should focus on the strategies for increasing productivity and efficiency of small scale poultry production, certain socio-cultural practices require attention.

No study so far in Nigeria has operationalised an asset-based or a sustainable livelihood approach using both quantitative and qualitative techniques in investigating the livelihood impacts of HPAI and its control policies.

Summary of HPAI (disease) risks

A review of the available literature and studies that have been carried out on HPAI showed that the risk of persistence of the disease in Nigeria and evolution to an endemic situation may be considered as high because of lapses in control of movement of poultry and poultry products within the country. In addition, the greatest problem seems to be from very low to sometimes non existence of biosecurity measures designed to exclude and/or contain the disease. Biosecurity levels in the country vary with system of poultry production from very high levels in the large commercial farms to low/non-existent in rural poultry production systems. The major biosecurity measures observed in the medium-to-large scale commercial poultry production system include walling/fencing of poultry farms, provision of farm gates, foot and vehicle dips, use of protective clothing by poultry workers, movement control facilities for poultry waste disposal and hand washing facilities. About 75-90% of the rural poultry production lack the above mentioned biosecurity measures, thus increasing the risk of HPAI spread and sustenance in between rural communities. Provision of customized biosecurity measures that are realistic to rural system of poultry production remains an important area of intervention for HPAI control and containment in Nigeria.

In wetlands, the possibility of domestic poultry, especially local ducks mixing with migrant wild-birds, is high. These wetlands witness a lot of agricultural activities like the growing of millet, rice and sorghum. The abundant post-harvest crop provides abundant food for wild-birds. It is common practice, in such areas, to have local ducks raised near ponds, lakes or pools of water. The above provides ample opportunity for domestic poultry to mix with wild-birds, thus increasing the risk of disease transmission.

Results of some studies that were carried out in Nigeria show it is common practice for mixed species of poultry to be sold, and in many cases, housed together in the same cages in Live-Bird Markets (LBMs). This is a likely source of introduction of HPAI into hitherto uninfected villages since these LBMs are potential sources of replacement stock for village poultry keepers. It is recommended that a study be carried out to help establish, as part of a pro-poor HPAI control programme, the desirability, feasibility and sustainability of a scheme for the production by the rural farmers, individually or as cooperatives, of day-old local/indigenous chicks as replacement stock for the village.

In commercial poultry farms routine animal health practices include vaccinations against various diseases, de-worming of the birds, prophylactic antibiotic treatment and mineral supplementation. Others include administration of Coccidiostat, de-lousing and debeaking. These services are provided by qualified animal health specialists. In rural extensive poultry systems in Nigeria there are little or no animal health interventions provided by qualified veterinarians. To reduce costs it is quite

common for such small scale farms to utilise the services of non-professional animal health service providers. This group of unqualified animal health service providers have been implicated in the spread of HPAI from one location to the other. Alternatively such rural poultry farmers patronize ethno-veterinary medicine. One identifiable gap is the provision of community-based animal health services in the rural extensive poultry production.

Summary of institutional findings

Previous HPAI research that have been carried out in Nigeria include H5N1 surveillance in wild-birds in wetland areas in northern Nigeria; Avian Influenza National Baseline Survey; and studies on the socio-economic impact of HPAI in Nigeria. Others are a nationwide active HPAI disease surveillance; H5N1 virus surveillance in selected LBMs in Nigeria; as well as the role of wild birds, wetlands, domestic ducks and floodplain agriculture in the introduction, spread and persistence of H5N1 virus in northern Nigeria. Attempts at isolation and molecular characterization of H5N1 viruses from poultry in Nigeria have also been made. Results obtained from some of these studies showed that overall the veterinary facilities/poultry farm ratio is poor and that 65% of rural poultry has little or no access to veterinary services. Although it seemed that overall, the rural village poultry and backyard and medium scale farmers were most severely affected by the HPAI outbreaks, the initial study by UNDP (2006) focused on both macro and micro – economic perspectives but utilised only a rapid appraisal method (RRM), which is subject to a number of limitations. Rural and urban poor form a higher percentage of total human population in Nigeria and a large percentage of rural households engage in a free-range poultry production, while many urban poor are also involved in backyard poultry production. Since poor households comprise a very significant share of the poultry-sub sector in Nigeria, a RRM will only generate data that are not accurate representatives of the whole population. Also, there are no reliable household survey statistics that could properly aid in determining the micro-impact of HPAI in Nigeria at the surface using a RRM. For example, there is no national livestock statistics on free-range poultry in the country. Hence, a 'free-range poultry mapping' may be required for adequate assessment of impact of HPAI on the livelihood of the poor in Nigeria. This study should be augmented with a more detailed study of the impact of HPAI of rural livelihood, food security and social wellbeing of the rural poor in Nigeria.

Although the results so far obtained from the Live-bird markets surveillance showed clearly that the H5N1 virus circulates in some markets in Nigeria without any signs of overt disease in market poultry, the exact role of LBMs in the spread and sustenance of HPAI in Nigeria needs further attention. Future studies should also trace forwards and backwards where the virus is isolated. It is being recommended that a more bio-secure system of mechanized slaughter and processing of poultry should be an integral part of any restructuring of the poultry marketing and processing system to reduce human exposure to the virus.

Some evidence has been produced to show suitable combinations of ecological conditions, farming practices and land use that are conducive for the introduction, spread and persistence of H5N1 virus in parts of northern Nigeria. The authors postulated that HPAI may have been present in rural backyard poultry 6-8 weeks before the official identification and confirmation of the disease in commercial poultry in Kaduna State in February 2006. This finding highlights the need to build a participatory rural disease search in rural poultry into the national HPAI disease surveillance programme.

Some identified gaps in research into HPAI in Nigeria include elucidating various aspects of the epidemiology of HPAI in Nigeria including the role of LBMs, indigenous poultry breeds and resident wild birds (such as local domestic ducks, guinea fowls, cattle egrets and vultures) in the spread and sustenance of HPAI in Nigeria. Others are molecular characterization of Nigerian H5N1 viruses and comparison with other isolates, and the development of a more effective and efficient control strategy for HPAI based on continued active disease surveillance in various poultry production and marketing systems in Nigeria including the rural poultry production system.

Although there are no specific laws and regulations directed strictly to the poultry sector in Nigeria there are policies, laws and regulations relating to animal disease and production of which the poultry sector is included. These consist of the Meat Inspection and Hygiene Act of 2002, the Meat Hygiene Legislation of 1969 and the Animal Disease Control Act of 1988. With respect to Food Safety, production and standardization, regulations and laws are covered under the National Agency for Food, Drugs Administration and Control (NAFDAC) established in 1993, the Food and Drugs decree of 1999, and the Standard Organization on Nigeria which is vested with the authority to specify and elaborate on standards and provide quality assurance for commodities imported from outside Nigeria. There is also the National Biosafety Guidelines of 1994. Overall none of the above laws specifically targets the poultry industry and no attention is paid to the rural poultry sector, which forms the greater part of Nigerian poultry. Enforcement of the laws is generally poor and sometimes non-existent.

Research gaps identified

1. Free range poultry is thought to constitute about 60% of Nigeria's poultry population but there is a lack of national livestock statistics on free range poultry in the country to back this up. A 'free range poultry mapping' is required for adequate assessment of impact of HPAI on the livelihoods of poor households keeping free range poultry in Nigeria

2. The role of indigenous poultry breeds and resident wild birds such as local domestic ducks, guinea fowls, cattle egrets and vultures in the spread and sustenance of HPAI in Nigeria.

3. The role of LBMs in the spread and maintenance of HPAI in Nigeria.

4. Molecular characterization of Nigerian H5N1 viruses and comparison with other isolates from poultry and humans from other countries.

5. Community (grassroots) participation in active disease surveillance in various poultry production and marketing systems in Nigeria. Although structures exist for responding to HPAI emergency mainly at the federal and state levels, these structures are non-existent in the rural areas where majority of the country's poultry are located.

1. Introduction

Background

Trans-boundary Animal Diseases (TADs) are diseases that are significantly important to many countries in economic, trade and/or food security and sometimes in public health terms – as is the case with Highly Pathogenic Avian Influenza (HPAI). The high level of importance attached to TADs is often because such diseases have the potential to spread rapidly and reach epidemic proportions and also because their control and eradication require cooperation between several countries.

Recent outbreaks of HPAI in Africa have increased the devastating effects of existing trends of transboundary animal diseases on national and international economies. It has recently been recognised as a critical development challenge facing human societies because it represents a serious threat to the livelihood of smallholder livestock producers, especially in poor economies (Roland-Holst et al., 2008). The impact of HPAI is thus added to the existing problem of poverty and gender inequality in Africa. Loss of poultry due to HPAI outbreak does not only destroy businesses, but also increases challenges for achieving sustainable livelihoods, especially for women, children, and other vulnerable people (the aged and physically challenged) who dominate family poultry production (Sonaiya, 2007). It exposes them to the risk of livelihood failure through the removal of the income source, the associated rise in micronutrient deficiency and the potential risk of animal-human transmission.

Motivation

Although there have been increasing efforts directed towards the outbreaks, most of them have focused on the control, prevention and eradication of the disease. Again, most studies that assessed the impact of the disease in Nigeria have ignored the broader picture of the livelihood effects (Akpabio et. al., 2007; Obayelu, 2007; You and Diao, 2007). Less attention has been paid to the specific nature of HPAI implications for livelihood of the smallholders in developing countries. This deficiency limits the evidence base of discussions that should lead to the development of appropriate poverty reduction policy in Africa.

Significance and Scope of the Paper

The objective of this background paper is to identify key issues associated with livelihood impact of HPAI at national, community and household levels. It attempts to make available information on the risk factors for entry and spread of the disease, institutional responses and constraints to controlling the disease; while providing an overview of the structure and economics of the poultry sub-sector in Nigeria. The study also presents an overview of HPAI status in the country with an attempt to identify categories of stakeholders affected and how and why they were affected. This enables the identification of the level of vulnerability of each category for further study. Overall, the background paper serves as an introduction to the country-level (Nigeria) collaborative research project on pro-poor HPAI risk-reduction strategies by International Food Policy Research Institute (IFPRI),

International Livestock Research Institute (ILRI) and other international research institutions[1.] Some research gaps are identified in the country guide to this collaborative study.

[1]Pro-Poor Livestock Policy Initiative (PPLPI), The Development Field - Agricultural & Resource Economics, University of California at Berkeley, Royal Veterinary College (RVC) Population Biology and Disease Control

2. Vital Country Statistics

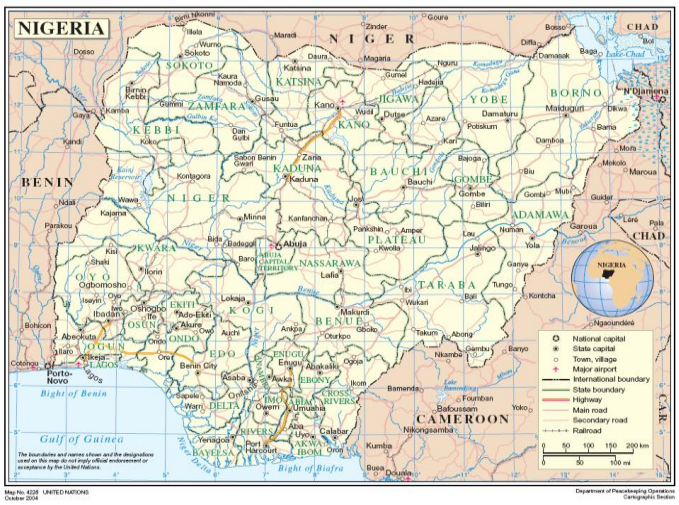
Geography

Nigeria is located in West Africa on the Gulf of Guinea with a total area of 923,770 sq. km and total land area of 910,770 km. Sq. (FAO, 2005), falling within 14o East Longitude and 4o and 14o North Latitude (NBS, 2006a). It shares borders with Benin in the west, Niger and Chad in the north, Cameroon in the east and the Gulf of Guinea in the south. It is about 4047 km in length, but this is subject to change after the boundary demarcation between Nigeria and Cameroon over the oil-rich Bakaasi-Peninsula is concluded by the Cameroun-Nigeria Mixed Commission. River Niger and River Benue are some of the key environmental resources in the country that are of transboundary significance. River Niger, which is Africa's third largest river, flows from Sierra Leone and enters Nigeria through in the north-west. The River Benue emerges from Cameroon and forms a confluence with River Niger at Lokoja (North Central).

The country is a federal constitutional republic and is made up of 36 states (see Figure 2.1), 774 local government areas (LGAs) and the Federal Capital Territory (FCT), Abuja. The states are divided into six geopolitical zones as shown in Table 2.1. Abuja is the country's administrative centre, or the Federal Capital Territory (FCT), with a total area of 7,607 sq. km. The total human population in Abuja increased from 371.7 thousand in 1991 to 1.41 million (52.7% Male and 47.3% female) in 2006, forming 0.4% of the national population (NPC, 2007).

According to the National Bureau of Statistics, Nigeria is made up of many ethnic groups ranging from 'Hausa, Fulani, Tiv, and Kanuri in the north; Igbo in the south-south and south-east; Yoruba in the south-west; Bini, and Ijaw and Ibibio in the south-south, in addition to other minority ethnic groups. Although English is the official language in the country, most of the states have more than one major ethnic group and several local languages. It is rare to find only one local language being spoken in any state in Nigeria due to strong ethno-cultural diversity; however surprisingly, the NBS data shows that only one local language is spoken in Osun and Kano States.

Figure 2.1 Map of Nigeria showing 36 States and the Federal Capital Territory



Source: United Nations (http://www.un.org/Depts/Cartographic/map/profile/nigeria.pdf)

Table 2.1 States in Geopolitical Zones of Nigeria

S/n	Zones	States
1	North-Central	Benue, Kogi, Kwara, Nasarawa, Niger, Plateau, and Federal Capital Territory, Abuja.
2	North-Eastern	Adamawa, Bauchi, Borno, Gombe, Taraba and Yobe
3	North-Western	Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto and Zamfara.
4	South-Eastern	Abia, Anambra, Ebonyi, Enugu, and Imo
5	South-South	Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers
6	South-Western	Ekiti, Lagos, Ogun, Ondo, Osun and Oyo

Nigeria's climatic conditions are of tropical (or equatorial and semi-equatorial) nature. The country experiences two seasons (wet and dry seasons). The wet or rainy season is usually characterised with high humidity and a large amount of rainfall, but recent data (NBS, 2006a) show that there has been a drastic change in the amount of rainfall in the country. This shift in the climatic condition of Nigeria could probably be attributed to several factors including climate change. The rainy season usually lasts from April to October while the dry season lasts from November to March. In 2004, the annual mean minimum temperature ranged from 17.60C in Kaduna State to 24.20C in Ogun State, while the annual mean maximum temperature ranged from 31.20C in Cross-River and Lagos States to 36.90C in Maiduguri (Borno State).

Population, Poverty & Trends

The 1991 census puts the total human population of Nigeria at 88.9 million. No census was conducted in 2001, but projections (as shown in Table 2.2) made by the National Population Commission, Nigeria (NPC) show an annual growth rate of 2.83% between 2000 and 2005. The data indicate that Nigeria's population is on an increasing trend, and the 2006 census recently estimated it at 140 million (48.8% female and 51.2% male). According to the World Bank, the annual population growth rate in Nigeria in 2006 was 2.4% (World Development Indicator (WDI)). However, the population data contained in WDI are generally higher than those presented in Table 2.2.

In 2005, there were more people in rural areas (63.7%) than urban areas (36.3%). Nigeria is the most populated country in Africa and one of the most densely populated in the world, with a population density on total land of 132.8 persons/km2 (FAO, 2005). However, an estimation using current population figures shows a population density per total area of 153.9 persons/km2. There are 11 major cities across the breadth of the whole country. Lagos is the most densely populated of all with a population density per total area of 2455.3 person/km2. Table 2.3 and Appendix I contain information on the population size and density of states in Nigeria and indicate that there are more people per square kilometre in the south than in the north. Lesser population density in the north makes keeping free-range livestock (cattle, poultry, etc) more practical and common among the Fulani households in this region because there is more scavengable area.

Table 2.2. Total Human Population in Nigeria (in thousands)

Year	1991	1996	2001	2002	2003	2004	2005	2006
Population	88,992	102,339	118,801	122,163	125,620	129,175	133,767	140,004

Note: 1991 is the base year for actual census and figures for 1996 – 2005 are projections based on this year.
(-): Not Available
Source: National Bureau of Statistics, Annual Abstract of Statistics (2006), The Nigerian Statistical Fact Sheets on Economic and Social Development (Nov. 2006), http://www.nigeriastat.gov.ng

Table 2.3 Population Density of States with Major Cities in Nigeria (2006 Census)

State	Major City	Total Area (km^2)	Population	% of Total Population	Population Density (persons per km^2)
Lagos	Lagos	3,671	9,013,534	6.44	2455.3
Anambra	Aba	4,865	4,182,032	2.99	859.7
Rivers	Port Harcourt	10,575	5,185,400	3.70	490.4
Kano	Kano	20,280	9,383,682	6.70	462.7
Oyo	Ibadan	26,500	5,591,589	3.99	211.0
FCT	Abuja	7,607	1,405,201	1.00	184.7
Edo	Benin City	19,187	3,218,332	2.30	167.7
Kaduna	Kaduna, Zaria	42,481	6,066,562	4.33	143.0
Plateau	Jos	27,147	3,178,712	2.27	117.1
Kwara	Ilorin	35,705	2,371,089	1.70	66.7
Borno	Maiduguri	72,609	4,151,193	2.96	57.2

Source: NPC, OFFICIAL GAZATTE (FGP 71/52007/2,500(OL24)

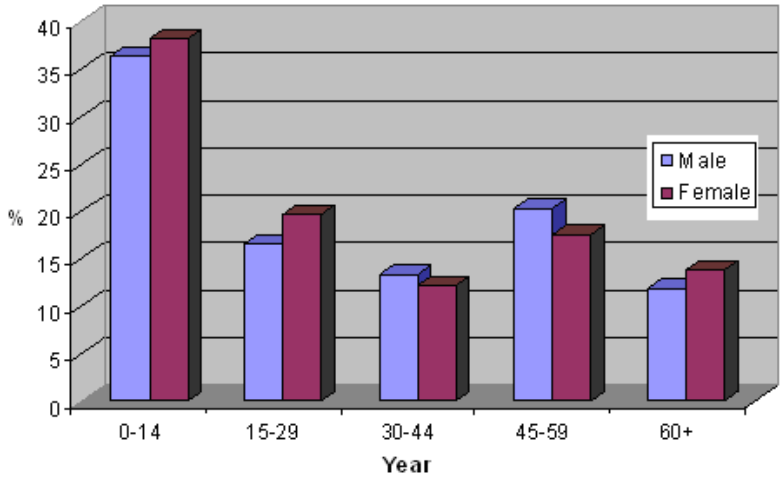
General household surveys conducted by NBS between 1995 and 2005 show that Children (0 – 14 years) constitute a very high percentage of the household population in Nigeria (about 37% in 2005) (NBS 2007). This is an indication of how important poultry production and consumption are to the nation because children need food with high protein content. Poultry products like eggs and chicken are reliable sources of protein, thus making the outbreak of HPAI in Nigeria a great threat to household food security and to the future of the country.

Table 2.4 Household Expenditure by Gender of the Head of Household, Sector and Type of Expenditure

	Per capita Food expenditure (%)		Per capita non-food expenditure (%)		Total mean expenditure (Naira)	Total per capita expenditure (Naira)	Per capita food expenditure (Rural) Naira	Per capita food expenditure (Urban) Naira
Gender/Year	1996/97	2004	1996/97	2004	1996/97	2004	2004	2004
Female	48.9	45.08	30.5	54.92	3,849.5	41,004	16,491	17,824
Male	37.7	48.68	30.4	51.33	4,530.4	34,576		

Note: Table adapted from NBS (2005) and NBS (2006a)

Figure 2.2 Percentage distribution of persons in households surveyed in Nigeria (2005)



Source: NBS, 2007, General Household Survey Report, 1995 – 2005

The household survey report generally shows that females within the age range of 19 - 29 years (which is part of the productive labour force) constitute a large percentage of household members (NBS 2007). This indicates that the aggregate impact of a HPAI outbreak may be quite significant for women because they use a higher share of their income to provide protein for children in the households. Although there are no data on household expenditures on poultry products, per capita household expenditure breakdown obtained from the 2006 annual abstract of the National Bureau of Statistics (NBS) and its Nigeria Living Standard Survey show that females use a high proportion of their income to purchase food items (Table 2.4). More recent survey data (Table 2.5) suggests that the role of women in households is more significant in the south than in the north, especially in the south-west (Osun and Ekiti States) and south-east (Abia State) zones. This could be attributed to the religion that is dominant in each zone. Generally, in the north, most male household heads are Muslims. Hence, many women are mostly indoors or engaged in small scale trade (mostly agricultural products) at a distance not far away from their homes.

Table 2.5 Percentage Distribution of Households by who contributes to Household Income in Some States in Nigeria

State	Male Head	Female Head
Adamawa	31.6	4.2
Gombe	46.6	0.7
Kaduna	33.6	2.6
Jigawa	56.4	1.2
Kogi	18.6	14.3
Kwara	22.0	14.9
Abia	12.9	17.0
Enugu	12.7	13.4
Ekiti	16.5	22.4
Osun	11.4	19.6
Akwa-Ibom	15.5	14.1
Delta	23.5	17.8

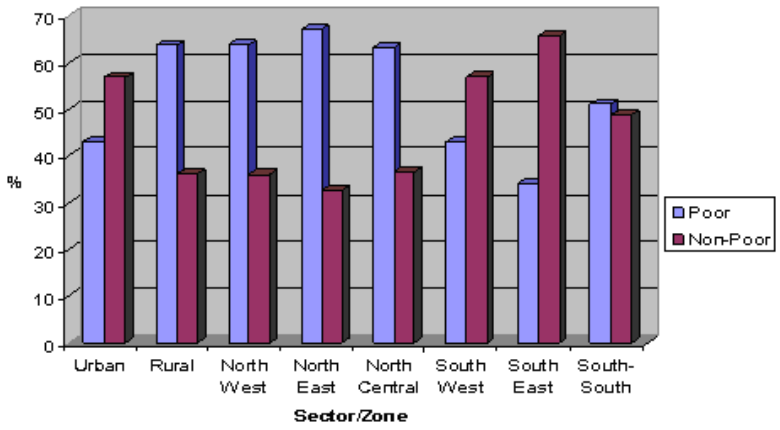
Source: Core Welfare Indicator Questionnaire Survey, Nigeria (NBS, 2006b)

Agricultural land as a proportion of the total land area in Nigeria is 722,000 km2 (79%). FAO (2005) estimated the total population in the agricultural sector as 38.1 million, which represents 28.48% of the projected population in 2005. Agricultural population density of Nigeria is therefore 52.8 persons per square kilometre. In 2005, agricultural land per 100 people and agricultural land per 100 people in agriculture was 60 ha and 190 ha respectively. These numbers indicate that there is at least 1 ha of land available per capita for agricultural practices in the country. The 2006 census data available from NBS does not contain information on the number of people living in rural areas of each state, per capita income of agricultural population nor rural per capita income. This makes it difficult to establish the nature of and variation in rural poverty across the six geopolitical zones in Nigeria. This notwithstanding, northern parts of Nigeria have a higher population living in the rural areas and a lower average per capita household income compared to the southern part. For example, the mean of the average per capita household income in the north-western zone was N647.8 while that in the south-west was N1747.4 in 1998/99 (NBS, 2006a).

Based on the subjective measure of poverty, NBS (2005) reported that 70.7% and 29.3% of households are poor and non-poor, respectively, in the urban areas while 79.2% and 20.8% of rural households are also poor and non-poor, respectively. The NBS also used an objective measure of poverty to define a poverty line as the minimum food energy intake (FEI) required per household. Consequently, 21,743 Naira (taken as the extreme poverty line) was estimated as the minimum annual expenditure on food required per adult to attain 2900 calories per day (FEI). Based on this, it was reported that in 2005 the rural sector had the highest poverty incidence at 63.1%. Consistent with the lowest per capita household income obtained in the northern zone in 1998/99, highest poverty incidence (67.3%) was maintained in the north-east in 2004. However, the South East zone had the lowest poverty level (Figure 2.3) in the same year. Generally, the trend of poverty shown in

Figure 2.4 indicates that poverty had generally been increasing in Nigeria since 1980, with a reduction from 46.3% in 1985 to 42.7% in 1992 followed by a significant increase in 1996 (65.6%).

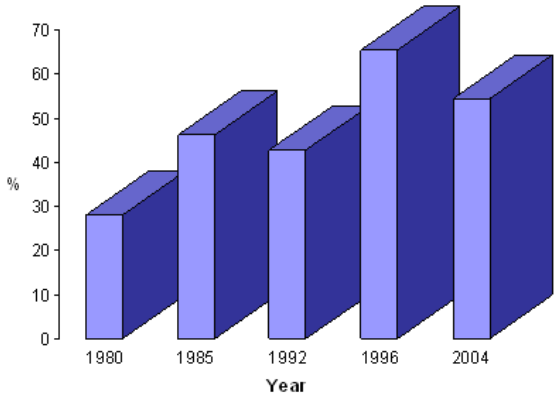
Figure 2.3 Poverty incidence by sector and zone (2004)



Source: NBS, Poverty Profile for Nigeria (2005)

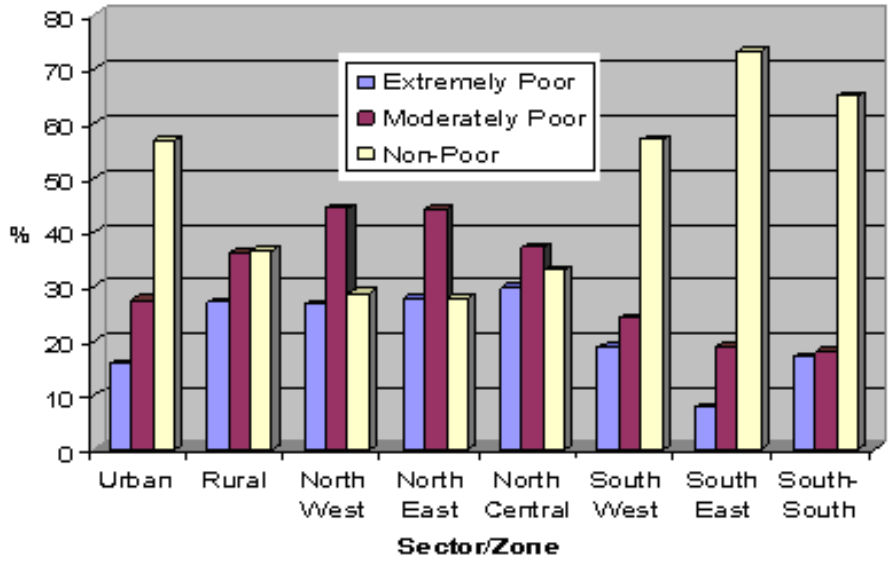
Figure 2.5 shows that extreme poverty is highest in the rural sector and in northern zone states (e.g. Kogi, Sokoto, Yobe and Bauchi), thus stressing the state of welfare in rural Nigeria. Also, the poverty level increases with the household size and the trend of poverty in Nigeria rose steadily between 1980 – 1985 and 1992 – 1996, but this was on a decreasing trend until 2004 (Figures 2.4 and 2.6).

Figure 2.4 Trend of poverty incidence in Nigeria



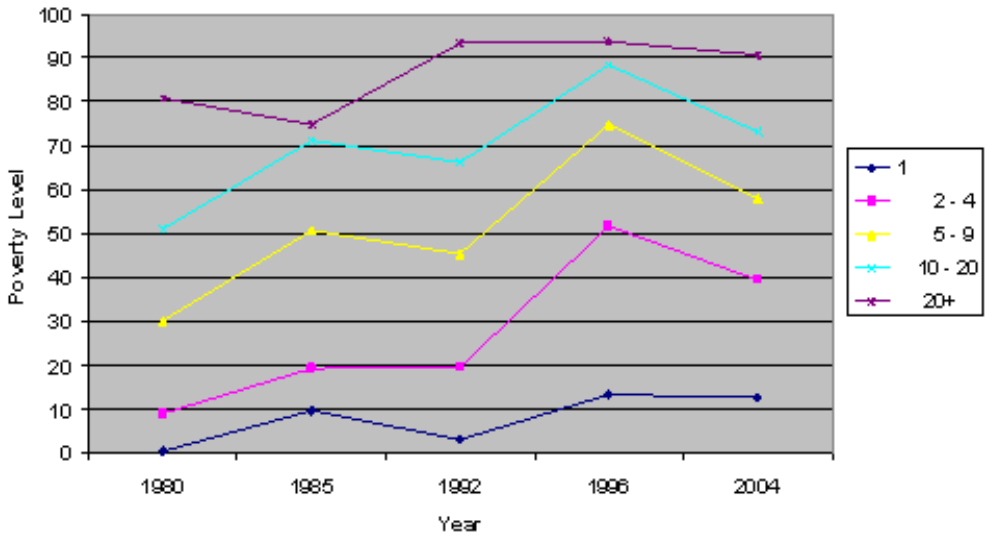
Source: NBS, Poverty Profile for Nigeria (2005)

Figure 2.5 Percentage poverty head count by sector and zone (2004)



Source: NBS, Poverty Profile for Nigeria (2005)

Figure 2.6 Poverty trend by household size in Nigeria



Source: NBS, Poverty Profile for Nigeria (2005)

Extreme poverty is highest in the rural sector and in the northern states such as Kogi, Sokoto, Yobe and Bauchi (NBS, 2005). The trend of poverty in Nigeria rose steadily between 1980 – 1985 and 1992 – 1996, but this was on a decreasing trend until 2004 (figures 2.4 and 2.6). Also, the poverty level increases with the household size. Zones with low per capita household income have a higher number of persons in households. The results of the core welfare indicator questionnaire survey conducted in Nigeria by NBS in 2006 show that there are more people per household in the northern states than in southern states. Households where the head is employed in the agricultural sector have the second highest mean household size (5.1) next to those whose head is employed in the public sector (5.3). Lowest mean household size was obtained for those whose head is unemployed (4.1), which is close to those in other sectors and raises concern for its poverty implication. However, the NBS (2004) NLSS survey report indicates that high costs of agricultural inputs (28.54%) and lack of capital to expand agricultural businesses (7.48%) are among the most important reasons leading to poverty in Nigeria.

Economy

After the oil sector, agriculture significantly contributes to the economy of Nigeria. Agriculture provides inputs, stimulating local manufacturing, small scale enterprise and reducing poverty. In 2005, the agricultural GDP was US $11,761 million, which was 35.7% of the total GDP. The livestock sub-sector contributed 9.4% (US $1,100 million) to the national GDP in the same year (FAO, 2005). However, the trend of gross domestic product (GDP) from 1960 to 1995 reveals that the contribution of agriculture to GDP has fallen drastically. Agriculture contributed 62.9% in 1960, 22.2% in 1980 and 39.3% in 1995 to the national GDP (Adenikinju, 1998), but recent data show that this trend improved rapidly between 2003 and 2004 due to the government's policy restructuring. Since 2002, the agricultural sector has witnessed a significant growth with highest growth rate of 7.06% in 2005 compared to only 0.5% in the oil sector (NBS, 2006c).

According to the World Bank, Nigeria's GDP in 2006 is equivalent to 114.7 billion in current US$. Between 2001 and 2005, the GDP annual growth rate in real terms ranged from 4.72 to 9.57% (NBS, 2006c). Also, GDP per capita per year was US $248 (at 1995 constant price) or 1,128 (PPP US $) in 2005 (UNDP Human Development Report, 2007) with an annual growth rate of -0.6% between 1990 and 2000 (FAO, 2005). This growth rate indicates a decrease in human well-being in the country. The Human Development Index was estimated as 0.466 for Nigeria by FAO (2005), which ranks the country 151st among a total of 177 countries.

3. Overview of Economics and Structure of the Poultry Sub-sector

Poultry Sub-sector Overview

Livestock contribute about 3% to Nigeria's GDP (NBC 2006c). The poultry population in Nigeria has been estimated as 150 million in 2005 (NBS, 2006d), which is surprisingly close to the total human population in the country (Table 3.1). This figure suggests without statistical proof that every person in Nigeria could in one way or the other have come in contact with poultry products. The poultry sub-sector contributes 9 – 10% to the agricultural GDP with a net worth of $250 million (FDLPCS, 2007). About 38 million people are in the agricultural sector in Nigeria (FAO, 2005) but no information is available on the employment provided by the poultry sub-sector. However, the UNDP's (2006) study of the impact of HPAI on poultry-related employment in Nigeria indicates that a significant number of people are employed in its poultry sub-sector. Data contained in the NBS Nigeria Living Standard Survey (NLSS, 2004) clearly indicates that agriculture constitutes 21.54% of occupation in the country. Studies on the significance of poultry to families have also shown that keeping poultry is a part of life in rural Africa (Sonaiya, 1999). The NBS livestock survey data, which was obtained from Adene and Oguntade (2006) again shows that a higher percentage of households keep subsistence poultry in southern Nigeria than in the northern zones (figure 3.1.3). Even in the north, where a smaller number of households keep poultry; women, children and aged people are the important stakeholders in family poultry management in the country (Abubakar, 2007).

Table 3.1: Poultry Population in Nigeria

Year	No. of Heads	% Increase
2000	113,192,123	-
2001	124,618,191	9.17
2002	131,125,008	4.96
2003	137,681,258	4.76
2004	136,631,000	-0.77
2005	150,683,000	9.33

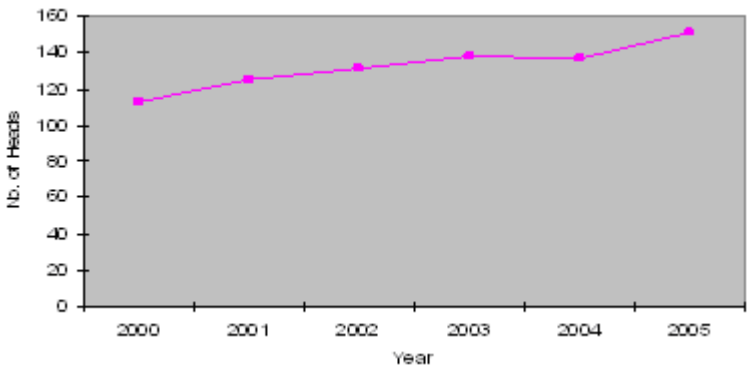
The poultry industry witnessed a successful increase in production in 2005 after the federal government placed a ban on importation of poultry products. The ban stimulated local production in the commercial sector and lead to the proliferation of backyard producers, mainly comprised of low income earners and retirees, especially across the major cities. This boosted the export prospect of the sub-sector until the outbreak of Highly Pathogenic Avian Influenza in February 2006. The outbreak removed this export potential and redirected government efforts towards disease control and surveillance.

Again, the poultry industry in Nigeria experienced an introduction of economic measures aimed at boosting the industry through improvement in local production in 2003. Data on poultry population

in Nigeria are not very clear mainly due to the fact that no recent survey covering all poultry production sectors is available. This is why various contradictory estimations and projections have been done by both the National Bureau of Statistics and the Federal Department of Livestock and Pest Control Services (FDLPCS). For example, the NBS estimated the population of poultry (chicken) as 137,681,258 in 2003 while data presented in a FAO study by Adene and Oguntade (2006) show that FDLPCS estimated the total poultry population in the same year as 137,678,943. The two sources of data are ambiguous. First, it is not clear whether the NBS (2006a) poultry data represent the only chicken or include all types of poultry, as it is very close to FDLPCS figure. Second, Adene and Oguntade (2006) already noted that the FDLPCS data only disaggregate poultry into backyard and exotic, which is a classification that does not give any clear clue as to the structure of poultry in the country.

Unfortunately, these projections have been based on the 1990 RIM[2]/FDLPCS livestock census, which is now about 20 years old. This makes it necessary for a fresh survey to be conducted in Nigeria that will take into account the exact structure of the poultry sub-sector that has recently developed. This is of particular importance in order to obtain a clear picture of the rural family poultry production system in Nigeria. Data presented in Adene and Oguntade (2006). do not clearly differentiate between what constitute free range (or village extensive poultry production) and backyard (intensive) poultry production systems. Since these data show only the percentage and number of households keeping subsistence poultry (which is defined to include backyard production) in all states across the country, it is not clear whether they are urban or rural households. This is why an average flock size as high as 177 chickens could be estimated for households in Delta State. Hence, it can conveniently be said that there has not been any clear free-range or village extensive poultry 'mapping' or survey in the country. Controlling HPAI and mitigating its impact requires a good understanding of the extensive village poultry production system, which is important owing to the zero or minimal biosecurity level associated. Free range poultry have easy access to risk factors, especially wild birds. Research has recently linked agricultural practices (rice paddy and ducks) and HPAI spread in Asia (Gilbert et. al., 2007).

Figure 3.1 Poultry population trend in Nigeria (million)



However, based on the data available from NBS (2006a and 2006d) total poultry population in the country is collated as shown in Table 3.1. Figure 3.1 shows that poultry population increased

[2] RIM: Resources Inventory and Management Limited (UK)

gradually between 2000 and 2003, and declined in 2004. However, the percentage annual increase in the poultry population declined from 9.17% in 2001 to -0.77% in 2004. This drastic change between 2003 and 2004 can be attributed to the ban on importation of poultry inputs like day-old chicks and the associated constraints which local production had to cope with. In 2005, after the poultry sub-sector had adapted to the policy change, it experienced a 9.33% increase in total poultry population in the country. However, poultry population at the state level does not follow the same trend, meaning that the impact of policy change on state-level poultry sub-sector is different. For example, while the total population of poultry increased in 2005, both Lagos and Osun States experienced a decrease during the same period. This could probably be due to the fact that these two states are in the south-western zone, through which poultry inputs are mainly imported. Hence, the poultry sub-sector in this zone might be more dependent on importation than in other zones, and as a result be more sensitive to the policy change.

Structure of the Poultry Sub-sector

Classification of Poultry Production Systems in Nigeria

The classification of poultry production systems in recent years began with a dependence on general classification with housing scale as the key criterion. Kitalyi (1998) classified poultry production in Africa into three sectors: intensive, semi-intensive and extensive. The intensive system is commonly referred to as the commercial scale production while the semi-intensive system is referred to as the 'backyard poultry production', which is also the intermediary among the three systems. While it is clear from several studies that family poultry is a growing area in developing countries (e.g. Sonaiya, 1999), it is unclear from some studies whether family poultry in Africa is a rural or urban and/or intensive, extensive or mixed 'concept'. For instance, in the lead paper 3 of INFPD/FAO Electronic Conference on Family Poultry[3], it is referred to as encompassing intensive, backyard and scavenging management system, which could lead to a misconception of family poultry as including commercial production (referred to as intensive management). It is also tempting to assume that family poultry in Nigeria is a rural concept, as presented in Adene and Oguntade (2006).

However, it is crucial to note that family poultry in Africa is a transitory process, which is growing from a village system to rural-town and urban production processes. Also, it encompasses both intensive/semi-intensive (backyard production) and extensive (free-range) management systems. In line with this, Sonaiya and Swan (2004) provided a comprehensive definition of family poultry as 'small-scale poultry keeping by households using family labour and, wherever possible, locally available feed resources'. This definition clarifies that family poultry comprises a flock size of 5 – 100 birds in Africa, but recent data from short survey by Adene and Oguntade (2006) show that this has increased over time in Nigeria. This is corroborated by the NBS data on household keeping subsistence poultry across geopolitical zones in Nigeria where average poultry flock size per household is up to 177 birds in Delta State (South-South).

It is also worthwhile to mention that while many studies (e.g. Kitalyi, 1998; Muchadeyi et. al., 2005) have shown that family poultry production in Africa is largely extensive, in Nigeria, an important

[3] Kitalyi, A.J, Family poultry management systems in Africa. Lead paper 3: The First INFPD/FAO Electronic Conference on Family Poultry. http://www.fao.org/ag/AGa/AGAP/LPA/Fampo1/leadpap3.htm

factor in determining the type of poultry management system practiced is location. Therefore, it can be noted that extensive and backyard (extensive) poultry production systems are common in the rural-village while backyard (intensive) systems are common in rural-town and urban areas. This is why the Adene and Oguntade (2006) household survey data does not provide precise guidance on the range of poultry flock size in Nigeria and why it is unclear whether their samples were taken from rural-town or rural-village areas. Hence, it is difficult to attribute a flock size of 59 – 181 chickens to free-range or village extensive production systems (in south-east Nigeria), which they regarded as conventional rural poultry.

Apart from a classification based on the housing scale, biosecurity level has become the key criterion in recent literature probably due to increasing emergence and spread of TADs across continents. FAO (2004) defined four poultry production sectors based on experiences in Asia as follows:

- Sector 1: Industrial Commercial Farms - integrated system with high level biosecurity and birds/products marketed commercially (e.g. farms that are part of an integrated broiler production enterprise with clearly defined and implemented standard operating procedures for biosecurity).
- Sector 2: Large Commercial Farms - poultry production system with moderate to high biosecurity and birds/products usually marketed commercially (e.g. farms with birds kept indoors continuously; strictly preventing contact with other poultry or wildlife).
- Sector 3: Small Commercial Farms - poultry production system with low to minimal biosecurity and birds/products entering live bird markets (e.g. a caged layer farm with birds in open sheds; a farm with poultry spending time outside the shed; a farm producing chickens and waterfowl).
- Sector 4: Village or backyard production with minimal biosecurity and birds/products consumed locally.

This classification emphasizes commercial production by segregating it into 3 levels of intensive management and biosecurity. Although scale of production and level of biosecurity are glaring criteria that separately identify sectors 1 and 2, overlaps still exist between these criteria for the operational sectors of commercial production in Nigeria. The Adene and Oguntade (2006) report shows that in some respects, there is no clear cut-off line among the sectors. For instance, some sector 2 farms have a production capacity (e.g. 250, 000 flock of turkey), high biosecurity level (except for different vaccination schedules) and input scale (e.g. automation) as high as those in sector 1.

Available data show that the Nigeria poultry sector is dominated by small commercial farms and family poultry, which suggests a bottom-up approach for classifying poultry production systems in the country since the lower sectors are the most important for the prevention, control and surveillance of HPAI. This approach was utilised in a recent study (UNDP, 2006) in which the poultry sub-sector is classified into commercial, semi-commercial, backyard (intensive) and extensive sectors. The information presented in FDLPCS (2007) was based on this classification. It indicates that backyard and/or village extensive production systems form 60% of the whole poultry sub-sector in Nigeria. Semi-commercial systems of poultry production form 15%, while commercial comprise 25% of the sub-sector. According to NBC (2006a), as of 2000, the total value of livestock resources in Nigeria was N356.3 billion (approx US$3 billion), which included cattle valued at N254.1 billion

(approx US$2 billion), goats worth N59.2 billion (approx US$0.5 billion) and local poultry valued at N1.2 billion (approx US$0.1 billion).

In contrast, the FAO's (2004) classification is utilised here in order to allow for consistency (or comparison) with studies in other developing countries where this collaborative research is being undertaken concurrently.

Structure of Industrial Commercial and Large Commercial Production Systems

Industrial commercial farms (sector 1) are those with very high production capacity, up to 250,000 birds, and very high processing technology. They are few in number and are mainly found in southern Nigeria (see the list in Table 3.2). For example, Folawiyo Farms has an annual day old chick production capacity of 120,000, while Shobowale Animashaun and Ayokunle farms in Ogun State have an operation capacity of 120,000 and 250,000, respectively[4]. Sector 1 farms comprise a significant share of the poultry sub-sector in the country. They form the apex of the poultry sub-sector in Nigeria, supplying mainly poultry inputs (day old chicks) to large commercial farms (sector 2), as well as providing various services such as equipment hire. Available evidence shows that these apex companies have a production capacity with grand parent stock of 2,845,875 and parent stock of 385,000 in 2004/2005 (PAN).

Table 3.2 List of some integrated commercial farms in Nigeria

S/N	Company Name	Location	Main Products
1.	AMO FARMS	Oyo State	Broiler DOC, Pullet DOC, Eggs, Feeds, Cockerels
2.	AVIAN SPECIALITIES Limited	Oyo State	Broiler DOC, Pullet DOC, Eggs, Frozen chicken, Cockerels
3.	CHI Limited (AJANLA FARMS)	Oyo State (Headquarter located in Lagos)	PS DOC, POL pullets, Boiler DOC, Emus, Pullet DOC, Equipment, Table eggs, Drugs, Cockerels
4.	LIPAKALA FARMS	Ondo State	Broiler DOC, Pullet DOC, Eggs, Dressed chicken
5.	NIYYA FARMS Limited	Kaduna State	Day old chicks, Eggs
6.	Obasanjo Farms Nig. Limited	Ogun State	PS DOC, Broiler DOC, Pullet DOC, Frozen Chicken, Cockerel, Equipment
7.	S & D FARMS	Ogun State	
8.	TUNS FARMS	Osun State	Broiler DOC, Pullet DOC, Eggs, Frozen chicken, Feed concentrates, Cockerels
9.	ZARTECH FARMS	Oyo State	Broiler DOC, Pullet DOC, Eggs, Frozen Chicken, Further Processed Chicken, Cockerels

Source: Poultry Association of Nigeria
Key: DOC: Day Old Chicks; PS: Parent Stock

Large commercial farms of operation capacity within 5,000 and 100,000 birds dominate sector 2. Many that have production capacity on the lower tail are widely spread in Lagos, Osun, Ogun, Oyo, Ekiti, Ondo, Delta, Edo and northern states. However, the primary economic objective of many large commercial farmers is the production of eggs and rearing of day old chicks to table birds for meeting

[4] See PAN data of commercial farms in Adene and Oguntade (2006)

substantial demand from many corporate firms in the food processing industry (eateries such as Big Treat®, Tantalizers®, Sweet Sensation®; meat shops such as UTC, ShopRite®; hotels and large scale food companies). As for the small commercial farmers, many of the large commercial farms with lower production capacity also sell their products to wholesalers and retailers who distributes to food outlets or shops. In the north, many Hausa men who process and sell poultry meat along the road sides in cities purchase broiler birds from these retailers (also common in some southern states). Some large commercial operators also obtain processing technology and inputs through franchises from the industrial integrated farms.

The biosecurity level in sector 1 is very high, which is coupled with a very sophisticated level of technology input obtained through importation and local sources. The sector is the most organised, with each of the industrial integrated farms having its own feed mill and significant staff strength covering areas such as farm administration, health and safety, veterinary control, quality control and quality assurance, engineering, stock control and marketing. Such organisational structure can also be found in large commercial farms. This allows for effective biosecurity practices, especially among the integrated farms. Achievement of high production standards in the sector is also strengthened through an apex body (Poultry Association of Nigeria) that has a majority membership formed of owners of many commercial poultry farms.

Structure of Small Commercial Production System (Sector 3)

Small commercial poultry producing farms (sector 3) with a flock size ranging from 1000 – 4999 birds are unevenly located across the six geopolitical zones in Nigeria. As discussed in previous sections, this sector forms the smallest percentage share of the Nigerian poultry sub-sector. Although there is no adequate information on the trend and growth of small commercial farms in Nigeria, available evidence reveals that many of these farms grew from backyard production scale. Therefore, such scale of production represents the intermediate level between free-range non-commercial and integrated industrial commercial production systems in the country. This sector focuses primarily on egg production, with some farmers also simultaneously engaged in broiler meat production. Retirees and employees in the public sector, i.e. civil servants, at all levels of government are the main stakeholders in this sector. It is particularly common to find many state veterinary officers producing poultry on a small commercial scale.

The majority of sector 3 farms are located in the southern part of Nigeria. This is to be expected because many evolved from a backyard production system, which, as previously explained, is associated with urban and rural-town areas where infrastructural development grows at a significantly different level. Infrastructure required for semi-commercial poultry production is fairly more developed in the south than in the north. For example, NBS (2005) reported that 82.20% and 25.40% of households surveyed in Jigawa and Osun States, respectively, lack access to electricity. Thus, it may be relatively easier to produce poultry at such a scale in the south.

Available data also show that most of these sector 3 farms are located in Lagos, Ogun State and the surrounding areas. This could be due to the fact that Lagos and Ogun State are the major entry points in Nigeria for imported poultry inputs, such as vaccines and drugs. In addition, the market for poultry products in Lagos and other southern states (especially eggs) is huge. Production and marketing of eggs is very profitable in the south. Afolabi (2007) shows that an average egg marketer (mostly married women) in Oyo State earned mean revenue of N25, 822 and a gross margin of N4,

223 per month. Eggs and broilers are usually sold directly to the retailers or through middle men (wholesalers) who transport the products from farm gates to customers in the retail market (food outlets, shops and poultry markets).

The level of biosecurity in sector 3 is moderately high. Unlike backyard poultry producers who consult unqualified pseudo-experts, semi-commercial farmers hire periodic professional consultation, especially through the local and state governments' veterinary departments. However, there is evidence that diseases associated with poor levels of farm sanitation management (such as Fowl Typhoid, Fowl Cholera, etc.) are still common among semi-commercial poultry flocks in the south.

Structure of Village Free-Range/Backyard (Extensive) Production System in Nigeria (Sector 4)

Sonaiya and Swan's (2004) definition of family poultry, as discussed above, is used to describe the smallholder poultry production in Nigeria. It is important to clarify from the beginning that family poultry in Nigeria comprises both sectors 1 and 2 of the UNDP classification rather than being only rural poultry. Thus, what is discussed here is a facet of family poultry in Nigeria. Village chicken production is an integral part of the farming system, providing income and protein for centuries in Africa. It is based on an extensive management system where birds survive by scavenging.

Village poultry production system in Nigeria is a 'low input low output type' with a small flock size. Usually, the birds are not confined or housed and they scavenge on the available grass seeds and leaves, earthworms, insects, household food wastes and other food materials found freely within the homestead or community while hiding in a tree or bush at night. Sometimes, the birds' owners supply additional feeds like cereal grains (maize, millet, or wastes from food processing). In this low input system of production, the birds are exposed to dangers such as predators (like snakes or hawks), theft and disease. These risk factors are also coupled with the owners' limited knowledge of poultry disease management. In addition, superstitions are common among rural dwellers in Africa. For example, villagers in Senegal believe that poultry has a mystical function of receiving bad spirits targeted at the household. This is why chickens that exhibit mad behaviour (as a symptom of Newcastle disease) are considered affected by an evil spirit (Guèye, 2007). Due to the low input requirements of village chicken production, its productivity generally low. UNDP (2006) reported that 10 – 12 eggs per clutch and an annual egg production of 45 – 60 is found in free range systems in Nigeria.

Households usually engage in village poultry production for their own consumption and very few sell their poultry products in the markets for additional income. Apart from consumptive and cash value of rural poultry, households in Nigeria rear poultry for gifts and sacrificial purposes. It is common to find that poultry are kept as an insurance asset to secure the livelihood of young children and even unborn babies among married Yoruba women. Published literature on household coping strategies to livelihood vulnerabilities (e.g. economic hardship, drought, hungry season, and policy change) have shown that livestock is usually kept in Africa as an insurance asset to be disposed of during a period of unexpected shock and stresses (Campbell and Trechter, 1982 (Cameroon); Watts, 1983 (Nigeria); Cutler, 1986 (Sudan); Corbett, 1988; Pyle, 1992 (Sudan); Webb, 1993 (Ethiopia); Adams et. al., 1998; Ellis, 2000; Smucker and Wisner, 2008 (Kenya)). Data available from NBS (2006b) confirms that in Nigeria, a significant percentage of male headed households considered the sale of household assets as an important coping mechanism during hardship. The 'intimacy' between

livestock and humans is high, as many rural families give their chicken the same name as children. Such practice has been reported to be common in rural Africa and is termed a 'humanized relationship with poultry' (Guèye, 2007). Many bird owners apply different colours of dye or attach a piece of cloth on the feathers of birds as a means of identifying their birds among the village or community flocks or for tracing the bird in case of theft.

Existing evidences show that village poultry dominates the poultry sub-sector in Africa. Almost every household in rural areas in Nigeria keep poultry. Ownership of poultry is common across the six geopolitical zones. In Oyo State, for example, approximately 70% of the inhabitants are found to keep livestock, particularly poultry (Afolabi, 2007). There is also evidence that households keep poultry irrespective of educational or occupational status (table 3.3). Some literates working in the public sector, such as village primary and secondary school teachers, or those who live in peri-urban areas, such as office clerks, typists, etc., rear poultry for both meat and egg production. In a study on the role of women in animal production in north-east Nigeria, it was found that over 70% respondents surveyed kept poultry (Kushi et. al., 1998). They were able to engage in this activity as a livelihood strategy because it is a low-input production (less land, low labour and financial inputs). Poultry keeping, therefore, is an important component of the rural livelihood system in Nigeria because it reduces poverty and other associated problems, such as food insecurity and malnutrition. Even poor households that do not rear poultry may derive their livelihoods from poultry by trading poultry in the live birds markets.

Table 3.3 Ownership of Poultry in Nigeria by Occupational Group

Occupation	Chicken	Other Poultry
Student/ Rtd. Unemployed/ Inactive	1.91	1.09
Pros. or Tech.	2.97	4.41
Admin.	0.05	0.21
Clerical	2.34	2.38
Sales	3.82	3.28
Services & related	1.84	3.27
Agric. & Forestry	84.71	83.32
Production and Transport	0.65	0.32
Manufacturing/Processing	0.46	0.73
Other	1.25	0.99
Total	100	100

Source: NBS Nigeria Living Standard Survey (NLSS), 2004

Table 3.4 Household and Poultry Keeping Data across the Six Geopolitical Zones in Nigeria

State/Zone	Total No. of Households in each state NBS Social Statistics (2005)	Average Household Size in each state NBS 2006 Welfare Survey	No. of Households Keeping Subsistence Poultry[5] (NBS 2006 Household Livestock Survey)	Poultry Ownership (Chicken) [% of Households (NBS 2004 Survey)]
North-East		5.5		29.64
Adamawa	626252	5.6	155,178	
Bauchi	778711	5.9	642,645	
Borno	792663	4.3	162,143	
Gombe	451161	6.4	101,163	
Taraba	446579	5.5	61,128	
Yobe	376253	6.3	69,719	
North-Central		4.9		14.96
Benue	767561	5.0	181,329	
Kogi	792218	4.3	49,078	
Kwara	615079	4.8	74,448	
Nasarawa	413930	5.8	115,452	
Niger	781568	5.6	116,924	
Plateau	592185	4.8	155,179	
FCT (Abuja)	139757	4.6	9,778	
North-West		5.8		32.44
Jigawa	825062	6.3	221,042	
Kaduna	1154022	6.0	340,768	
Kano	1319418	6.1	763,637	
Katsina	1038281	5.4	674,772	
Kebbi	616253	5.8	257,621	
Sokoto	653684	5.1	232,009	
Zamfara	689858	5.6		
South-East		4.5		22.33
Abia	1034100	4.5	85,383	
Anambra	1083080	4.1	189,329	
Ebonyi	400125	5.5	16,037	
Enugu	617729	4.7	99,824	
Imo	1153498	4.4	212,042	
South-West		4.1		5.4
Ekiti	436875	3.8	39,286	
Lagos	2497419	4.2		

[5] These data were obtained from Adene and Oguntade (2006). They obtained the data by estimation from the NBS (2006) household livestock survey. The figures only show the number of households keeping poultry out of the total sampled in each state. Data contained in column 2 do not represent the total number of households sampled but the total number of households in each state (i.e. sampling frame).

Table 3.4 Continued

State/Zone	Total No. of Households in each state NBS Social Statistics (2005)	Average Household Size in each state NBS 2006 Welfare Survey	No. of Households Keeping Subsistence Poultry[6] (NBS 2006 Household Livestock Survey)	Poultry Ownership (Chicken) [% of Households (NBS 2004 Survey)]
Ogun	1063360	3.8	10,347	
Ondo	1221029	4.3	20,737	
Osun	1013154	4.0	74,753	
Oyo	1576874	4.1	130,615	
South-South		4.5		5.43
Akwa-Ibom	910485	5.0	119,023	
Bayelsa	265189	4.7		
Cross-River	740248	4.7	50,307	
Delta	1056106	4.1	109	
Edo	1018119	3.8	42,676	
Rivers	1194399	5.0	40,528	
Total	28025273			

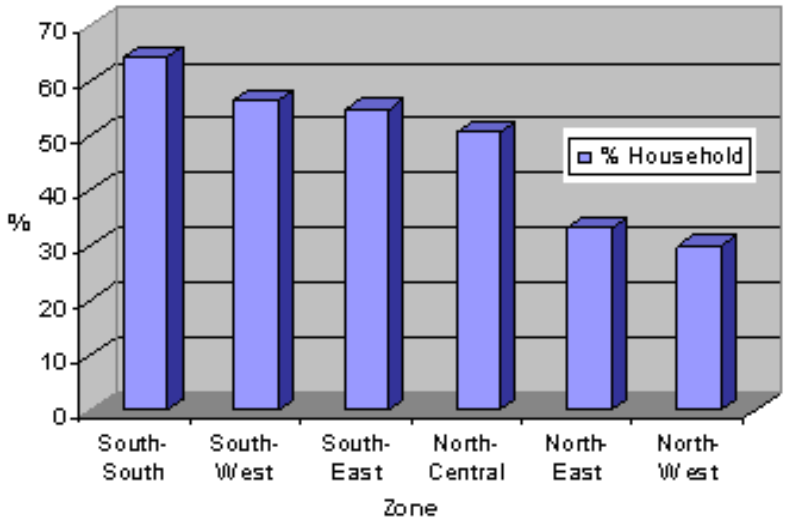
Source: Data collated from NBS, Social Statistics in Nigeria (2005); NBS (2006b); Adene and Oguntade (2006) and NBS NLSS (2004).

Free Range Extensive Poultry Keeping across Zones in Nigeria

As earlier mentioned, subsistence poultry keeping is higher in the south than in northern Nigeria. The NBS survey data on household livestock keeping available from Adene and Oguntade (2006) was utilised to determine the distribution of small scale (or subsistence) poultry in Nigeria as follows. The percentage of households rearing poultry is highest in the south-south zone (64.42%) followed by south-west (56.44%) while north-west have the lowest number of families that engage in poultry production (29.96%). Among the six states in the south-south, it was only in Delta State that every household surveyed by NBS kept poultry (100%) compared to only 48.1% in Akwa-Ibom State, which is the lowest in the zone. Surprisingly, the information contained in table 3.4 shows that only 109 households kept poultry in Delta State while 119,023 households kept poultry in Akwa-Ibom State. This indicates that only 109 out of 1,056,106 households were surveyed by NBS, which probably could have been due to the inability of the enumerators to access the area due to crisis or community conflicts during the year of the survey. Hence, the percentage of households keeping poultry in Delta State is not representative of the total population in the state.

[6] These data were obtained from Adene and Oguntade (2006). They obtained the data by estimation from the NBS (2006) household livestock survey. The figures only show the number of households keeping poultry out of the total sampled in each state. Data contained in column 2 do not represent the total number of households sampled but the total number of households in each state (i.e. sampling frame).

Figure 3.2 Percentage of households keeping subsistence poultry by zone in Nigeria



Source: Extrapolated from NBS livestock survey data presented in Adene and Oguntade (2006)

Among the Yoruba States (south-west), Ogun has the highest percentage of households keeping subsistence poultry (74%), followed by Osun State (57.3%), while Oyo State has the lowest (42.4%). This is in line with expectations because Ogun State has one of the key international borders (Idiroko Border Station) through which poultry importation (legal and illegal) takes place. Many importers and exporters of other goods make use of this border, thus creating opportunities for small scale businesses, especially food preparation and hotel/restaurant. Such household enterprises could have stimulated growth in the rural poultry sector (poultry meat production and egg marketing) in the state. NBS General Household Survey (1995 – 2005) shows that households in Nigeria began to participate in hotel/restaurant businesses in 1998 (0.04%) and that this increased significantly in 2002 (0.60%). Ogun State shares boundaries with Lagos State, which is the economic capital of Nigeria. A dynamic market for poultry products exists in Lagos considering its high population figure and level of urbanisation. This potential represents a 'pull' factor for egg/birds traders and a stimulating factor for poultry investments in Ogun State. Again, Core Welfare Indicator Questionnaire Survey (NBS, 2006b) shows that the percentage of core poor households (1st Quintile) is highest in Ogun State (27.2%) among all states in the south-west, which is consistent with existing evidences that poor households are mostly engaged in free-range poultry.

In south-eastern Nigeria, more households keep poultry in Abia State (61.4%) than any other state in the zone. However, in northern Nigeria, where a smaller percentage of households keeps poultry, all the states in the north-central zone (Benue, Kogi, Kwara, Nasarawa, Niger, Plateau, and Federal Capital Territory) have more households engaged in subsistence poultry than any other state in both north-east and north-west zones. This ranges from 47.7% in Nasarawa State to 55.1% in Benue State.

Adene and Oguntade (2006) identifies that 'conventional rural poultry' (i.e. poultry production which is non-urban, subsistent or non-commercial) has not undergone much changes over decades in the north unlike in the south where backyard intensive system had emerged from rural poultry. On this note, it is important to mention that the percentage of households engaged in village chicken

production could actually be higher in the northern zones than in the southern zones when a new survey that takes into account the already mentioned deficiencies (see section 3.1) is conducted.

Free Range Poultry Flock Size and Dynamics

Village poultry flock composition is dominated by chickens. More chicken are generally kept per flock in the south-south, as shown in table 3.5, but this is subject to limitations already discussed above. On the other hand, a higher percentage of households in the north keep other types of poultry more than those in southern parts of Nigeria. A high flock size for turkey, ducks, and guinea fowls can be found there. The flock size for turkey ranges from 2 – 20 birds in north-east zone while that for guinea fowls ranges from 6 – 30 birds in the north-west.

Productivity and dynamics of village poultry vary with seasons because the birds are exposed to various weather challenges apart from other risk factors (predators and diseases). Flock sizes are usually largest in the dry season (November – March) with a high number of chicks due to more favourable environmental conditions (e.g. temperature) for egg laying and hatching. Exits from the flock during this period are significant, mostly affecting the matured birds (e.g. cocks, hens, etc). This is mainly due to the fact that Christmas and many festivals and ceremonies fall within the dry season. Thus, high demand for live birds during this period and the need for households to consume poultry meat for celebrations affect the flock production potential and efficiency. This is complemented by a high predation rate on chicks, especially by carnivorous birds such as the black kite (*Milvus migrans*) and the Kestrel (*Falce tinnunculus*), as well as wild carnivorous mammals, because bushes are normally dry and open, reducing the extent of their camouflage effect on predators. During this time, many households normally apply multicolour dye.

Variations in village poultry flock size, entries (chicks and number of chicken bought-in, entrusted, or obtained as a gift) and exits (number of chicken sold, consumed, dead, and used as gifts, exchanged, or entrusted in other households) throughout the year are important indicators of the period when HPAI or other poultry disease outbreaks could affect the poor households in Nigeria. However, there is no household-level livestock survey data that contain information on village poultry flock sizes and flock structure during the rainy or wet season (April to October) and dry season across the country.

Table 3.5 Range of Average Poultry Flock Sizes in Nigeria

Zone	Chicken	Guinea Fowl	Ducks	Turkeys	Other Birds
North-East	9.0 - 16.0	5.0 - 10.0	3.0 - 12.0	2.0 - 20.0	
North-Central	9.0 - 16.0	5.0 - 10.0	3.0 - 12.0	2.0 - 20.0	
North-West	18.0 - 19.0	6.0 - 30.0	5.0 - 13.0	2.0 - 14.0	2.0 - 45.0
South-East	10.0 - 18.0			3.0 - 7.0	5.0 - 17.0
South-West	5.0 - 15.0	8.0 - 10.0	2.0 - 7.0	4.0 - 12.0	
South-South	9.0 - 177.0		3.0 - 55.0		

Source: NBS Livestock Survey, 2006

Contribution of Free Range Poultry to the National Economy

The contribution of village poultry in the national economy of Nigeria has been significant over decades. Akinwumi's et. al. (1979) work shows that family poultry contributed 61% and 19.5% to the total poultry meat and egg production, in Nigeria between 1977 and 1978, respectively. Also, evidence from Sonaiya et. al. (1990; cited in Sonaiya, 2007: 134) indicates that family poultry contributed 68.9% of the total poultry meat produced in the country. Recently, UNDP (2006) indicated that the total number of birds under village extensive and backyard semi-intensive/intensive production systems constitute about 70% of the total poultry population in Nigeria.

However, the exact contribution of sector 1 to the total poultry population in Nigeria could not be currently ascertained owing to some limitations already identified by Adene and Oguntade (2006). First, there is no information on flock structure and disease prevalence. Second, there is no poultry population data that could specifically identify the number of birds under village extensive system separately from the backyard intensive system. Thus, the available data (Adene and Oguntade, 2006) show that subsistence poultry population (probably under both backyard intensive and extensive management systems) in Nigeria compose of 52, 383, 612 chickens, 7,621,773 guinea fowls, 3,579,945 ducks, 469,583 turkey, and 1,214,669 other bird types.

Backyard Intensive Production (Sector 4)

Prior to Nigeria's independence, poultry production in the country was based mainly on the traditional system. In the 1950s, modern poultry production mainly suffered from deterrent from sociological attachments to all kinds of beliefs that prevented people from accepting poultry products, but as time passed it witnessed several other challenges (see figure 3.3). A typical backyard intensive poultry production common in Nigeria today emerged as a response to the increasing population growth and poverty in the country. Nigeria's economy has been dependent mainly on the oil sector for more than three decades. Before the 1970s, the various groups of people that currently made up Nigeria were largely farmers.

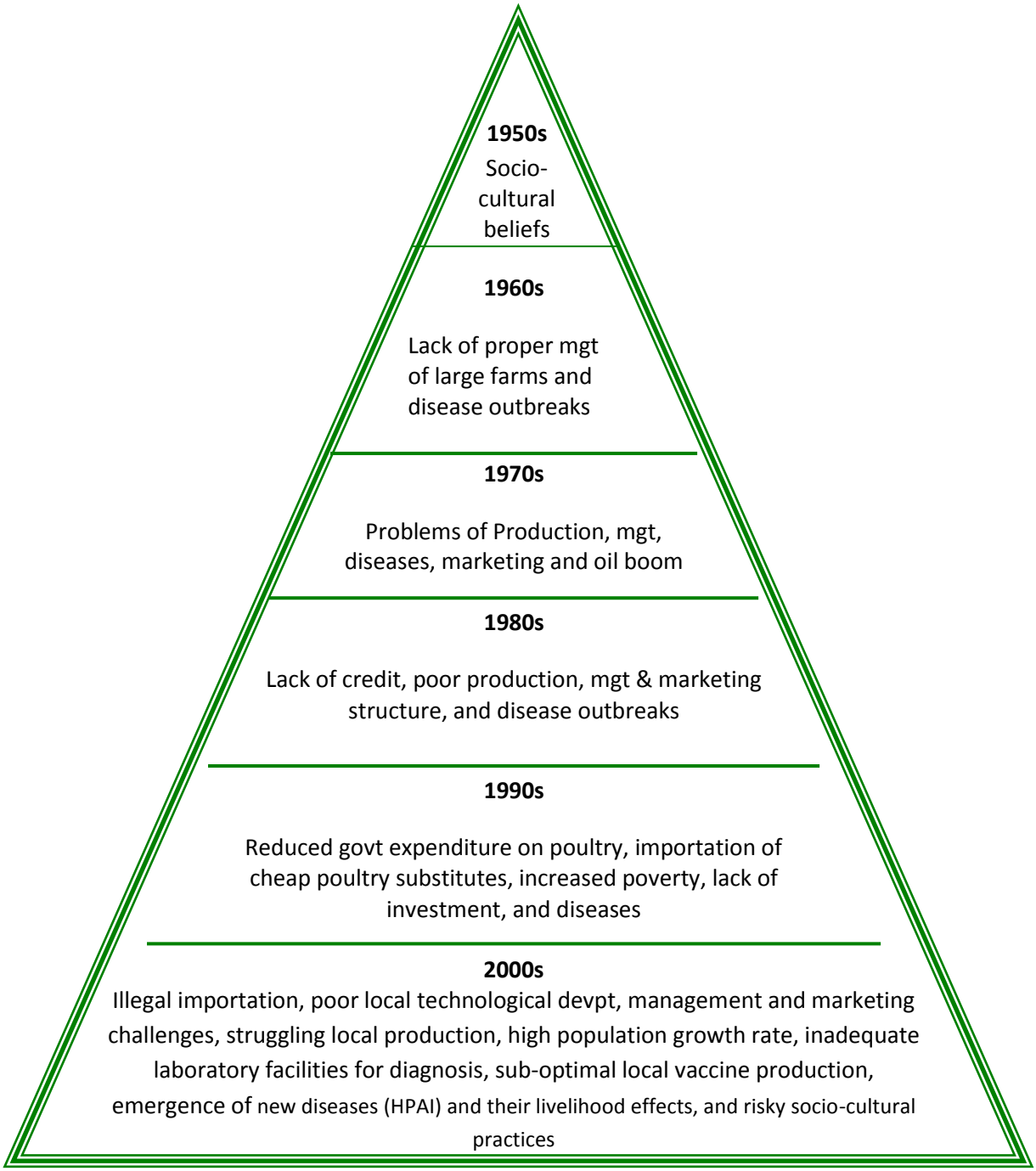
The country's economy was dependent on commodity markets exporting their agricultural produce to industrialized economies and importing the finished products. However, the emergence of the oil boom in the 1970s turned the majority of the agricultural labour force to non-agricultural sectors, changing the country to an 'import-dependent' economy, importing what it used to export. Although the consumer purchasing power responded positively to the oil boom era, rapid increase in poverty level emerged in the mid-1980s (NBS, 2005). In 1986, the average animal protein intake per capita per day was about 7.6g, while only 13.26g per day was estimated as the available protein for every Nigerian in the year 2000 (Okuneye, 2002). Both figures are less than the minimum animal protein per capita recommended by the FAO, which clearly shows that neglect of the agricultural sector could have negatively affected poor people the most since average consumption of eggs was 3kg per annum before the oil boom years (UNDP, 2006). This necessitated a return to agricultural production which was neglected due to oil boom as a focus for alleviating poverty in the country. The Federal Government of Nigeria (FGN) and many state governments initiated various poverty alleviation programmes focused on providing employment for millions of unemployed youths, especially the graduates of tertiary institutions since late 1980s (many of which were sponsored by the

international financial institutions such as the World Bank). Some of the more recent poverty alleviation schemes at the national level are the National Poverty Eradication Programme (NAPEP), National Directorate of Employment Poultry Farming Scheme and Agricultural Credit Guarantee Scheme. Each state also has public policy focused on reducing poverty, which are implemented through agricultural development in most cases.

Consequently, small scale backyard intensive poultry production became the most popular investment type among beneficiaries of various poverty alleviation schemes in Nigeria. The majority have been attracted because it is less capital intensive and very profitable. Many of the backyard poultry producers prefer broiler chicken production because of its rapid turn over. The projected profit per broiler in 2003 was N150 (or $1.18)[7] (Abiola, 2003). The flock size is small and usually ranges from 50 – 999 birds. Some new beneficiaries under the Ogun State Agricultural Development Programme (OGADEP) could be found keeping fewer numbers of birds (less than 200) as a take off stock. Apart from the unemployed, many private individuals participate in this sector investing in point of lay production, egg production as well as broiler production. This category of sector 4 actors includes small scale investors with and without expertise in poultry production. Those without formal education in agriculture usually attend various training programmes organised by both private and public institutions. Some randomly selected individuals interviewed at Agege LGA (Lagos State) confirmed that they were attending a training course at the Livestock Training Centre, Oko-Oba, with the aim of using the knowledge to start backyard poultry production, but the recent news of HPAI outbreak scares them from going ahead.

[7] An exchange rate of N127 to $1 US was used.

Figure 3.3 Challenges facing Nigeria Poultry Industry since 1950



Also, agricultural experts such as veterinary doctors (especially those working in the public sector) also keep backyard poultry for meat production. Usually, most investors use personal savings, cooperative society loans and family labour. A personal saving up to N150,000 has been regarded as a take-off capital for small scale broiler production. In a relatively large backyard farm (above 500 birds) owners sometimes employ at least one poultry attendant.

Backyard (intensive) poultry producers are widely distributed in the peri-urban areas. There is a considerable population of backyard farmers in the cities, but mainly located in the less-developed areas (or urban poor areas) where the house design creates the opportunity for keeping poultry in

the backyard. For example, the density of backyard poultry farms and markets for livestock inputs (feeds, drugs, etc) is very high in the Oko-Oba areas in Lagos State and the Oke-Aro areas in Ogun State. Hybrids or exotic birds are the main poultry species kept in backyard farms, but in a few cases, local birds form part of the flock composition. Some owners attributed high disease resistance as the major reason for keeping local birds because they serve as an insurance asset in case exotic birds suddenly become susceptible to diseases. However, the keeping of mixed species is a common practice among poorer backyard farmers who can only afford a stock of less than 100 birds.

Backyard farmers use domestically produced feeds compounded mainly utilising available raw materials in the agricultural product markets (maize, millet, offal, etc). A few farmers also add concentrates of nutrients, which are usually over diluted in order to minimise input cost. This reduces the amount of vital nutrients available to the birds and affects their immunity, making backyard birds more susceptible to infections such as Newcastle disease. The biosecurity level is low with only very few relatively large backyard producers consulting private veterinary experts. Many pseudo-expert veterinary practitioners operate in this sector. Such impostors charge cheap fees and consult for many farms per day, thus creating a certain level of risk for disease spread within the backyard production sector because they generally lack expertise and knowledge of biosecurity. It is surprising that even well educated backyard producers patronise these pseudo-experts and regard them as 'doctors'. Hence, cost rather than ignorance is one of the major reasons for high patronage of these incompetent 'doctors' in the backyard (intensive) poultry production sector in Nigeria.

The government sometimes provides agricultural inputs to supply to farmers and fishermen through farm service centres and primary distribution points. At the initial stages of various poverty alleviation programmes in the country, governments at all levels (local, state, and federal) were distributing poultry inputs to farmers either at zero or reduced costs in order to stimulate local production or prevent/control entry and spread of a disease. Generally, disease control policy in Africa has mainly involved the state's intervention through provision of subsidized inputs like drugs, disease-resistant breeds, vaccinations and funds. Poor farm households contest with one another and also with rich farmers in having access to these resources because oftentimes access to government resources depends on the complex relationship between those who administer the resources and those who received them.

Owing to the fact that variation in political asset endowment create constraint for some poultry producers from having adequate access to government resources, many backyard farmers depend on own-produced feeds, and inputs from markets and intermediary marketers or sales agents. Those households that engage in backyard point of lay production obtain their pullet chicks (0 – 18 weeks old) from commercial farms in sector 1 through their agents or middle men. In contrast, few exotic birds found in the village extensive system are supplied by backyard farmers. During the period of low sales, it is common to find many backyard farmers from rural-town areas using motor cycles to market growers and matured chickens in the villages. Generally, birds are sold in the live birds markets (especially through 'Alarobo') but households producing free range birds also participate in the same market to dispose off their pigeons and chickens for cash.

Poultry Production Inputs

Poultry Breeds in Nigeria

Various species of poultry can be found in the Nigeria poultry sub-sector. These include chickens (local and hybrid), turkeys (*Meleagrididae*), guinea fowl (*Numididae*), pigeons (*Columba livea*), ducks and geese. The commercial and small commercial farmers mainly keep the hybrids while local breeds are found mainly among the rural smallholders (village extensive management system), as has been elaborated in previous sections. The choice of flock composition is determined by the farmer's goal. Commercial farmers are usually interested in producing meat, eggs and day-old chicks. Therefore, they usually select breeds that can achieve this objective. In the cities where there are large commercial farming enterprises, improved breeds that produce more meat and eggs are mostly selected. In Lagos state for example, Marshall and Anak species of chicken are commonly found in large commercial, semi-commercial and backyard poultry farms because of their high meat production while Harco is chosen for its high egg yield. Light breeds are common among commercial farmers mainly involved in hatchery because they are good egg layers but are of low meat market value. In Osun State, Nera Black and Brown birds, as heavy breeds, command higher prices when sold as spent hens and are, therefore, most popular among semi-commercial farmers.

Hybrids of chicken (broilers, Layers, Cockerel, etc) are also found among free-range poultry flocks in Nigeria, but these are only chosen by a few rural households. The level of resistance to immunity, mothering ability and broodiness are the criteria upon which the free-range poultry flock composition is determined. Local (indigenous) breeds are more resistant to diseases and require less-intensive inputs. They have a good ability to mother chicks and therefore ensure sustainability of income or protein production for the owner. Smooth-feathered, multi-coloured native chickens are preferred among most rural farming households in Nigeria because their multicoloured feathers serve as a camouflage against predators like eagles (Sonaiya and Swan 2004). Hence, one or two multicoloured hybrid fowls with high egg or meat yield potential is/are sometimes found within a free-range flock. Some households may keep a female hybrid chicken among local males with the aim of cross-breeding and generating a mixed gene that is more resistant to diseases and has better meat production. The quality of poultry meat is also an important criterion for selecting poultry flock composition among rural smallholders. Some traditional poultry product consumers in Nigeria prefer local chicken to hybrids because they believe that the former have a better taste and aroma while the latter have a soft meat texture. This therefore increases the market value of local chicken and some consumers are willing to pay more. Owing to these attributed values, the difference in the village market price of local chicken and a hybrid in a few cases encourage rural households to keep more local breeds in the flock. Apart from this, rural smallholders are usually discouraged from keeping hybrids because of the additional management required. For example, chicks purchased from a hatchery require special starting feed and artificial brooding, which is expensive (Sonaiya and Swan 2004).

Although limited information is available on the genetic composition of local chicken in Africa, Kitalyi (1998) indicates that dwarf, naked neck, frizzle, silky, slow feathering, non-inhibitor, fibrio-melanosis, pea comb and blue shell are the predominant genes in the local fowl populations of Africa.

Feed Resource Types in Nigeria Poultry Production

The type of feeds used in poultry production is very important, as there is clear evidence that the production output is a function of nutrient intake (ter Horst, 1986). The village extensive or free range production system is a low output type because birds mainly depend on a scavengable resource base (SRB) within the community. A SRB is defined in Sonaiya and Swan (2004) as - 'the total amount of food products available to all scavenging animals in a given area, and this depends on the number of household, types of food crops grown, crop cultivating and processing methods, and climatic conditions that determine the rate of food products decomposition'.

In Nigeria, many villages are small, with less than 100 people practising mixed farming or mono-cropping. The farming practice determines the type of food available to the scavenging fowls. For example, in the southern part of Nigeria, cash crops like cocoa, oil palm, and tuber crops (cassava and yam) are commonly planted because of the prevailing long period of rainy season and the soil type. Village chickens mainly feed on succulent leaves, insects and food debris from households during the rainy season. Early dry season is, however, the harvesting period and as a result, oilseeds, and remnants from oil palm processing as well as cereal grains become available to scavenging birds. The type and the availability level of scavengable feed resources available to birds across zones in Nigeria are presented in Table 3.6.

Owners of scavenging birds usually supplement the feed during the rainy season with handfuls of cereal grains either purchased from the village market or purposely stored during the harvesting period. A recent study in Borno State shows that millet bran is the supplement most commonly used among households involved in village chicken production followed by food scrap (Abubakar, 2007). Decreased availability of scavengable foods during the rainy season forces households to provide supplements, a common occurrence in Africa. Muchadeyi's (2007) results show that the majority of households surveyed in Zimbabwe gave supplements between May and July (74%) while 20% provided supplements to their birds throughout the year. Feed supplements are usually given to birds in the morning, and in some cases between 1400 and 1700 GMT, before the birds finally rest.

Meanwhile, various strategies have been utilised among rural households in Nigeria to ensure that a wide range of feed resources are available to scavenging birds. In the northern part of Nigeria, cereals like maize, sorghum, millet, etc. are mainly planted during a short rainy season, and thus there is a low availability of grains to the scavenging birds during this period. However, the Fulani have utilised the integrated-farming approach (Sonaiya and Swan, 2004) by rearing chickens with cattle in an extensive system. While the cattle feed on the available grass and hay, the chicken feed on ticks on the cattle as well as maggots in their dung.

In the backyard intensive production system, flock is fed with a combination of feeds purchased from feed mills and shop outlets. Feeds from these sources usually contain a balance of nutrients (proteins, vitamins, and minerals). Balanced feeds are expensive and as a result the smallholders usually produce feeds themselves using locally available inputs. Most backyard farmers produce their feeds using a mixture of local materials, like corn and bone meal only, or in combination with oyster shell, fish meal, and wheat offal. Concentrates of minerals and drugs such as vitamins, Lysine, salt, Methionine, Premix, Full Fat Soya, coccidiostat, etc. are usually diluted and added to the mix. Coccidiostat is added as a drug against Coccidiosis. Wheat offal is not included in the feed mix by

some farmers because of the notion that it reduces chicken production output. Concentrates are mainly imported into the country through the input providers in the commercial sector 1.

Table 3.6 Available Feed Resources for Free Range Poultry across Geopolitical Zones in Nigeria

Feed resource	Northwest	Northeast	Southwest	Southeast
Energy				
Cassava by-products	RQ	RQ	AB	AB
Cocoyam			AB	AB
Irish potato		RQ		
Jack bean				RQ
Oil-palm by-products			GQ	AB
Sweet potato	GQ	GQ	RQ	A
Protein				
Fish offal			RQ	RQ
Shea butter waste	GQ	GQ	RQ	A
Shrimp head			RQ	RQ
Energy and Protein				
Brewer's grain	A		AB	RQ
Cashew			A	GQ
Cottonseed	GQ	GQ	A	A
Cowpea	GQ	GQ	RQ	RQ
Grain by-products	AB	AB	GQ	GQ
Groundnut	GQ	GQ	RQ	RQ
Lablab	RQ	RQ		
Melon			RQ	
Pigeon pea		RQ		
Rubber seed			RQ	
Sesame seed		RQ	A	RQ
Soybean	RQ	RQ	RQ	RQ
Sunflower seed	A	A	A	A
Minerals				
Limestone	RQ	RQ	RQ	RQ
Oyster shell			RQ	RQ
Periwinkle shell			A	GQ
Vitamins				
Rice by-products			RQ	RQ
Wheat offal	A	A		

Source: Sonaiya, 1995; Keys: A: Available; RQ: Reasonable Quantity; GQ: Good Quantity; AB: Abundant.

Commercial farmers obtain their feeds from both local and international sources. Many sector 1 operators have their own feed mill and have been referred to as the integrated feed millers (Adene and Oguntade, 2006). These farmers do not produce feeds for supply into the market, but instead mainly for their own operational consumption. Another common group in feed production in the country is the toll millers who do not package processed feeds into the market but only mill ingredients for poultry farmers for a fee, and thus are usually located within the surroundings of livestock farms. The third group are the commercial feed millers who have a relatively large production capacity and modern technology (such as pelleting machines, roller mills/flakers, bran mixers, corn grinders, bagging units, and automation). They formulate, compound, and package feeds for sale to farmers in all poultry sectors. Their products include Chicken Mash, Grower Mash, Layer Mash, Broiler starter, Broiler Finisher, Turkey starter, Turkey grower and Turkey Finisher, which contain different concentrations of various nutrients essential for normal growth and

development in birds. The feed are packaged in bags of 25kg and 50kg. Available information from the Highlight of Activities of the Osun State veterinary services department show that the average price of a 25Kg Turkey starter in the State was N1,000 in 2006. Many backyard farmers (with less than 100 birds) are usually unable to afford a bag of poultry feed and thus liaise to share with other small scale farmers. This has actually created a market for small scale feed sellers in livestock markets. Many individuals use personal savings to purchase bags of feeds and sell to backyard producers at a per kg rate or using local measuring equipment. Most of these feed retailers do not have shops, but sell from house to house or by displaying the feed in a live bird market.

Housing & Technology (Watering, Feeding, Heating)

Among poor households in urban areas and towns, owners usually enclose their birds at night as a strategy to protect them from theft and predators. Also, some households create a portion of their house or shelter for keeping birds at night while others use handmade baskets to enclose the chickens. In some cases, owners simply allow these birds to share the same room with them at night. There is an indication that the mud/thatch is the most common poultry housing type in some villages in northern Nigeria.

In the backyard intensive system, most farmers use cages of various sizes and designs, which depend on four basic poultry housing requirements (space, ventilation, lighting, and protection from weather and predators). Many commercial farms in Nigeria use tropical intensive open-sided deep litter housing with a large area (at least 150m x 275m) that can contain 5,000 laying hens at a stock density of 3 birds/m^2. The space available in a housing unit determines the number of birds that can be kept. Some semi-commercial farmers make use of smaller deep litter housing systems while a few backyard farmers utilise a free-range method coupled with some cages. Buildings in commercial systems are usually installed with open sides to allow air flow to the birds. Many buildings where backyard poultry production is practiced in the cities lack such ventilation units, as the buildings were originally designed for residential purposes. As a result, backyard farmers also make use of wire-netting for providing cross-ventilation at the bird-level.

More sophisticated, environmentally improved and fully automated facilities are employed in commercial poultry production in the country. 'Hi-tech facilities such as automatic feeding, watering, manure scrappers and egg collection systems can be found in commercial farms (UNDP, 2006). Nipples, water through and deep litter bell-shaped types of drinkers are mostly used in both commercial and semi-commercial sectors, as well as in some backyard farms with relatively large flock sizes. Bedding materials commonly used for reducing reflected heat from the floor and for making perches include wood savings (especially in semi-commercial farms) and maize cups (in rural-town backyard farms). The use of wood savings is most commonly found in deep litter housing systems. Sources of lighting mostly utilised in the Nigerian poultry sub-sector are electricity, lantern, stove, and charcoal pots, especially in brooder houses.

Annual Poultry Production Capacity in Nigeria

As already noted, many of the data on the Nigerian poultry sub-sector are old and even recent, available data lack comprehensive information that could be utilised in establishing the exact annual

poultry production capacity in the country. Available data from the CBN (2002)[8] are presented in Table 3.7. The table shows that the sub-sector produced 107,000 tonnes of poultry meat in 2002. It has also been estimated that the country produced 4 million tons (carcass-weight equivalent) of poultry meat in 2004-2005, representing about 17% of the total meat consumption during this period (FGN, 2007).

However, a more realistic attempt to estimate the annual poultry production in Nigeria has been made by Adene and Oguntade (2006). Based on the assumption of resource optimal utilisation, they employed pre-HPAI outbreak data[9] on grandparent stock import (79,000) and parent stock (1,632,400) to arrive at approximate annual production capacity.

Table 3.7 Estimated Poultry Output (tonnes)

S/N	Poultry Meat	Eggs
1998	77,000	436,000
1999	82,000	450,000
2000	88,000	465,000
2001	95,000	487,000
2002	107,000	514,000

Source: Abiola (2003)

It was reported that Nigeria has the capacity to produce 40,740 tonnes of dressed culled layers, 96,980 tonnes of dressed broilers and 8.2 billion eggs annually. However, this information has limitations. It does not generally include the productivity in the rural poultry sector, where the majority of the DOC inputs are local breeds. Nonetheless, village chicken poultry production in Nigeria suffers severely poor growth in productivity due to low inputs. Newcastle disease is one of the major constraints to rural poultry production in the country. Apart from this, exposure to uncontrolled environmental conditions reduces the chick production rate for local layer hens. Many of the eggs in a clutch spoil and only few finally get hatched due to an inappropriate environmental temperature. Also, in many cases in Nigeria more than 50% of eggs from village chickens become spoiled before reaching the market or the customer's kitchen (UNDP, 2006).

Poultry Trade

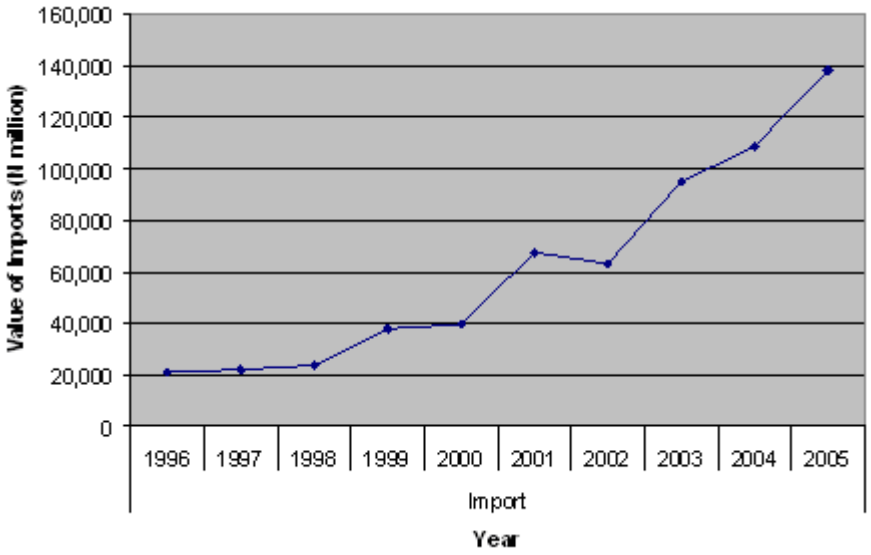
Trend of the Import and Export of Poultry Products

In the overall economy, importation is an important aspect of trade in the country as most of the consumer products are usually imported from Asia, other African countries, Europe and United States. Until 2002, when the FGN placed a ban on the importation of poultry and poultry products, importation had been a very significant source of inputs (D.O.C, equipment, feed concentrates, drugs, vaccines, etc) and poultry products (such as frozen chicken, frozen turkey, etc) in the Nigerian poultry sub-sector. Figure 3.4 shows that the number of imported live animals and animal products into the country has been on an increasing trend since 1997, except for a slight decrease in 2002.

[8] CBN Annual Report (Derived from data complied by formerly Federal Office of Statistics (or now NBS) and FAO production year book)
[9] They obtained the data from PAN

The interest of the present government in changing Nigeria's economic structure from an import-based economy to an export-based economy makes a review of the trade balance (total exports minus total imports) an important aspect in this study. Various types of commodities, including live poultry, fresh meat, live fish, etc., are imported into Nigeria from several countries across all continents. Only a small number of items are exported from Nigeria, and these are mainly mineral and petroleum-related products. Meanwhile, the trade balance has been increasing since 2002, which can probably be attributed to the efforts of the government to improve agricultural and manufacturing sectors in order to stimulate exportation in the country, as well as the increased amount of crude exports between 2003 and 2005.

Figure 3.4 Importation trend of live animals and animal products in Nigeria (N million)



Source: NBS (2006a)

One example of such efforts by the government is the compensation and reduced tariff given to anyone exporting from the country through the Export Promotion Council. However, these figures do not indicate that the growth in exportation of agricultural products, especially poultry, has manifested because even after the 2002 poultry ban the government still struggled in keeping out illegal importation (most importantly from border areas of neighbouring countries like the Republic of Benin). It shows, rather, the dependency of the economy on minerals and oil exportation.

Table 3.8 Trade Balance in Nigeria (N million)

Year	Export	Import	Balance
2002	2,239	1,054	1,185
2003	3,109	1,923	1,186
2004	5,137	1,576	3,562
2005	6,621	1,780	4,842
2006	7,555	2,922	4,633

Source: NBS Nigeria Foreign Trade Summary, 2003

Available evidence indicates that the exportation of poultry products from Nigeria has not been significant over the years. Data that has been gathered show that the country exported only live fowls of the species Gallus domesticus (weighing > 185g) of value N79,000 between 1995 and 2005 (NBS trade statistics by commodity) and only 4,355kg of net weight skins and other parts of birds (excluding feathers for stuffing; down) worth N15, 331,800 in 2006 (Table 3.9).

Table 3.9 Imported and Exported Poultry Products in 2006

Commodity	Country of Origin	Net Weight (Kg)	Value (Naira)
Importation			
pig/poultry fat, not ren./ ext.fresh/chilld/frozn/saltd/smoked	GERMANY, F.R	433	57,122
dried egg yolks	UNITED STATES	21,040	17,128,390
birds' eggs, not in shell (excl. dried)	UNITED KINGDOM	4,100,000	14,270,198
Exportation			
Skins and other parts of birds (excluding stuffing; down)	ITALY	4,355	15,331,800

Source: NBS, Nigeria Foreign Trade Summary (January – December, 2006)

Owing to the trans-boundary significance of HPAI, the countries from which commodities are imported from are also an important consideration. For example, in 2003 Nigeria imported 2634 kg net weight of live birds (poultry input) from the United Kingdom and 350 kg from Hong Kong, two of the countries where HPAI outbreaks have occurred. Many poultry and other animal products (see Tables 3.9 & 3.10 for a list) are imported from Asia, which is presently the centre of HPAI concern.

Nigeria imported 4,000 kg of egg yolks from Singapore, 24,100 kg of frozen fish from Indonesia, 2,034,243 kg of frozen fish from Taiwan, and 43365 kg of smoked fish from Bahrain in 2003. Again, presently implemented HPAI mitigation and control strategies that involve surveillance and disease control strategies like containment require a proper collaboration with neighbouring countries so as to prevent the trans-boundary movement of the disease in Africa. Nigeria imports products of animal origin from a majority of its neighbours like Ghana and Cameroon (Table 3.10), and these trading activities continue. A total of 415,578 kg of poultry products (live birds, meat and eggs) worth N5, 536,583,019 was imported in 2003. Hence, it is important that the federal government of Nigeria review its regulations and improve its quarantine control facilities and international control posts in order to accommodate the HPAI control policy in the country.

Table 3.10 Importation of Poultry Products by Country of Origin in 2003

Commodity	Country of Origin	Net Weight (Kg)	Value (Naira)
Live Birds			
Live fowls of species Gallus domesticus., weighing ≤ 185g (chicks)	NETHERLAND	105	1,130,675
Live turkeys weighing ≤ 185g	NETHERLAND	252	1,448,668
Live fowls of species Gallus domesticus., weighing > 185g but < 200g	EGYPT	896	1,695,235
"	CHRISTMAS ISLAND	185	1,753,779
"	FRANCE	1,478	8,986,979
"	GERMANY, F.R.	2,415	9,806,089
"	ISRAEL	315	3,441,125
"	NETHERLANDS	942	5,622,699
"	SWITZERLAND	1,294	1,087,266
"	UNITED STATES	123	1,119,847
"	DOMINICAN REPUBLIC	1300	2,008,447
"	HONG KONG	350	644,749
"	UNITED KINGDOM	2634	17,024,174
Meat			
Frozen whole chickens	BELGIUM	51255	3,114,681
	GERMANY, F.R.	19,746	3,187,329
	ITALY	1,300	1,958,296
Frozen cuts and offal of chicken	UNITED STATES	21,033	2,049,162
	BELGIUM	47,388	2,923,255
	NETHERLANDS	183,620	7,660,088
Fresh whole turkeys	NETHERLANDS	9,504	608,244
	UNITED KINGDOM	1,000	247,885
Frozen whole ducks, geese or guinea fowls	ITALY	1300	1,958,296
Fresh/Chilled cuts & offal of ducks, etc (excluding fatty livers)	ITALY	52,558	5,455,719,275
Frozen cuts & offal of ducks, geese or guinea fowls	UNITED KINGDOM	2,000	140,868
Egg/Egg Product			
Egg yolk (excluding dried)	SINGAPORE	4000	807,719
Birds' eggs, in shell, fresh, preserved or cooked	EGYPT	1025	172,356
	UNITED STATES	7560	265,833
	Total	41,5578	5,536,583,019

Source: NBS, Nigeria Foreign Trade Summary (2003)

Table 3.11 Some Statistics on Importation of other Livestock Products by Country of Origin (2003)

Other Livestock Meats			
Fresh or chilled boneless bovine meat	South Africa	17000	915,950
Fresh or chilled unboned meat of sheep	United Kingdom	7772	234,738
Frozen edible offal of sheep, goats, horses, etc	United States	98556	10,830,204
Fresh, chilled, or frozen meat and edible offal	Togo	4500	1,339,104
Fish & Crustacean			
Fresh or chilled sardines, brisling or spats	China	19776	6,054,426
Fresh or chilled mackerel	Namibia	522990	25,758,566
‘’	South Africa	318912	19,414,216
Frozen sardines, brisling or spats	Singapore	800000	51,299,099
Frozen mackerel	Ghana	501792	30,271,432
Frozen fish	Cameroon	50600	3,223,111
‘’	India	1427	10,852,566
‘’	Indonesia	24100	1,826,451
‘’	Taiwan	2034243	234,729,290
Smoked fish (excluding salmon and herrings)	Bahrain	20930	6,678,238
	China	232110	75,880,027
	Togo	15189	5,670,900
	Taiwan	11070	3,833,298
	Indonesia	43365	25,201,764

Source: NBS, Nigeria Foreign Trade Summary (2003)

With a rapid spread of HPAI across many states in Nigeria within a year of its emergence, it is also important to review the distribution of trading activities across the zones. This may provide an understanding of the level of risk associated with entry of trans-boundary animal diseases through importation across all the borders in the country. Most of the importation activities took place in the south-west (Lagos) and south-south in 2006. Throughout this year, KATSINA COLLECTION contributed only 0.01% and 0.03% to the total import and export in the country, respectively (Table 3.12).

Table 3.12 Percentage of Total Trade Value by Ports across North and South Zones (2006)

Port	Exports (%)	Imports (%)	Total Trade (%)
South-West			
APAPA PORT	88.79	35.32	73.76
IDIROKO BORDER STATION	0.13	0.06	0.11
KIRIKIRI LIGHTER TERMINAL CM	0.01	11.54	3.24
Mohammed Murtala Cargo	0.00	2.27	0.64
Ogun State	0.01	4.37	1.23
SEME BORDER POST	0.00	0.43	0.12
Tin Can Island	0.42	32.37	9.37
Tin Can Island Port	0.00	0.06	0.02
LILYPOND PORT	0.00	1.52	0.42
PAN ATLANTIC	0.00	0.01	0.00
South-South			
CALABAR PORT	0.00	0.34	0.10
WARRI PORT	5.57	1.97	4.59
PORT HARCOURT (1)	4.04	1.71	3.41
PORT HARCOURT (2)	0.02	1.15	0.33
PORT HARCOURT (3)	0.82	6.21	2.33
North-West			
KADUNA COLLECTION	0.00	0.00	0.00
KANO AIRPORT	0.16	0.15	0.16
KATSINA COLLECTION	0.01	0.03	0.01
North Central			
ABUJA AIRPORT	0.02	0.51	0.15
	100.00	100.00	100.00

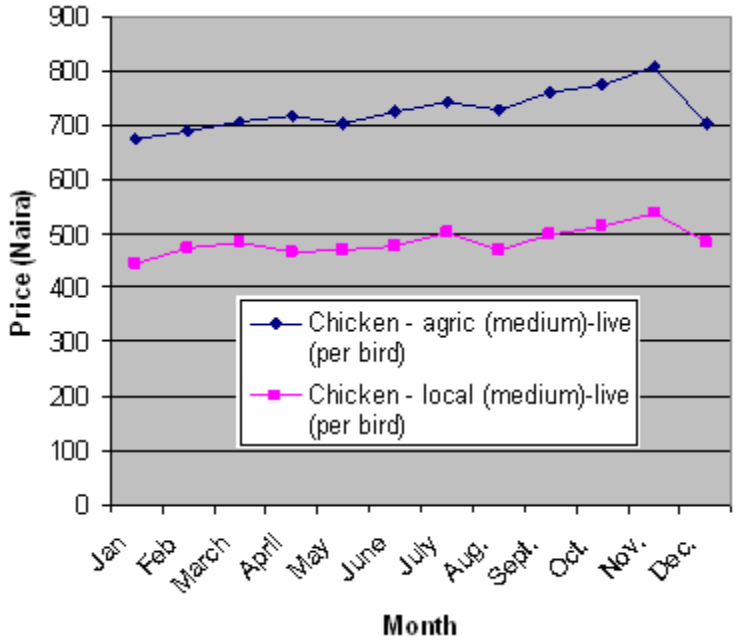
Source: Source: NBS, Nigeria Foreign Trade Summary

Markets and Marketing in the Poultry Sub-sector

Live Birds Markets and Prices of Poultry Products

The livestock market is available in most peri-urban areas and in the cities. Usually, segregation according to livestock species exists in live animals marketed across the country. It is common to find a market for live, small ruminants (goat, sheep) separate from cattle and poultry markets. Mixed livestock products (beef, mutton, goat meat and poultry meat) are mainly found in the meat section of major markets across the country. Live bird markets in Nigeria are of traditional structure in which poultry and poultry products are displayed in an open system (e.g. Abubakar Rimi market in Kano State). In major cities and rural-town areas, growers, live matured chicken, turkey and ducks are usually displayed in wooden cages in shops or bus-stops along major streets (e.g. Onipanu bus-stop on Ikorodu Road). Farm gate sales of egg and live birds are common among semi-commercial poultry producers.

Figure 3.5 Trend in urban poultry price in Nigeria (2005)



Generally, in live bird markets birds are displayed in raffia baskets (most cases) and in wooden cages (urban areas). In some cases, one section of a major market is also segregated for live bird sellers. This is the case in the Ikotun market in Lagos. Retail sellers obtain day old chicks through sub-agents while matured birds are mostly sourced directly from backyard intensive and small commercial producers. Also, backyard farmers sell their products directly in the live bird markets or from their shops, especially during a festive period. Villagers mainly sell their birds during festive periods in order to obtain cash needed to acquire other household needs for the celebration. Apart from this, the decision to sell household chickens is stimulated by several reasons, such as large flock size, individual cash need old or non-productive hens, etc. Egg marketing and sales, on the other hand, is not left to live bird markets alone, but is a popular economic activity among rural village traders and urban petty traders. Frozen poultry meats are usually sold by some small scale meat shop owners in rural–town areas. In the urban centres, processors of fresh or frozen poultry meats usually obtain their products from farm-gate and distributors or agents of commercial producers. These include hotels, modern restaurants and fast foods companies.

Table 3.13 Average Poultry Meat and Egg Prices in Nigeria (Naira)

Year	Local Chicken (per bird)	Guinea Fowl (per bird)	Exotic Chicken (per bird)	Duck (per bird)	Exotic Turkey/ Turkey (per bird)	Frozen/ Dressed Chicken (kg)	Eggs (per crate)
1991	42	38	47	70	258	47	
1992	55	52	69	64	528	58	
1993	95	87	106	111	1,021	103	
1994	125	107	202	151	1,165	147	
2001	424	335	395		3,000	327	298
2002	356	390	498		3,741	369	346
2003	404	395	650	576	4,590	403	356
2004	521	418	790	583	4,589	477	408
2005	508	422	690		4,373	475	403

Source: FDLPCS 1994 Livestock statistics; Adene and Oguntade (2006)

Table 3.14 Average Meat Prices in Nigeria (Naira/Kg)

Year	Beef	Mutton	Goat Meat	Pork	Camel Meat
1991	25	22	21	22	20
1992	41	37	36	35	20
1993	70	61	61	50	-
1994	99	83	86	-	-
2001	296	251	292	250	
2002	349	317	330	273	
2003	394	335	375	272	
2004	356	328	318	269	
2005	433	350	382	273	

Source: FDLPCS 1994 Livestock statistics; Adene and Oguntade (2006)

Available data show that poultry products are relatively costlier than other livestock protein. The national average price of 1 kg of dressed chicken in 2005 was N475, compared to N433 for 1kg of beef in the same year (Table 3.13 & 3.14).

There is evidence that prices of poultry products in urban areas are usually higher than the national average. It is also discernible from the data that poultry prices are usually lowest in the late dry season (Jan – March) and normally increase during the rainy season (April –October). The highest price of poultry products is obtainable in November of every year, which is obviously due to the anxiety about Christmas season. However, the emergence of HPAI in 2006 has resulted in significant decrease in prices of poultry products with a resultant increase in prices of other livestock products (Obayelu, 2007).

4. Detailed Review of the Poultry Sector and Biosecurity

An overview of the poultry sub-sector and a detailed analysis of the poultry production systems have been described in section 3. This section describes various actors in the poultry sub-sector, their activities and how these activities relate to biosecurity and management practices in Nigeria. Biosecurity (bio-exclusion and bio-containment) encompasses a set of principles that limit the spread of disease causing organisms, which when combined with disinfection and sanitation procedures can eradicate or reduce pathogens to non-infectious levels. It is essentially a defensive health plan against poultry diseases that have the potential for reducing the magnitude of important factors associated with the transmission of these diseases ((e.g. basic reproductive number (R_0), period of infectiousness and probability of transmission)).

Although biosecurity is a private preventive investment constituting a necessary production input for each farmer, it has been recognised that poor biosecurity is a public bad because inadequate investment by a single farming agent increases exposure of other farmers within a susceptible region (Gramig et. al., 2005; Beach, 2007). Improved bio-security in poultry production and trade is not only an important longer-term strategy to guard against the damaging effects of HPAI, but also a complicated intervention that requires understanding of the entire market value chain. This aspect is very critical to the case of HPAI in Nigeria because poor bio-security practice in poultry production (Fasina, 2007; Monne et al., 2008) constitutes a considerable level of threat to other operational sectors. There are many challenges for bio-security in Nigeria in view of the structure of the poultry industry which consists predominantly of village scavenging poultry and/or family poultry with little or no bio-security, while peri-urban and urban commercial poultry production has minimum to moderate bio-security. The important bio-security concerns in Nigeria are the constant introduction of new birds from relatively unknown and unverifiable sources, rearing flocks of different species, exchange of inputs and poultry products among various actors within the sub-sector, uncontrolled and unregulated movement of poultry and poultry products as well as close contact between poultry and the people. In the live bird markets there is co-mingling of different species from different sources under poor sanitary conditions. All the enumerated factors above create a favourable environment for the transmission and spread of HPAI in the country. A recent study by Monne et al., 2007 suggested that an AI virus (H5N1) with new genetic characteristics has emerged in less than 7 months and is widespread in Nigeria. Therefore, there is need to improve biosecurity measures to prevent spread of the virus. This re-iterates the importance of understanding the activities of each category of actors in order to inform Pro-poor HPAI control policies, strategies and studies in Nigeria.

Actors in the Poultry Sub-sector

There are many actors in the poultry sub-sector ranging from the actors involved at the peak foundation level that breed grandparent and parent stock to those at the support service level such as feed mill, live bird marketers/ retailers involved with the industry at both formal and informal sectors. The following section discuses the role of the various categories of actors in the Nigeria poultry sub-sector according to the production system, facility type, types of poultry species kept, nature of services provided, and their number and distribution across the country.

Breeding (Sector 1)

Around one dozen primary breeding companies supply the breeding stock from which almost all the commercial poultry meat (broiler and turkey) and table eggs are derived world-wide. In Nigeria, pedigree pure lines and great grandparent stock are not available but the apex sector actors (Sector 1-Industrial Integrated) possess grandparent and parent stock that serve as the foundation to the entire commercial production sector. These are slightly more than a dozen in number and fully vertically integrated with joint venture links to Europe. The typical species are heavy and light breeds of the grandparent stock and the broiler and layer (black and brown) breeds which include Black (Nera and Harco), Isa (Brown, Amo Brown, Swiss Brown and Babcock), Hyaline (White) layers and White Broilers (Anak, Abor and Cobb). GPS and PS are typically housed in tropical intensive open sided deep litter housing. In some instances, the housing includes incorporation of ventilators, foggers and cooling pads to ameliorate unfavourable weather conditions. The all-in-all-out system of management is practiced with high biosecurity. Preventive medication by use of coccidiostats and anthelminthics administered by trained in-house veterinarians and a rigorous established vaccination regimen are targeted to achieve vertical integration/transfer of immunity for major poultry diseases. The major products range from parent stock DOCs and commercial DOCs (layer and broiler).

Table 4.1 Breeding stock available in Nigeria and their production capacity

Production Type	*Capacity
Pedigree pure lines	Not present in Nigeria
Great grand parents	Not present in Nigeria
Grand parents	79,000
Parents	
Layers	640,350
Broilers	974,050

*Capacity based on estimates by Adene and Oguntade 2006

Commercial sector (Sectors 2 &3)

The number of actors in this sector is not available although the World Bank AICP project in Nigeria is currently undertaking poultry farm registration across all states in the country, but the activity has not yet been completed. Adene and Oguntade (2007) presented an estimate stating that over 65% of Nigeria's commercial poultry is located in the 5 states of Lagos, Ogun, Oyo, Oshun and Ondo; while another 25% is based in south-south and south-east geo-political zones. The remaining balance of 10% or less is based in the 15 north-central, north-west and north-east states. This is, however, subject to backing by a comprehensive survey or the outcome of the current farm registration exercise by the AICP project. The majority of the operators in this category are either satellite for Sector 1 companies for marketing products and surpluses or stand alone operators that compete with Sector 1 companies for market share. The number operators in the sector are also small compared to those in Sector 3 and are mostly independent farmers who buy DOCs from Sector 1 hatcheries. The breeds are typically a reflection of the Sector 1 actors that provide the foundation stock in Sector 1. The housing is an open sided, wire-meshed deep litter system but with a different biosecurity compliance between the Sector 2 and 3, which is low in Sector 3. The veterinary health care delivery is administered by veterinarians who may be on a full time (most of Sector 2) or

consultancy basis (Sector 3). Sector 3 actors also patronise para-vets and sometimes agrovets and other unqualified personnel in order to cut the cost of production.

Table 4.2 Commercial Sector Actors

Types	Breeds	Enterprises	Location of enterprises
Parent stock (PS)	Layer: Black (Nera and Harco), Brown (Isa, Amo, Swiss and Babcock), White (Hyaline); Broiler: Anak, Bor and Cobb	PS DOC, Broiler DOC, Pullet DOC, POL Pullets,Cockerels, Emus, Frozen chiken, Dressed chicken, Processed chicken, Table eggs, Drugs, Feed concentrates	Ogun, Lagos, Oshun, Oyo, Kaduna
Hatchery	Lohman, Bowan, Rhode Island red, Yaffa brown, Olympian black Nera, Amo, Swiss, Babcock, Anak broilers, White and Black cockerel	Pullet DOC, POL Pullets,Cockerels, Table eggs, Drugs, Feed concentrates	Lagos, Ibadan (Oyo), Abeokuta (Ogun) Ife (Oshun), Kaduna, Jos (Plateau)
Rearing Broiler Production	As above Anak, Hybro, Rose, Bor and Cobb	As above Live and Frozen broilers, Dressed broilers	Nationwide Nationwide but mostly South-West, South-East and South-South
Layer Production	Lohman, Bowan, Rhode Island red, Yaffa brown, Olympian black Nera, Amo, Swiss, Babcock	Dressed culled layers, Eggs, POL Pullets, Live spent layers	Nationwide but mostly South-West, South-East and South-South

Support Service Actors

Under the support service actor category, the key players are the feed mills, poultry meat processing plants, vaccine producers and to a lesser extent the specialised poultry veterinarians. Others in this category, which include transporters (feed, DOCs and eggs) and many poultry slaughter facilities in live bird markets, operate under an informal sector arrangement.

Feed mills

Feed mills in Nigeria are of different types which include custom, toll and integrated farms. Poultry feed accounts for approximately 98% of the total feed produced in Nigeria. The few commercial custom feed millers control about 50% of the over 1 million metric tonnes of poultry feed produced in the country, compared to control of about 70% of the market in 2001. This has been largely due to medium to large scale farms buying mostly premixes to produce their own feed and the growing number of small scale producers using the services of toll millers to reduce costs. The toll millers are many and widespread across different locations in Nigeria and usually compound feed for poultry farmers for a fee. The toll millers operate under poor conditions without regard for bio-security measures. Inputs such as grains are sourced from mostly from the northern parts of Nigeria through merchants with established networks for aggregating grains from the smallholder farmer with good knowledge of the logistics of grain transportation across the country. The grain collectors and

merchants are another category of informal actors indirectly involved in providing support service. Other inputs like fish meal, lysine, methionine, soy meal etc are imported from other countries, mostly in Europe. Some of the custom feed millers are also linked to multinational franchises in European countries and market their products using various brand names. There is also a backward integration of oil and flour mill by-products by the top five actors in the industry. The table below summarises the major custom feed millers in Nigeria.

Table 4.3 Major feed industries in Nigeria

S/NO	Company	Metric Tonnes (MT)	Value 000,000	Market Share %	Remarks
1	Top feed group (Formally Seepc & Top Feeds)	120,000	4.2	12	Multinational, Market leader in the industry, Access to foreign raw materials input, Backward integration of flour mill by-product.
2	Vital Feeds (UAC group)	60,000	2.1	6	Adequate funding, Technologically advaced milling facility, Backward integration of oil and flour mill by-products
3	Animal Care	60,000	2.1	6	Indigenous animal health, production and feed industry player, Major importer of vet & human health products and micro-ingredients from India, Possess professional and technical capabilities.
4	Bendel Feed & Flour Mills (BFFM)	60,000	2.1	6	Multinational, Backward integration of flour mill by-products, Access foreign inputs and micro-ingredients
5	Feed Masters Ltd	18,000	0.630	2	Indigenous, Professional & technical capabilities, Flexible production facility (mash/pellets), Strong marketing/technical support, No backward integration
6	ECWA feeds	18,000	0.630	2	Indigenous, Professional & technical capabilities, Strong marketing/technical support, No backward integration
7	Amobryang	18,000	0.630	2	As above
8	Livestock feeds	18,000	0.630	2	As above
9	Boar Feeds	18,000	0.630	2	As above
10	Ayokunle Farms	35,000	1.23	3	As above but with backward integration
11	Obasanjo Farms	45,000	1.675	4	As above but with backward integration
12	Zartech Farms	45,000	1.6	4	As above but with backward integration
13	Others (Toll Millers, Farms, etc)	500,000	17.5	49	Toll millers control 25% of market share, Unprofessional practice, No bio-security measures. Others (24%) include self feed millers on-farm
	TOTAL	**1,015,000**	**36.0**	**100**	

Source: Feed Masters Ltd, Kaduna

Other Support Service Actors

Transporters

The actors in this category include the transporters of feed, DOCs and other poultry products, poultry meat processing companies and poultry vaccine producers. Transportation of poultry

products and feed is mainly by road. Occasionally, DOCs are air freighted to long distances. For the feed industry, some big customized feed producers have their own vehicles for freighting feed to long distances but these are usually not very convenient for the small holder poultry farmers trying to reduce the cost of production. Usually, there are a group of transporters that hang around the feed mills and make their trucks available to farmers for an agreed fee. Again these transporters do not observe biosecurity measures and move from one farm to another to take delivery of feed, thereby constituting a biosecurity concern. For the DOCs and frozen chickens, the big hatcheries transport day old chicks with appropriately designed vans while the frozen chicken are usually transported by processors to their sales outlets, supermarkets and major customers in cool vans and refrigerated trucks. Otherwise, other types of vehicles (cars, buses, truck, motorcycles, etc) are used. The retailers use all types of vehicles to transport live birds which are put in plastic and cane basket cages or even without any form of cage but just the legs tied together as a form of restrain. The table eggs are packed in crates, stacked in cartons loaded directly into the vehicles and transported. A recent AICP survey indicated that bird transportation is carried out in vehicles that could be closed or open and transported either alone (53%) or along with humans (47%). The same study also estimated that 2 million birds are available for sale in the markets all over Nigeria on a daily basis. The actual numbers and statistics of the actors in these categories are not available, but their activity cut across all parts of the country.

Abattoirs

There are designated abattoirs in major towns and cities across Nigeria, but they predominantly slaughter large animals such as cattle, sheep, goats and camels. Very few abattoirs exist that specialize in poultry. In most cases, it is the large-scale poultry farms that process their table birds into frozen chicken, chicken and turkey parts. Industry experts indicate that about 90% of broiler production are slaughtered, processed and sold as frozen chicken, while the rest are sold live in the bird markets and slaughtered there or in various homes. About 50% of the broiler produced are processed in automated slaughtering plants and stored in cold rooms before distribution and sales. The local chickens are mostly slaughtered in the live bird markets.

Poultry Vaccine Producers

There is one major actor serving as the source of vaccine supplies to Nigeria's poultry industry, the National Veterinary Research Institute (NVRI) in Vom, Plateau state. The institute carries out research and produces a range of vaccines for the poultry industry against major poultry diseases such as Newcastle Disease, Fowl Typhoid, and Fowl cholera in addition to other vaccines for ruminants and small animals. The shortfall in supply is usually bridged via importation. In the years since the 1980s, the range and volume of poultry vaccines have nearly tripled, which has created the need for importation to supplement supply. Many of the integrated Sector 1 operators depend on supplementary importation with an attendant associated with heterologous imported strain.

Table 4.4 Backyard poultry-keepers

Species	Present in country	Significant*	Numbers	Distribution - geographical	Breeds
Poultry	Yes	Significant	N.A	Nation wide	L/chicken Exotic breeds
Turkey	Yes	Significant	N.A		Black, white and mixed types
Duck	Yes	Not significant	N.A	Mostly wetlands and riverine areas	Muscovy Mallard
Geese	Yes	Not significant	N.A		White
Guinea fowl	Yes	Not significant	N.A	Northern Nigeria	Local breed
Quail	Yes	Not significant	N.A	Plateau-NVRI	Exotic
Pigeon	Yes	Significant	N.A	Northern Nigeria	Local
Song birds	Yes	Not significant	N.A	NA	NA
Wild birds killed for meat	Yes	Not significant	N.A	N.A	N.A
Other	N.A	N.A	N.A	N.A	N.A

* kept/exploited by more than 1 in 1000 people

Backyard Poultry Keepers

The Sector 4 poultry is basically rural and subsistent in nature. Local chickens are found in all the states of Nigeria, although about 84.5% of them are reared in northern Nigeria (RIM, 1993). Local chickens, which sometimes are referred to as unimproved, village, rural, native, indigenous, African and scavenging birds are kept under a small-scale production system and reared extensively. This type of management system is found mostly in the developing countries of Africa and Asia. They are owned by households that are left scavenging for food, and are poorly managed, housed, unvaccinated and largely non-medicated. However, with decades of appreciation in its position as the true poultry of the non-urban/rural dwellers (i.e. over 70% Nigeria's population), this category of poultry and its socioeconomic importance have been receiving some increased attention. In the process, terms like 'family poultry' evolved in view of the fact that the sector includes isolated pockets of mini-commercial mixed stocks with some inputs into housing and feeding. This version has also enjoyed some patronage from low to middle class peri-urban dwellers who therefore keep pockets of poultry in their backyards. Clearly, this sector has many actors not only at the village subsistence level, but also at the urban and peri-urban centers where middle class keep some pockets of poultry in the backyards. The table below highlights the main features of the type of poultry managed under the rural/backyard holdings by different actors ranging from women, children and rural dwellers and their geographical distribution.

The table below shows the total poultry population per state and the poultry population density.

Table 4.5 Total Projected Poultry and Poultry Population by District/Region

States	*Total poultry population	**Total Area (km sq)	Poultry Density (poultry/km sq)
bia	1631544	4900	333
Adamawa	4777851	38700	123
A/ibom	3530559	6900	512
Anambra	3162793	4865	650
Bauchi	13519620	49119	275
Bayelsa	1147432	90059	13
Benue	7796652	30800	253
Borno	6766906	72609	93
C/river	1471066	21787	68
Delta	3000976	17108	175
Edo	1426934	19187	74
Ebonyi	6818234	6400	1065
Ekiti	3383453	5435	623
Enugu	4310216	7535	572
Gombe	588427	17100	34
Imo	7428886	5288	1405
Jigawa	5590052	23287	240
Kaduna	3265767	42481	77
Kano	4459328	20280	220
Katsina	6031372	23561	256
Kebbi	8826399	36985	239
Kogi	4266093	27747	154
Kwara	3868905	35705	108
Lagos	3633534	3671	990
Nasarawa	676691	28735	24
Niger	3530559	68925	51
Ogun	4118986	16400	251
Ondo	3824773	15520	246
Osun	4118986	9028	456
Oyo	3604113	26500	136
Plateau	4398489	27147	162
Rivers	4413199	10575	417
Sokoto	1706437	27825	61
Taraba	3133372	56282	56
Yobe	3971879	46609	85
Zamfara	6766906	37931	178
FCT	4413199	7607	580
National total	159380586	909890	175

Source: *FDLPCS 2006; **National Population Commission & NBS

Informal Sector Poultry and Egg Trade

This sector involves a large number of actors, ranging from retailers to rural and urban based producers. In certain parts of Nigeria, some of the actors have organised themselves into various groups such as the Fowl sellers association, Egg sellers association etc. A recent survey by the AICP (2007) in 36 states of Nigeria and the FCT sampled live bird markets and found that over 1400 live bird marketers were available for sale with an estimated 2 million birds in markets throughout Nigeria.

Table 4.6 Informal sector egg sellers

Actors	Proportion	Numbers	Turnover (eggs/month)	Specialisation
Producers	40%	N.A		
Producer/retailers	20%	N.A		
Wholesalers	2%	N.A		
Wholesaler/retailers	20%	N.A		
Retailers	8%	N.A		

Table 4.7 Informal sector chicken sellers

Actors	Proportion	Numbers	Turnover (eggs/month)	Specialisation
Producers	10%	N.A		
Producer/retailers	30%	N.A		
Wholesalers	10%	N.A		
Wholesaler/retailers	10%	N.A		
Retailers	50%	N.A		

Production System and Biosecurity

The bio-security measures differ depending on the type of poultry production system. In most medium and large-scale commercial farms, bio-security measures include walling/fencing of the farm, provision of farm gates, foot and vehicle dips with constantly replenished disinfectants and movement control. Other measures include non-recycling of egg crates, provision for a separate sales department for poultry and poultry products well removed from the farm housings and bird-proof facilities.

The level of biosecurity in sector 3 is moderately high. Unlike backyard poultry producers who consult pseudo-experts (Non-professional Animal Health Service Providers), semi-commercial farmers resort to periodic professional consultation especially through the local and state governments' veterinary departments. These service providers have been implicated in the spread of HPAI in parts of Lagos and the Ogun states of Nigeria.

In sector 4 (commercial production), the biosecurity level is very high, coupled with a very sophisticated level of technology input obtained through importation and from local sources. The sector is the most organised of all, with each of the industrial integrated farms having its own feed mill and significant staff strength covering areas such as farm administration, health and safety, veterinary control, quality control and quality assurance, engineering, stock control and marketing.

Such organisational structure allows for effective biosecurity practices, especially among the integrated farms.

Conversely, the rural, free-range poultry production system is characterized by no or minimal bio-security facilities. Some indication of the level of bio-security in the rural extensive poultry production system was obtained in the questionnaires that were administered to poultry owners during the nation-wide HPAI active disease surveillance in March 2007 in all the 35 states and the FCT. For the study, a statistical software was used to determine the sample size (14) based on the estimated poultry population of 159,380,586, 95% confidence level, 99% sensitivity and a 20% prevalence of the disease. Arc View GIS 3.1 was used to generate 409 random points with 11 reserve points (Random Geographic Coordinate System) and Autocard software was used in the map overlay of the RGCS. Analysis of the questionnaire information that was collected from poultry owners during the exercise showed that 88.9% of birds sampled were from farms/premises without farm gates while 6.2% were from farms with farm gates. Similarly, 89.1% of birds sampled were obtained from farms whose attendants did not have protective clothing while 5.6% had protective clothing. About 86.5% of birds sampled were obtained from farms/premises without functional foot baths while 9.5% were from farms with functional foot baths. The majority of samples (82.9%) were obtained from farms/premises without bird proof housing while 12% were from farms with bird proof housing. Also, 84.2% of the bird samples were obtained from farms/premises with no control of human or animal movement. About 85.8% of birds sampled were from farms/premises with no hand washing facility for poultry attendants, 75.4% of birds samples were obtained from farms/premises with no waste disposal facility for proper disposal of poultry waste while 83.1% of bird's samples were obtained from farms where egg crates were not being recycled. The above results are summarised in Table 4.8.

Table 4.8 Assessment of bio-security measures in sampling locations

S/No.	Biosecurity Measure	Present (%)	Absent (%)	Not specified (%)
1	Farm gate	6.2	88.9	4.9
2	Protective clothing	5.6	89.1	5.4
3	Foot bath (functional)	9.5	86.5	4.0
4	Bird-proof housing	12.0	82.9	5.1
5	Movement control	10.3	84.2	5.5
6	Hand washing facility	8.8	85.8	5.4
7	Waste disposal facility	11.1	75.4	13.5
8	Egg crate recycle	5.7	83.2	11.2
9	Sales on farm	10.1	79.2	10.7
10	AI Vaccination	0.1	95.4	4.5

An important area of intervention for HPAI control and containment in rural, free-range production system in Nigeria is the provision of bio-security measures that are customized to the reality of village situations.

During the targeted HPAI active disease surveillance that was carried out in 56 Live Bird Markets (LBMs) in 25 previously infected states and the FCT, efforts were also made to evaluate the bio-security measures in place in LBMs in those states. It was observed that 78% of the markets opened daily without any resting day when the markets could be cleaned and decontaminated. It was very

common to find mixed species of poultry being sold and held together in the same cages/baskets. About 44% of the marketers did not practice disinfection of the poultry cages and it was calculated that about 76% of the marketers did not separate newly-arrived birds from the old stock. About 59% of the marketers did not separate sick birds from the healthy ones, 57% of them sold sick birds at lower prices to reduce losses while 65% of the marketers practiced the salvage slaughter of sick birds. All of the above observations sum up to a very unacceptably low level of bio-security in LBMs in the country.

With regard to the disposal of dead birds, the methods included burying (25%), burning (20%) and dumping into refuse bins (59%). Overall, the facilities for the disposal of such dead birds were grossly inadequate.

In wetlands, the possibility of domestic poultry, especially local ducks mixing with migrant wild-birds, is high. These wetlands, like the Hadejia-Nguru wetlands, witness a lot of agricultural activities like the growing of millet, rice and Guinea corn. After these crops are harvested, crop residues provide abundant food for wild-birds. It is common practice in such areas to have local ducks released near ponds, lakes or pools of water. The above provides a good opportunity for domestic poultry to mix with wild-birds. Some of the local ducks fly away to mate with migrant waterfowls, thus enhancing the chances of mixing with wild-birds. It is equally established that there are constant contacts between various types of domestic birds under the free range system of management, but the degree has not been quantified.

Production systems and biosecurity

- Vaccination teams who cover more than one farm and who do not disinfect thoroughly between premises.
  - A problem in this country
  - Most small sector 3 poultry farms use paravets to vaccinate poultry and sometimes buy a single vaccine to share
  - 80% do not disinfect thoroughly
- Vehicles, containers and catching teams used to transport birds to production units not cleaned and sanitized before and after visits.
  - A problem in this country
  - Number of premises N.A
  - 70-80% do not disinfect thoroughly
- Hatching egg (HE) collection vehicles, equipment, packaging material and staff not cleaned and sanitized before and after visits.
  - Not a problem in this country
  - Sector 1 and 2 farms have high level biosecurity
  - Most equipment and packaging materials are sanitized
- Reject egg collection vehicles, equipment, packaging material and staff going from farm to farm.
  - A problem in this country
  - Number of premises N.A
  - 50-60% do not disinfect thoroughly
- The disposal of surplus males just prior to the commencement of lay to workers, markets or backyard industry.
  - A problem in this country
  - Number of outlets N.A
  - Over 80% of excess males disposed prior to lay

- The acquisition of replacement males due to a shortage of males during the laying period.
  - Not a problem in this country
  - Most local chicken producers breed the replacement males
- Drivers not following bio-security procedures.
  - A problem in this country
  - Number of bio-security breaches N.A
  - Over 50% of the drivers do not observe biosecurity
- Imports of HE and DOC arriving in contaminated vehicles and containers.
  - Not a significant problem in this country
  - Most sector 1 and 2 farms are highly biosecure and source birds from reliable companies abroad
  - Over 95%
- Disposal of non-hatching eggs, unhatched eggs, culled chicks and contaminated packaging materials.
  - A problem in this country
  - Biological waste disposal techniques are not well developed in the country. Dumping in refuse is a common feature
  - 55-60%
- Disposal of manure to the environment.
  - A problem in this country
  - Most poultry manure is used in the fields
  - Over 80%
- Inadequate cleansing and disinfection of catching vehicles, equipment, bird containers.
  - A problem in this country
  - Most often, poultry equipment and bird containers are not properly cleaned and disinfected
  - Over 50%
- Poor staff hygiene and lack of clean protective clothing needs.
  - A problem in this country
  - Most sector 3 and 4 farmers do not observe biosecurity
  - Over 70%
- Depopulation lasting more than 48 hours.
  - Not a major problem in this country
  - Less than 10 farms
  - About 10%
- Birds going to more than 2 abattoirs.
  - Not a problem in this country
  - N.A
  - Almost nil
- Lack of integration (e.g DOC, HE suppliers, feed mills, abattoirs belonging to different actors).
  - A problem in this country
  - Majority of the farms are not integrated
  - More than 90%
- Different age groups of birds on any one farm not separate.
  - Not a major problem now in this country
  - Pre HPAI, many farms but Post HPAI only very negligible few mix different spp
  - Less than 10%

Routine Animal Health Practices

In commercial poultry farms, routine animal health practices include vaccinations against various diseases, de-worming of the birds, prophylactic antibiotic treatment and mineral supplementation. Others include administration of Coccidiostat, de-lousing and debeaking. An example of recommended vaccinations and other prophylactic treatment regimes for domestic chicken (Adene 2006) are shown in Table below.

Table 4.9 Recommended Poultry Vaccination Regime

Week	Vaccine	Comments
1	NDV i/o	Day 2-3
2	Gumboro (live)	10-15 days
4	Fowl pox	
6	ND-K	I/m
8-10	Fowl typhoid	
14	Gumboro	Oil vaccine
16	ND-K	i/m
35	Gumboro	Oil
37	ND-K	i/m

Other recommended prophylactic measures include:

- Administration of glucose and vitamins on day 1 in water, the vitamins being repeated every 2 days for 1 week.
- Antibiotic treatment for Chronic Respiratory Disease (CRD) and *E. coli* as per the advice of a veterinarian.
- Treatment with Coccidiostat in weeks 3, 6 and 10 in water or feed.
- Deworming in weeks 5, 7 and 12.
- Coccidiostat and dewormers are to be repeated every 2 months.

In the rural extensive poultry system in Nigeria there are little or no animal health interventions provided by qualified veterinarians. Apart from the fact that such animal health officers are not relatively available in rural areas, the cost of such services are relatively out of reach for most family poultry farmers, most of whom are women. In Nigeria. like in most other African countries, ethno-veterinary medicine is more commonly used in rural family poultry. In the middle Belt area of Nigeria it is estimated that about 35% of family poultry farmers regularly use ethno-veterinary medicine. In Nigeria, Newcastle Disease (ND) is treated with the barks of *Parkia filicoidea* soaked in water (Nwude and Ibrahim 1980) or fruits of *Lagenaria brevifora* and *Capsicum sp*. in drinking water. Treatment of Coccidiosis is said to be effective through the use of *Khaya senegalensis* in Nigeria (Fajimi and Taiwo 20050). In Uganda, a recommended local Coccidiostat consists of crushed seeds of slightly mature, but not ripe, papaya fruit dried under the sun then mixed with an equal amount of crushed and similarly dried male papaya mixed with water to create a thin paste. This is administered orally to chicken. Other local treatments for poultry diseases in Nigeria include *Allium cepa* and *Terminalia avicennoides* for helminthisis and *Citrus aurantifolia* for worm infestation.

Coccidiostats

Available information in Nigeria shows that the most common coccidiostats in the country are as follows (Adapted from Adene 2006):

Table 4.10 Common coccidiostats in Nigeria

Group of Chemical	Generic name	Trade name
Guanine thiamine analogues	Amprolium	Amprol, Ampromix
Organic arsenicals	Monesin	Coban, Elancoban
Organic arsenicals	Lasalcocid	Avatec
Sulphonamides	Sulphadimidine	Sulmet
	Sulphadimethoxine	Agribon
	Sulphaquinoxaline	SQ Sulfquin
	Sulpha chlaropyrazine	ESB

Other combined preparations include Pancoxine, Nicarb, Davisul and Amprol-plus.

Growth Promoters, minerals and vitamins

These are marketed as nutritive pre-mixes containing vitamins and amino-acids or non-nutritive pre-mixes containing antimicrobials to help control diseases and act as growth promoters. These are obtained from big companies like the Grand Cereal and Oil Mill Limited in Kaduna, Tuns Farms Nig. Ltd Osogbo, Osun State, Feedsmaster in Kaduna, Pfizer Nig. Ltd and Amo Byng Nig. Ltd in Awe Oyo state.

Use of Poultry Health Service Providers

Large scale commercial poultry farms have their own veterinarians that employed full time by the companies. Such veterinarians work within the official working hours (0800-1700 Hrs) and also outside these hours as the need arises. It is commonplace to employ more than one veterinarian, thus making it possible to operate shifts and ensure the presence of at least one qualified animal health officer at any given time. Medium and small scale commercial farms have arrangements with private veterinarians for farm visits. To reduce costs, it is quite common for such small scale farms to utilise the services of non-professional animal health service providers. These service providers are usually involved in prophylactic measures such as vaccinations, debeaking, delousing and deworming of poultry. There is no fixed frequency of farm visits, which are only determined by the appearance of disease or poor performance by the chickens. Since all poultry vaccinations are paid for by the farmers, public veterinarians do farm visits for such serious Trans-boundary poultry diseases as HPAI for purposes of depopulation, decontamination and restocking assistance.

Sources of Poultry – Point-of-Lay (POL) and Day-Old-chicks (DOC)

Commercial poultry farms in Nigeria obtain their stock as either day old chicks or point of Lay birds from a number of farms with hatcheries. Since the ban by the FGN, an increasing number of other lesser equipped farms have gone into hatcheries operation. This has led to a number of health related problems, especially in the area of vertically transmitted poultry diseases. Records available at the PAN headquarters list the under-mentioned farm as sources of chicken and some poultry products.

Table 4.11 List of major sources of poultry, poultry products and feeds in Nigeria (PAN Records)

Farm	Hatchable Eggs	Table eggs	Day Old Chicks (Commercial)	Day Old (Parent)	Frozen chicken	Feeds
Obasanjo farms Ota, Ogun	+	+	+	+	+	-
Avian Specialties Ibadan Oyo	+	+	+	-	+	+
CHI farms Lagos	+	+	+	+	+	+
TUNS farm Osogbo Osun	+	+	+	-	+	+
Niya farms Kaduna	+	+	+	+	-	-
AMO BYNG Awe Oyo+	+	+	+	-	_	+
Lipakala farms Ibadan,Oyo	-	+	+	-	-	-
S&D Abeokuta	-	+	+	+	-	-
Zartec Ibadan, Oyo	-	+	+	+	+	-

With regard to rural free range poultry the only available record of likely sources of poultry and feeds are in the result of the FAO/FDL HPAI active disease surveillance which was carried out in late 2007. The majority (70.4%) of the extensively reared rural poultry sampled were bought from local markets by their owners, while the remaining birds were obtained from commercial hatcheries. Most of the birds sampled (66.1%) were scavengers with little or no supplementary feeding. Only 16.9% were fed a commercially available compounded poultry ration. Rural farmers seldom consult professional or non-professional animal health service providers, except when such a need is necessary. Because of the cost and ease of availability, most rural farmers consult non-professional animal health service providers.

Marketing and other uses of poultry

Table 4.12 Stability (continuity) of each actor over time and space

		Present	Numerical trend	Location	Geographic trend
Commercial	Rearing	30 years	Up	Urban	Up
	Broiler	20 years	Up	Urban	No change
	Layer	40 years	Up	Urban, Peri-urban	Up
Backyard	Chick	Always	Up	All	Up
	Duck	Always	No change	All	Up
Support services	Feed mill	50 years	Up	Peri-urban	
	Transport day old	30 years	Up	Up	Up

5. Poultry and Rural Livelihoods

Rural livelihood comprises the capabilities, assets and activities required for a means of living (Scoones, 1998). Attenuating the poverty effect of HPAI outbreak on rural livelihoods in Nigeria through livelihood diversification or improvement in the family poultry system (via training) requires a thorough knowledge of the importance of poultry to household members and the intra - household dynamics in family poultry management. This section attempts to provide an intra - household structure of village poultry production in Nigeria with specific emphasis on the relationship between gender and labour allocation, and the importance of poultry in achieving sustainable livelihood outcomes at the household level (food security, well-being and resilience to expected stresses).

Rural poultry production, allocation of labour and gender issues

Across all ethnic groups in Nigeria, every category of household members disaggregated by age and gender groups participates in extensive poultry production (women, men, boys, girls, children and aged people). However, certain household members are more involved. Hence, developing a scheme aimed at reducing HPAI impact and improving *ex ante* risk management capability of poor households must give particular attention to the specific responsibilities and contributions of relevant stakeholders. This helps identify the target groups for policy intervention.

The pattern of poultry ownership is a good proxy for understanding the gender issues in the village poultry production system (Kitalyi, 1998; Guèye, 2005; Muchadeyi et. al., 2005), but there is no national data on poultry ownership by gender. Data contained in tables 3.3 and 3.4 only indicate that poultry keeping is part of life in Nigeria. The insufficiency of this data is not limited to Nigeria, but also the major problem in rural poultry production across Africa (Gueye, 2005). In any case, women have been widely recognised to be the most important stakeholder in rural poultry keeping in Africa, constituting more than 70% of all ownership (Alder, 1996; Gueye, 1998; Gueye, 2000). While this is true at a continental level, there are some variations at both local and national levels. Recent available evidence has shown that while women are the most important household members for village extensive poultry in southern Nigeria, men are mostly responsible for ownership and decision making concerning family fowls in the north. In most cases, children provide assistance to women in poultry husbandry with less ownership of birds among them. A household study conducted in the north-east region of Nigeria shows that a majority of birds were owned by men (55.55%), while 38.87% and 11.10% were owned by women and children respectively (Abubakar, 2007). The rearing of chicken is usually considered an entry point into livestock production in Africa (Alabi et. al., 2006). However, among the relatively rich rural pastoral households in the north (Fulani), men are mostly concerned with managing cattle and small ruminants, and thus are less involved in poultry. Owing to this, women and children in an average Fulani family own poultry and are solely responsible for its management.

Furthermore, intra-household decision making concerning division of labour for poultry management, consumption of poultry, sales and marketing of the birds also follows this gender pattern of poultry ownership with certain differences. Men and children are mostly responsible for the construction of poultry shelters. In some cases in other African countries, women have been

found collecting the building materials as well as building the floor and walls, while leaving the roof construction to the men (Gueye, 2007). In general, women and children are mainly responsible for feeding, hygiene, and health maintenance (cleaning of shelter, administration of local herbs or paracetamol dissolved in water to birds) of rural poultry in Nigeria. Across the country, children have the main responsibility of letting the birds out in the morning and in the backyard. There are also extensive cases of children letting the birds back into the backyard or raffia baskets at night. However, there is no data on the exact nature of poultry management within the rural household in Nigeria. Understanding household division of labour for poultry management is quite important for identifying the major stakeholders in the village extensive production sector across the six geopolitical zones and for focusing information on dissemination or training aimed at preventing and controlling HPAI in Nigeria.

Among farming households in the south, men are not the key decision makers in village extensive poultry because many are busy with crop production and hunting for supplying household energy and protein requirements. Even though men are mostly consulted for the killing of fowls, decisions about killing or selling chickens is usually the joint responsibility of women and children, but mostly the former. On the other hand, during a time of scarcity, poor crop harvest or when there is an urgent need (e.g. money to pay children's school fees), men become involved in poultry marketing and sales decisions. More specifically, in the south-south, women are mostly burdened with agricultural activities including poultry, fisheries, and ethanol production. Alabi et. al. (2006) reported that 44% of the women surveyed in the Niger-Delta area (which is made of Rivers, Delta, Cross-Rivers, Akwa-Ibom, Ondo, Bayelsa, Imo, Abia, Edo and Anambra states) major in business and were selling poultry products (eggs, live birds and poultry meat). In contrast, men in most households in the core north decide to sell or dispose of the chicken. Men (young and elderly) dominate the selling and buying of chickens and other poultry species in live bird markets in the north, while women (young and old) dominate in the rural south. However, it is common to see men, young boys and girls participating in live bird markets in peri-urban areas and cities in the south, especially in Lagos.

As Gueye (1998, 2005) already showed, the role of women in poultry management and ownership is a decreasing function of level of intensification. Men are usually more involved in backyard (intensive) poultry production in Nigeria (both ownership and husbandry) while egg marketing is common among women.

Importance of Poultry in Household Income

A considerable number of Nigerians derive their livelihood from livestock breeding and related activities such as sales, marketing and transportation of meat[10]. According to environ quest integrated environmental solutions (FGN, 2007), about 10% of Nigerians are engaged in poultry production. While poultry forms the main source of income for many engaged in the intensive management system of production (backyard intensive, semi-commercial, and commercial sectors), it is not the major occupation of many poor households practising a village extensive production

[10] Adamu, F., M. Filani, and A.B. Mamman. Market and Transport Institutions in Nigeria's Livestock Trade: Case Studies from Sokoto and Ibadan. Usman DanFodiyo University, Sokoto and University of Ibadan.

system, which dominates the poultry sub-sector in the country. Atteh (1990) and Sonaiya et. al. (1993) have shown that a very small percentage of rural households in the western middle belt region (north-central zone) (10.5%) and none in the south-western zone (0.00%) of Nigeria consider keeping poultry as their main source of income. Table 5.1 shows households' reasons for keeping different poultry species across zones in Nigeria. The majority of poor households keep poultry for the purpose of consumption.

Table 5.1 Percentage of Households by Purpose of Keeping Poultry in Nigeria

Poultry Species	States	Total No. of HHs Surveyed	Consum-ption	Income	Income + Consumption	Socio-cultural/ Religious Ceremonies	Income + Socio-cultural	Gift or Exchange	Hobby or Security
				South-west and North Central					
Chickens	Kwara, Ogun, Oyo	353	27.5	10.5	44.7	3.4	10.5	-	-
				South-east					
Chickens	Anambra	429	23.6	67.1	-	-	-	-	9.3
				North-west					
Guinea Fowls	Kaduna	41	20.9	43.5	-	-	-	35.6	-
Ducks	Kaduna	41	19.0	52.8	-	-	-	28.2	-
Pigeons	Kaduna	41	80.0	-	-	-	-	20.0	-

Source: Gueye (2007)

However, village poultry rearing, sales and marketing contribute significantly to the survival of poor rural households in Nigeria even though it is a 'low input-low output system'. Apart from being a source of income to meet households' immediate needs, poultry also play a form of 'banking or insurance' function in rural areas where there is the lack of a credit market. Poultry represents a store of value and appreciates with time. An initial investment in a day old chick increases in value as the weight of the chicken increases and as eggs and offspring are produced. Several authors have already shown the productivity parameters of village chicken across developing countries such as Sonaiya, 1990 (Nigeria), Kitalyi, 1998 (Africa); Sonaiya and Swan, 2004 (Africa and Asia). In fact, Chitukuro and Foster (1997) indicated that in Central Tanzania, five adult chickens will enable women to obtain an additional income of up to US $38 per annum.

The share of poultry income in a household's total income is a good indication of the household's dependence on poultry for its livelihood. Studies in Asia have shown that poultry is more important to very poor people. Maltsoglou and Rapsomanikis (2005) show that in Vietnam, households that depend less on livestock for their livelihoods are more likely to have incomes that lie above the poverty line. Recently, Roland-Holst et. al. (2007) also carried out a study in Vietnam and found that the lower the total household income, the higher the percentage share of poultry income. These studies indicate that consumption, sales and marketing of birds, eggs, feathers, and poultry meat are most important to the core poor households in the 1st income quintile. Unfortunately, it was

impossible to obtain any related data in Nigeria, as there has not been any recent national survey of free range poultry producing households which contain information on the proportion of household income that come from poultry. Hence, only a few available, relevant studies at the household level were reviewed to discern the importance of poultry in household total income across the geopolitical zones in Nigeria.

A survey of village extensive poultry keepers in the north-east of Nigeria (Bauchi State) by Kushi et al. (1998) shows that women earn an average of US$3 per month from poultry, contributing about 9.5% to the monthly household total income. Another econometric determination of contribution of family poultry to women's income in the Niger-Delta shows that each woman earns an average of US$132.17 annually from poultry after home consumption. This poultry income constitutes 25.7% of the annual national minimum wage (US$515) and 35.0% of an average woman's total income (Table 5.2). This amount is high because the majority of the households surveyed by Alabi et. al. (2006) were engaged in backyard intensive poultry production (91.2%), while only 8.8% were village extensive/backyard extensive poultry keepers. The study shows that poultry is a significant channel for reducing poverty among rural women in Nigeria. Tijani et. al. (2006) recently reported a 16% profit loss due to production inefficiency as a result of poor education among poultry farmers in the Ayetoro farm settlement (Ojo Local Government Area of Lagos State). Therefore, training on poultry husbandry and disease management information should be provided to enhance productivity of family poultry in the country. A similar result was also reported by Alabi and Aruna (2005), who found that family poultry in Niger-Delta is inefficient.

Table 5.2 Contribution of Poultry to Women's Total Income in Niger-Delta (2006)

Income Source	Percentage of women	Average Income (Naira)	Average Income ($ US)	Percentage of total income	Percentage share of average income in annual national minimum wage
Family poultry	35.29	16,785	132.17	35.03	25.66
Business income	43.70	10,961	86.31	29.96	16.76
Wage income	28.53	10,450	82.28	17.66	15.98
Loan income	4.20	6,160	48.50	1.53	9.42
Rent income	21.85	4,612	36.32	5.96	7.05
Other livestock	3.36	1,825	14.37	0.36	2.79
Farm income	23.53	1,189	9.36	1.65	1.82
Gift	5.88	464	3.65	0.16	0.71
Others	1.68	77,400	609.45	7.69	118.34
		Total		100	

Source: Adapted from Alabi et. al. (2006); Total number of women surveyed: 180; Total income for all women surveyed: N2,102,447.3; National minimum wage per month: US $515; Exchange rate used (N127 to US $1).

Importance of Poultry in Household Nutrition and Food Security

Food insecurity occurs when there is low food intake, which can be transitory (when it occurs in a time of crisis e.g. HPAI outbreak), seasonal (when it follows a pattern of recurrent stress e.g. hungry season), or chronic (when it occurs on a continuing basis e.g. due to drought) (Jenny and Egal, 2002). Seasonal food insecurity is ubiquitous in rural Africa. Annual temporary food insecurity is common in Tudun Wada, Warawa and the Tsanyawa local government areas in Kano State, Nigeria. It starts around January for chronically food insecure households and in April or May for temporarily food

insecure households (Dirorimwe, 1998). Hungry season or soudure, which is an annual season of food shortage occurring between months prior to harvest, is 'an expected event in the lives of people' of the Mandara Mountains region between the Nigeria-Cameroon borders (Campbell and Trechter, 1982). Food insecurity is generally a major problem in rural Nigeria. For example, in a study conducted in twelve villages in Kwara State, 64% of the rural households were found to be food insecure (Babatunde et. al., 2007). Also, an analysis of the food consumption pattern among households in rural Oyo state shows that there have been short falls (since 2002) of 18% and 11% in carbohydrate and protein intake, respectively, in three years (Olarinde and Kuponiyi, 2005). Olarinde and Kuponiyi also reported that peasant farming households have the 'least disposable income to cater for life's basic need', unlike artisan and civil servant households. Micronutrient deficiency (lack of essential vitamins and minerals), which is one of the manifestations of food insecurity and/or lack of food availability, food access and entitlements (Sen, 1999) among poor households in Nigeria are the major policy concerns when an asset shock due to disease outbreak occurs.

Table 5.3 Livestock Output per Caput in Nigeria: 1994 – 2000 (Kg/Person)

Year	Estimated Population (million)	Poultry Meat	Beef	Goat Meat	Lamb	Pork	Milk	Eggs
1994	97.770	0.644	1.781	0.818	0.869	0.256	9.727	3.856
1995	102.500	0.710	1.869	0.856	0.915	0.302	9.353	3.883
1996	105.820	0.699	1.862	0.869	0.907	0.369	9.185	3.988
1997	108.430	0.701	1.845	0.876	0.932	0.397	9.121	4.012
1998	111.670	0.689	1.809	0.856	0.913	0.385	8.874	3.904
1999	115.200	0.710	1.809	0.878	0.930	0.409	8.696	3.913
2000	118.340	0.744	1.817	0.904	0.955	0.423	8.552	3.929
Average	108.53	0.70	1.83	0.87	0.92	0.36	9.07	3.93

Source: Okuneye (2002)

Throughout the past decades, poultry and poultry products have been an important source of animal protein for these poor households in Nigeria. Foods from animal sources are important both in terms of the essential proteins they provide, but also for the increased bioavailable forms of micronutrients that are present. For example, poultry products may improve absorption of iron, zinc, and vitamin A which are common micronutrient deficiencies in Nigeria. They are more readily available in urban areas and are relatively more affordable by urban poor than rural poor in Nigeria. In the country, livestock supplies about 36.5% of total protein intake (FGN, 2007). The livestock sub-sector in Nigeria has not grown at a significant rate to match up with human population growth rate. This represents a great challenge for protein supply, especially in households with extreme poverty. Table 5.3, adapted from Okuneye (2002), presents the annual livestock output per capita (i.e. the amount of livestock product available to every Nigerian per annum).

Throughout the period between 1994 and 2000, the livestock sub-sector's performance was very low, with only an average of 0.70kg poultry meat, 1.83kg beef, 0.87kg goat meat, 0.92kg lamb, 0.36kg pork, and 3.93kg of eggs made available per person per year. Okuneye (2002) reported that only 13.26g of meat per day per head is supplied from this sub-sector, resulting in per capita protein consumption lower than the FAO recommended 20g of animal protein per day as the minimum

consumption for developing countries. There is also the usual recommendation that an average adult should consume an egg per day (see Okuneye, 2002). The World Health Organisation (WHO) complementary feeding guidelines prior to 2001 advised mothers in Ghana to introduce complementary foods at 5 – 6 months. The guidelines also emphasised the use of a variety of nutrient-rich foods (e.g. use of iron-rich and vitamin A-rich foods) for infants (WHO Multicentre Growth Reference Study Group, 2006). Taking a standard weight of 58g for an egg, an adult is required to consume 1.74kg of eggs per month. In 2000, that meant that the 3.929kg eggs per capita produced will only satisfy this requirement for about 3 months. Meeting this usual recommended egg consumption requires a total of 20.88kg of eggs per annum, meaning that there was a deficiency of 16.951kg (81%) in 2000.

Meat traditionally forms an integral part of the diet of an average Nigerian and there is also a form of social value associated with the type of meat consumed. Among the Yoruba people in the south-west, a household is considered rich if it consumes meats from cattle, game animals (called bush meat), 'fresh fish' (*Eja Odo*) directly from open water bodies (rivers, steams) or artificial ponds (not frozen fishes), and snails. A household consuming frozen fish is seen as relatively poor in the society. The poor in the urban and peri-urban areas usually have access to meat shops where refrigerated products are sold, unlike many rural dwellers. Two major criteria which Yoruba society uses to arrive at such stratification of households into social statuses are meat prices and sources. Live birds cost more than frozen ones. Apart from the lower prices of frozen chicken, there are cultural beliefs and values associated with consumption of live birds. Hence, consumption of live birds attracts higher social value than frozen poultry meat. There is more preference for local chicken than hybrids, thus the former receives higher market prices in some areas.

However, type of meat and often the protein source consumed in Nigerian households varies regionally and among ethnic groups. Gomna and Rana (2007) reported that an average household in the fishing communities in Niger state (North-Central), where villagers or rural people have easy access to open bodies of water from River Niger, consume more fish than meat by 3.4 times daily. Traditionally, cattle production is common among the Hausa and Fulani ethnic groups in northern Nigeria. Pastoral and agro-pastoral systems are the main umbrella systems under which these ethnic groups carry out their production activities, of which the Fulani manage the animals within a nomadic system. Hence, the northerners tend to consume more beef than any other meat because of its availability, cattle-rearing being the major occupation of many rural households. In the south where the population density is higher, a nomadic system of animal management is difficult to practice and, as a result, the few farmers who engage in cattle production do so under a mixed farming system in which only a few animals are kept in addition to their crop farms. Although cattle are produced in the north, the majority is consumed in the urban south.

Rural poor households generally depend on the collection of wild foods (mushrooms during the rainy season, hunting for game animals (bush meat) and fishing during the dry season)) and livestock rearing for meeting their daily protein need. Without supplies of eggs and meat which come from roaming chickens, many villagers will only depend on wild foods, which supply an inadequate amount of animal protein due to the high level of uncertainties associated with availability and frequency of catch, and also have environmental consequences. The majority of these poor people keep few numbers of cocks and hens. Hens only produce eggs periodically, maybe 3 or 4 times a year, thus eggs are only available for consumption a few times annually from village extensive

poultry in rural areas. Most of these times, children and women consume the eggs collected, however many bird owners generally prefer leaving eggs under hens for hatching rather than for consumption because they are aware of the high mortality rate associated with their flocks.

However, other areas of significance are the superstitious and magical beliefs associated with egg consumption among villagers. In the south-west zone, Yoruba people believe that a boiled egg has magical healing powers if consumed whole by the sick person only. Some aged women in the Ila-Orangun Local Government Area reported that this practice is commonly adopted for healing wounds and boils. Many times, traditional herbalists and healers prepare sacrifices using eggs, palm oil, and feathers to appease the gods (e.g. *Esu*) on behalf of a sick person, and ask him or her to consume the eggs afterwards. These practices show recognition of the importance of an egg's micronutrients for human health among the Yoruba, even though it is unintentional. In the 1950s, there used to be strong social and cultural attachments to the category of household members who should consume eggs, the increasing efforts of the FGN and other international organisations such as the UNICEF in creating awareness about the importance of micronutrients in an infant's diet have attenuated the effect of socio-cultural beliefs on household poultry consumption. In fact, many young mothers who travel long distance to buy and sell agricultural products can be found purchasing eggs as gifts for their children when they return home. Again, consumption of poultry meat in the villages is usually occasional. Cocks are usually killed for the Christmas celebration, naming ceremony, and during family festivals where chicken consumption is not seen as taboo. Chicken meat is commonly used in village church ceremonies, such as the 'annual harvest,' which is particularly popular among Catholics in the rural areas (south zones).

Food access is defined here as a measure of the household's ability to acquire available protein-rich foods during a given period (Hoddinott and Yohannes, 2002). Rural households obtain access to food through supply from their own farm production and from the market through their purchasing power, which they can control and their entitlements, which they have less power to control (Sen, 1982). Even though many rural poor in Nigeria can not afford frozen poultry products or eggs, village extensive poultry production still supplements some amount of needed protein in rural households, which helps in reducing rural food insecurity in the country. As high as 85% of families producing poultry may consume part of their own chicken output in Nigeria (Houndonougbo, 2005). However, there is no data on the amount of poultry consumed and sold by households across all zones in the country. When asset shock occurs, a household's food access is affected, leading to the adoption of coping mechanisms to build resilience. Food access determines the type and quantity of protein nutrients consumed by households.

The emergence of asset shock due to HPAI outbreaks, which has been witnessed by many households in Nigeria, has resulted in decreased consumption of poultry products. Loss of consumers' confidence due to perceived HPAI threats among households in Kwara State shifted their preference for substitutes to poultry products such as fish, pork, beef, and snail (Obayelu, 2007). In 2006, a drop of 81% was estimated for poultry consumption due to fear of HPAI in the country (UNDP, 2006). This is consistent with You and Diao's (2007) predictions of the impact of HPAI on poultry consumption and production in Nigeria. Obayelu also noted that the decreased demand for poultry products resulted in an 8% (Beef thick skin) to 67% (Kotte fish) increase in the market price of alternatives. Table 5.4 shows prices of livestock between 2006 and 2007.

Table 5.4 Price of Livestock (Medium Size) in Nigeria

Livestock	Price in August 2006 (Naira)	Price in August 2007 (Naira)	Remarks
Ram	15,000	18,000	Increase
Goat	5,000	6,000	Increase
Sheep	15,000	20,000	Increase
Cow	40,000	45,000	Increase
Bull	65,000	75,000	Increase

Source: USAID Nigeria Food Security Update, September 2007

Rural poor households are usually unable to afford poultry meat and even its alternatives, due to their low income and thus lack of food access as a result of their low purchasing power. Lack of food access has been shown to result in the adoption of various negative coping mechanisms that have consequences for micronutrient deficiencies. Reduction in daily meal frequency is common among households experiencing chronic and temporary food insecurity in rural northern Nigeria between January and May (Dirorimwe, 1998). There is also an indication that many households will depend on wild food (Watts, 1983; Webb, 1993). Contrary to expectation, many rural households may not use their income from sale of other livestock type in purchasing animal protein. Muhammad-Lawal and Balogun (2007) found that livestock production was not a significant determinant of animal protein consumption among rural households in Kwara State. Thus, ownership of other livestock types may not significantly influence household protein consumption after a HPAI outbreak in Nigeria.

A study conducted on calorie consumption in 12 Local Government Areas in Ogun, Ondo and Oyo states reveals that the main sources of micronutrients in rural households are legumes, vegetables, beverages, fruits, oil and fats, meat, fish and other animal products (Aromolaran, 2004). It is evident from the data that consumption of animal protein is not high among rural households. Adene and Oguntade (2006) already noted that poultry meat and eggs are luxury goods among some Nigerians. Among rural Hausa-Fulani villages in Northern Nigeria, for example, the dietary composition and quality have changed over time with a decline in local cultigens consumption, decrease in total caloric intake and adoption of new foods (Ross et. al., 1996).

Among the rural-town and urban dwellers, frozen poultry products (chicken, turkey) and eggs frequently form a component of the daily meal. In fact, fried and smoked turkey and chicken meats, and fried and boiled eggs are usually sold along road sides (or in communal areas) and in the market places, particularly in urban areas where many poor reside and conduct daily economic activities (for example Oshodi, Mafoluku, Agege, and Ketu in Lagos). In contrast, relatively rich urban dwellers patronise modern restaurants and eateries were they eat poultry products as part of their lunch or dinner.

Food Composition Databases in Nigeria

The major food composition databases that have been widely utilised for converting protein calorie intake to nutrient intake are:

- Nigerian Foods and Feeding Stuffs (Oyenuya, 1968)

- Nutrient Composition of Commonly Eaten Foods in Nigeria – Raw, Processed and Prepared (Oguntona and Akinleye, 1995)

Recently, Akinleye (2007) noted that Oguntona and Akinleye (1995) excluded information on nutrient content and nutritional values of some traditional foods which are important for reducing human diseases. Research has been ongoing to update this database. Nevertheless, the International Institute of Tropical Agriculture (IITA, Ibadan, Nigeria) has a food and nutrient coding database. These databases, supplemented with information on common foods available in the Food Intake Analysis System (FIAS) and USDA Food and Nutrient Database (CSFII), can be considered useful resources for studies in Nigeria.

Importance of poultry in local culture and traditional religious practices

Poultry has a close relationship with the everyday life of many villagers across Nigeria. Chickens are domesticated animals, and as such frequently receive attention and play a significant role in many homes, apart from dogs and cats. While dogs are usually reared for hunting and security purposes only, poultry serve multiple roles in local culture, ranging from the use of cocks as an alarm clock in the morning to use in socio-cultural activities (religions, offerings to deities or gods, rituals, gifts, bride price, symbolic value). It also has a recreational value to children in the village in the form of watching cockfights, or where two cock-owners go into betting and provoke their birds to fight with the outcome of only one winner.

Common poultry products used for ritual purposes (Juju) and in the preparation of sacrifices to the gods are feathers, hens and cocks. Feather colour and bird sex are the main criteria upon which herbalists and worshippers of traditional gods select poultry for these purposes. For example, white, red and black cocks are most commonly used, with each colour having a specific socio-cultural use. While white feathered cocks are usually employed to seek positive answers from gods (such as prayers for good harvest) or as a gift to another family and chiefs, red and black feathered cocks are used in witchcraft. In some homes, the presence of a strange scavenging bird is seen as a bad omen or signifying the presence of an evil spirit. The use of poultry for sacrifices or offerings to deities is most rampant in south-eastern Nigeria among the Igbo people, while live birds are commonly used as a bride price among many other ethnic groups. This socio-cultural value of poultry has created a market for feathers (from both domestic and wild birds) in villages and rural-town areas. Among the Yorubas, women selling feathers, other poultry products, and materials for ethno-cultural purposes are referred to as Lekuleja. Worshippers of Esu and many other gods utilise eggs in preparing sacrifices meant for magical purposes or appeasing the gods. Eggs and other poultry products are also used in the preparation of healing medicine for sick people. It has been reported in the south-west (Sonaiya et. al., 1990) that internal organs, or the viscera, of a chicken are used to increase libido in old men.

Poultry is one of the most popular livestock products for religious celebrations and traditional festivals. It is a common meat for the annual yam festival celebration in the south. The Ibos usually use teeth to cut the throat of the birds while conducting ritual activities, worshipping gods or during festival celebrations. As discussed earlier in section 5.3, poultry is commonly used as offerings in churches as well.

6. Previous HPAI Research and Findings in Nigeria

There have been very few research efforts on HPAI in Nigeria. This is largely due to the fact that there are very few laboratories that are equipped to handle the H5N1 virus in the country and research funding has not been a priority for the Government of Nigeria (GON).

Research that have been carried out by National Institutions

H5N1 surveillance in wild-birds in wetland areas in Northern Nigeria

This study was carried out by the National Veterinary Research Institute, Vom in November 2005 before the onset of HPAI in February 2006 and involved the collection of tracheal and cloacal swabs and sera from wild-birds in the Hadeija-Nguru wetlands, the largest wetland in Nigeria. Similar samples were also collected from live-bird markets, slaughter slabs and some commercial poultry in Kano, Jigawa, Yobe, Gombe, Bauchi, Borno, Kaduna, Edo, Nasarawa and Adamawa states. Overall, 2,350 samples were collected and analysed in NVRI Vom. No virus was isolated and there was no serological evidence of infection.

Avian Influenza National Baseline Survey

This study was a Consultancy carried out by environQuest on behalf of the World Bank funded the Global Program for Avian Influenza Control and Human Pandemic Preparedness and Response project (GPAI). The study involved the cross-sectional and retrospective collection of information using the Rural Rapid Appraisal (RRA) methods for the period two years before the May 2006 World Bank AI intervention. The Consultants used quantitative and qualitative methods to gather information from poultry farmers, transporters, processors, market women and men, members of the communities and AI Project Desk Officers, and then carried out analysis of AI disease management involving animal and human health as well as communication strategies. The results obtained showed:

- Inadequate capacity to respond to AI emergency
- Inadequate regulations and legislations for animal, human and environment protection
- Poor enforcement of existing regulations for animal disease control
- Estimated 773 veterinary clinics and 50,000 poultry farms in Nigeria with 85% of them sited in the southern parts of the country
- That overall the veterinary facilities: poultry farm ratio is poor and that 65% of the rural poultry has little or no access to veterinary services
- That of the country's 22,000 public and private health institutions, only 32 meet the required WHO standard for AI diagnosis in terms of equipment
- That information for AI awareness was done through the radio, television, rallies and workshops.
- The overall general AI awareness in the country to be fairly good with 60% of those interviewed being able to identify birds affected by HPAI.

A socio-economic analysis of the impacts of HPAI on households poultry consumption and poultry industry in Kwara state.

This limited study was carried out by the staff of Dr Obayelu at the University of Ibadan, in 2006. The study involved structured interviews of 30 poultry farmers and 100 households selected randomly in the state. The results showed that the disease caused 80% of the households to stop the purchase and consumption of poultry products out of fear of being infected, and about 75% of poultry farmers had stopped ordering for new supplies of birds and were prepared to opt out of poultry farming for alternative jobs. The author claimed that small commercial and backyard poultry farmers suffered more losses as a result of HPAI. Other negative impacts included a marked drop in the prices of poultry and poultry products and job losses. However, the choice of Kwara state for the study may not have been justifiable since up to date only one confirmed outbreak of HPAI has been officially reported in that state.

Previous research that had been carried out by International Institutions either alone or with Nigerian Government/Institutions

Isolation and molecular characterization of H5N1 viruses from poultry in Nigeria

This study was jointly carried out by Prof. Muller's Team at the National Public Health Laboratory, Institute of Immunology, Luxembourg and Dr. Owoade of the Department of Veterinary Medicine, University of Ibadan, Nigeria (Ducatez et al. 2006). The scientists sequenced H5N1 isolates from seven chicken farms in Lagos state, Nigeria, as well as from chicken and the hooded vultures from Burkina Faso. They provided data to show that the H5N1 virus was introduced into Nigeria by at least three independent routes that were most coincident with the migration routes of wild birds. However, they also opined that the introduction through poultry and poultry products was not ruled out.

Genetic characterization of a selection of H5N1 viruses in eight Nigerian states in early 2007

This was a joint research effort involving scientists from the National Veterinary Research Institute, Vom, the University of Ibadan, Ibadan, Nigeria, and the Viale dell'Universita, Legnaro, Padova, Italy with funding from the Food and Agriculture Organization (FAO) of the United Nations (UN). The researchers (Monne et al, 2008) sequenced the entire genome of twelve representative H5N1 viruses from different geographical areas of eight states in Nigeria. Results showed that:

- All the Nigerian H5N1 isolates were closely related to the viruses that were circulating in bird throughout Europe, Russia, Africa, and the Middle-East since 2005.
- Ten (10) out of the 12 strains obtained over a 39 day period were reassortant viruses.
- That the viruses circulating in 2007 were different from the original sublineage prototypes that were introduced into Nigeria in 2006.
- That the emergence of at least two reassortant viruses in Nigeria shows that co-infection with viruses of different sublineages has occurred in the country.
- That this phenomenon might have been as a result of poor bio-security particularly at the live-bird markets as well as ineffective poultry movement controls.

Studies on the Socio-economic impact of HPAI in Nigeria.

This study was carried out by a group of Consultants contracted by the United Nations Development Programme (UNDP) in July 2006. The Consultants used the Rapid Appraisal Method and administered questionnaires to poultry farmers, marketers, input suppliers and poultry workers in Kaduna, Katsina, Kano, Yobe, Bauchi, Plateau, Benue, Nasarawa, Lagos, Ogun, Oyo, Delta, Rivers, Anambra and Enugu states as well as the Federal Capital Territory (FCT). In addition, staff of the Federal Department of Pest Control Services (FDL&PCS) as well as officials of the Poultry Association of Nigeria (PAN) were interviewed.

The results showed that in overall microeconomic terms, the impact was not very severe. The official confirmation of HPAI in Nigeria caused initial panic resulting in total boycott of poultry and poultry products. Within two weeks, egg and chicken sales declined by 80.5% and up to 4 months after, prices had not recovered up to 50% pre-HPAI levels. There was about 82% drop in prices of poultry feed and it was calculated that approximately one million birds had died or were destroyed as a result of HPAI as of the time this study was carried out. In addition 80% of the workers in affected farms and 45% of those in un-affected farms had lost their jobs. Overall, the rural village poultry and backyard and medium scale farmers were most severely affected by the HPAI outbreaks. This study should be augmented with a more detailed study of the impact of HPAI on rural livelihood, food security and social wellbeing of the rural poor in Nigeria.

Active HPAI disease surveillance in Nigeria

This study, which was funded by the European Commission, was jointly carried out by the FAO and the Federal department of Livestock and Pest Control services of the Federal Ministry of Agriculture and Water Resources. The study was conducted in March 2007 in all 35 States of the Federation and the Federal Capital Territory (FCT). A statistical software was used to determine the sample size (14) based on the estimated poultry population of 159,380,586, 95% confidence level, 99% sensitivity and a 20% prevalence of the disease. Arc View GIS 3.1 was used to generate 409 random points with 11 reserve points (Random Geographic Coordinate System) and Autocard software was used in the map overlay of the RGCS. The disease data form was designed to obtain information on the geo-reference of sample collection site, information on the owner of the farm/holding, the species of bird, production system, sources of feed, and a set of clinical signs as well as mortalities in the preceding 12 months. Other information obtained from the forms included estimates of the bio-security level in the farms/holdings, method of sale of eggs including estimates of re-cycling of egg crates, information on AI and other major poultry diseases as well as history of vaccinations. Tracheal and cloacal swabs as well as blood for sera were collected. The swabs were examined by the Reverse Transcription Polymerase Chain Reaction (RT-PCR) for Avian Influenza M genes and virus isolation carried out in embryonated chicken eggs while sera were examined by Agar Gel Immuno-Diffusion (AGID) for AI virus antibodies. The results obtained showed that:

- Majority of the sampled birds (87.5%) were chickens, with 75.3% of all the birds sampled being the indigenous breed and 74.7% of the poultry birds reared extensively i.e. rural system of production.

- Low level of bio-security in the locations/farms from which samples were collected as shown by absence of farm gates, non-availability of functional foot baths, bird proof housing, waste disposal facility or control of human or animal movement.
- Majority (70.4%) of the poultry sampled were bought from local markets by their owners while the remaining birds were obtained from commercial hatcheries.
- About 15.4% of birds sampled were from flocks that had experienced mortalities with tentative diagnosis of Newcastle disease; 6.5% Avian Influenza; 1.3%, coccidiosis and 1.1% with chronic respiratory disease.
- In addition, 0.4% was from poultry with tentative diagnosis of fowl cholera and fowl pox (each), 0.1% fowl typhoid and infectious coryza (each).
- Although none of the samples tested was positive it was computed that the prevalence of the disease in free range rural poultry may have been about 0.06%.

H5N1 virus surveillance in selected Live-Bird Markets (LBMs) in Nigeria

This study was carried out by the FAO and the FDL&PCS in October/November 2007 in 54 LBMs in 25 states and the Federal capital Territory (FCT) where HPAI had been confirmed. Winepiscope® 2.0 was used to estimate the sample size which was based on 95% confidence that the disease will be detected if present at or above 10% prevalence given a test sensitivity and specificity of about 100%. Cloacal and tracheal swabs as well as sera were collected from two selected markets in each state every two weeks for a period of six weeks and questionnaires were administered to the poultry marketers during each visit. Four birds were purchased from each market during each sampling exercise and were euthanised, frozen and sent to the laboratory with the clinical samples for laboratory examination. Laboratory examination was carried out as described under HPAI active disease surveillance above.

Results of the study showed that:

- Majority of the LBMs hold on daily basis, are situated right in the middle of the larger markets with birds being sold amidst marketers of other items.
- A common practice of mixed species of poultry sold together and housed in the same cages as young chicks creates likely sources of introduction of HPAI into hitherto uninfected villages since replacement stocks for village poultry keepers are purchased from these markets.
- Generally the level of bio security in the LBMs was found to be unacceptably poor.
- Poultry cages, mainly constructed from wood or cane, were not cleaned and sick birds were not usually separated from the healthy ones and were either sold at lower prices or slaughtered and processed for human consumption to minimize losses.
- Facilities for safe disposal of dead birds were grossly inadequate.
- About 85% of the poultry sold in these markets are slaughtered in the LBMs at customer's request,
- H5N1 virus was isolated in 5 out of the 54 LBMs from chickens in three states, from a sick duck in one state and Avian Influenza genetic materials were detected from a chicken in another state,

However the exact role of LBMs in the spread and sustenance of HPAI in Nigeria needs further attention. Future studies should also trace forward and backward where the virus is isolated. It is recommended that a more bio-secure system of mechanized slaughter and processing of poultry should be an integral part of any restructuring of the poultry marketing and processing system to reduce human exposure to the virus.

The role of wild-birds, wetlands, domestic ducks and Floodplain Agriculture in the introduction, spread and persistence off H5N1 virus in Northern Nigeria

This consultancy study was commissioned by the Food and Agriculture Organization of the United Nations in January 2008 (Ilemobade et al 2008). In the study, global geospatial datasets were visually matched against reported HPAI outbreaks to broadly identify an association between environmental factors and HPAI disease occurrence. Logistic regression of disease presence/absence against environmental factors such as human population density, density of major roads and chicken density was carried out. Visits were made to dams, wetlands and irrigation schemes in Hadeja, Guzu Guzi, Jigawa, Yobe and Kano states. Staff of the FAO ECTAD Unit in Abuja, FDL&PCS Abuja, faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, were interviewed. The study provided evidence of a suitable combination of ecological conditions, farming practices and land use that are conducive for the introduction, spread and persistence of H5N1 virus in parts of northern Nigeria. Land use practices in the study areas increases contact between infected water birds and domestic poultry, especially domestic ducks. They postulated that HPAI may have been present in rural backyard poultry 6-8 weeks before the official identification and confirmation of the disease in commercial poultry in Kaduna state in February 2006. In conclusion, the authors stated that there was ‘a strong relationship between migratory birds, floodplain agriculture, land use pattern, domestic ducks and the spread and persistence of H5N1 virus in northern Nigeria.’

Research gaps

Although a number of research efforts have been made by both Nigerian National Institutions and foreign ones, mainly the FAO, a number of gaps exist in elucidating various aspects of the epidemiology of HPAI in Nigeria and the development of a more effective and efficient control strategy for HPAI. Among these include:

- The role of indigenous poultry breeds and resident wild birds such as local domestic ducks, guinea fowls, cattle egrets and vultures in the spread and sustenance of HPAI in Nigeria.
- The role of Live Bird Markets (LBMs) in the spread and maintenance of HPAI in Nigeria.
- Molecular characterization of Nigerian H5N1 viruses and comparison with other isolates from poultry and humans from other countries.
- Continued active disease Surveillance in various poultry production and marketing systems in Nigeria.

7. Threats and Incidences of HPAI and Institutional Response Capacity

As far back as December 2005, the group of Experts that was commissioned by the Federal Ministry of Agriculture to prepare the national HPAI prevention and contingency plans, carried out a risk analysis of the disease in Nigeria (Obi et al 2005). Risk factors that may aid introduction of the disease into the country are the fact that Nigeria lies in the East Africa/West Asia flyways and the North Atlantic flyway of migratory birds, increased trade and human traffic between countries where the disease is known to exist and Nigeria and the expanding HPAI disease phenomenon due to globalisation and relative ease of movement and transportation.

Nigeria's long porous borders and informal livestock movement/trading across the border, especially at border markets, resulting in smuggling/illegal movement of poultry and poultry products into Nigeria from infected countries, further increased the risk of introduction of the disease into Nigeria.

It was equally suggested that in the event of HPAI being introduced into the country, factors that may aid sustenance and maintenance of the disease included the structure of the poultry industry in Nigeria. As already discussed, the sector consists predominantly of backyard poultry with little or no biosecurity, and peri-urban and urban commercial poultry production with minimum to moderate biosecurity. Other factors included constant introduction of new birds from relatively unknown and unverifiable sources, the rearing of flocks of different species of poultry and different ages together, uncontrolled livestock and poultry movement within the country as a result of lack of enforcement of animal disease control laws and regulations in the country and increased close contact between poultry and humans. The expert group also identified a lack of an organised poultry marketing system and the existence of open, live poultry markets characterized by interspecies mixing and poor sanitary conditions. Also identified was deteriorating animal health delivery services due to inadequate funding and the inefficient re-structuring programme of the veterinary services. The risk was higher as a result of poor communication facilities for dissemination of information on HPAI and other TADs, lack of funding for compensation of livestock/flock owners in the event of slaughter of their animals for purposes of disease control, improper disposal facilities and the sale and consumption of sick and dead birds.

Apart from HPAI other major poultry diseases in Nigeria include Newcastle Disease (ND), Infectious Bursal Disease (Gumboro Disease) and Mareks/Avian Leucosis. Other important Transboundary Animal Diseases include Foot and Mouth Disease (FMD), Peste Des Petits Ruminants (PPR), African Swine Fever (ASF) and Contagious Bovine Pleuro-pneumonia (CBPP).

Table 7.1 Major Livestock Diseases in Nigeria

Disease Agent	Age group
Low pathogenic AI	NA
Newcastle Disease	Growers and Adults
Gumboro	< 8 weeks
Marek's disease	> 6 weeks
Leucosis	Adults
Campylobacter	
Foot and Mouth Disease (FMD)	All Ages
Peste des Petits ruminants (PPR)	Adolescents
Contagious Bovine Pleuro-pneumonia (CBPP)	All ages
African swine Fever (ASF)	All Ages

A seven year study of the prevalence of various poultry diseases in poultry brought to the poultry diseases clinic at the Department of Veterinary Medicine, University of Ibadan between 1975 and 1984 (Adene and Fatumbi 2004) revealed that Newcastle Disease (ND), Infectious Bursal Disease (IBD) and Mareks Disease (MD) were the most prevalent viral diseases; Fowl Cholera and Collibacilosis were the most important bacterial diseases and Coccidiosis and Ascaridiosis were the most prevalent parasitic diseases of poultry in exotic poultry (Table 7.2 below):

Table 7.2 Annual Incidence of major poultry Diseases in Seven Years in Ibadan Nigeria (Adene and Fatumbi 2004).

	Year									
Disease	1	2	3	4	5	6	7	Total	(%)	Annual %
Coccidiosis	10	9	11	8	6	10	18	72	0.161	2.3
Ascarids	11	7	1	3	-	-	5	27	0.0615	0.86
Fowl Cholera	5	4	4	5	4	3	19	44	9.96	1.41
Collibacollisis.	3	1	4	-	11	5	13	37	8.3	1.18
CRD	14	7	-	-	8	5	8	42	9.4	1.34
ND	14	10	5	21	9	35	35	129	28.9	4.13
MD	3	2	-	-	1	-	3	9	8.21	0.28
IBD	11	10	4	11	11	11	19	77	17.3	2.46
Leucosis	2	3	-	1	-	-	3	9	2.01	0.28
Total	73	53	22	48	50	69	120	446	1	

With regard to rural poultry, Adene (2004) classified the most important viral disease as Newcastle disease (+++), Fowl Pox and IBD (++) and Leucotic Sarcoma (+). The most important bacterial diseases reported were Pullorum Disease (+++), Fowl Typhoid and Fowl Cholera (++) and Infectious Coryza, Tuberculosis and other Salmonellosis (+). Parasitic diseases include Ascaridiosis, Cestodosis and Pediculosis (++), Syngamosis, Tetramosis, coccidiosis and Acarosis (+).

A more recent ten year study of poultry diseases in Gombe state Veterinary Clinic (Bukar-Kolo et al (2006), summarized in Table 7.3 below.

Table 7.3 Summary of ten year records of poultry diseases in Gombe state

	1995	1996	1997	1998	1999	2000	2001	2001	2003	2004	Total	Prevalence %
New Castle Disease	23	28	22	28	31	35	30	33	37	44	311	14.66
Fowl Pox	15	22	18	20	29	30	20	15	18	32	219	10.3
Gumboro	17	15	16	20	23	11	17	18	23	27	187	8.8
Fowl Thyphoid	15	17	19	24	23	27	23	30	28	49	255	12
Chronic Respiratory Disease	16	20	20	24	31	34	27		33	31	25	261
Fowl Cholera	18	15	18	17	25	20	14	25	13	18	183	8.6
Coccidiosis	19	16	19	25	28	30	18	22	25	14	216	10.2
Helmithosis	15	14	18	17	15	13	18	13	12	15	150	7.07
Ectoparasites	18	10	16	15	15	17	16	21	15	16	159	7.5
Nutritional Defficiency	16	15	12	15	19	23	21	17	20	22	180	8.5

Low Pathogenic Avian Influenza

As of yet, there is no confirmed evidence of Low Pathogenic Avian Influenza in Nigeria. So far, all AI H5N1 virus isolates made since February 2006 until now are HPAI H5N1 viruses. Similarly, serological studies that have been carried out in the country do not support the existence of LPAI in Nigeria. More studies are required to affirm this position.

Newcastle Disease (ND)

The first documented confirmed outbreak of Newcastle Disease in Nigeria was in December 1952-February 1953 in Ibadan, Oyo state (Hill et al 1953). The disease has subsequently become widespread and of considerable economic importance in both exotic and local poultry. In Nigeria, ND is believed to be the most prevalent disease in free range local poultry, with mortalities approaching 80% depending on the virulence of the virus strain. The most severe form, often referred to as Viscerotropic Velogenic Newcastle Disease (VVND), is highly pathogenic and easily transmitted with clinical signs such as watery, greenish diarrhoea, swelling of the wattles and neck. The onset of the disease is sudden, and respiratory signs include gasping, coughing, sneezing with nervous signs such as dropping of wings, twisting of neck and circling. Depression, a decrease in appetite, a drop in egg production and abnormality in the shape and colour of the eggs are commonly seen. In Nigeria, published literature shows that the disease is widespread in both local and exotic chickens (Fatumbi and Adene, 1979, Saidu et al 1994 Abdu et al 1985). In a 15 year study (Saidu et al 1994) on the incidence of ND in northern Nigeria, ND was reported to have caused the greatest mortality (36.1%) in local chickens in Zaria, with Gumboro disease at 7.1% and Fowl pox with 5.1%. Similarly, Adene (1990) showed that ND, Gumboro disease, Fowl Pox and Fowl Typhoid, in that order, were the most important diseases in family poultry. Another study reported that up to 6.7% of local ducks and 13.6% of Guinea fowls have antibodies indicative of previous natural infection. In Zaria, or northern Nigeria, ND is said to be more common in layers than broiler chickens, and the incidence is highest during the months of October-December. The yearly distribution of Newcastle Disease and other

poultry diseases in Zaria, Nigeria between 1990 and 1999 and the seasonal distributions are shown in Table 7.4 (Saidu et al., 2006).

Table 7.4 The yearly distribution of Newcastle Disease and other poultry diseases in Zaria Nigeria

Year	ND Frequency %	Frequency % Other diseases	Frequency % Total
1990	139 (17.1)	225 (13.2)	364 (14.5)
1991	101 (12.4)	240 (14.1)	341 (13.6)
1992	76 (9.4)	179 (10.5)	225 (10.1)
1993	53 (6.5)	134 (8)	187 (7.4)
1994	102 (12.	184 (10.6)	286 (11.4)
1995	89 (11)	181 (10.6)	270 (10.7)
1996	78 (9.6)	167 (6.8)	245 (9.7)
1997	57 (7)	125 (7.3)	182 (7.2)
1998	60 (7.4)	140 (8.2)	200 (8.0)
1999	57 (7.0)	126 (7.4)	183 (7.3)
Total	812 (32.3)	1,701 (67.7)	2,513 (100)

Table 7.5 Seasonal frequency of Newcastle disease and other poultry diseases in Zaria, Nigeria

Season	ND Frequency %	Other diseases frequency %	Total frequency %
Dry (Jan.-March)	250 (30.8)	492 (28.9)	742 (29.5)
Pre-Rainy (April-June)	135 (16.6)	461 (27.1)	596 (23.7)
Rainy (July-Sept.)	110 (13.5)	371 (21.8)	481 (19.1)
Pre-Dry (Oct.-Dec.)	317 (39.0)	377 (22.2)	694 (27.6)

Infectious Bursal Disease (Gumboro)

Infectious Bursal Disease (Gumboro disease) is an acute, highly contagious viral disease of poultry characterised by the enlargement of the Bursa of Fabrisii and moderate-high mortality. The first reported outbreak in Nigeria was in 1969 (Ojo et al 1973). Epizootics are said to occur in the poultry-rich southern states of Nigeria, where between 90-140 outbreaks involving about 0.5 million chicks are recorded annually (Nawathe and Lamorde, 1982). Serological studies that were carried out in Osun, Oyo, Ogun, Ekiti and Lagos states showed a 34% prevalence in 2000 local chickens that were examined (Oyedotun and Durojaiye 1999). A similar study in the Jos area of the Plateau state reported 61.9% prevalence in local chickens, 33.3% in Guinea fowls and 56.6% in local ducks (Okwori et al 2006). IBD, therefore, ranks second to ND among poultry diseases of highest prevalence in Nigeria.

Marek's Disease

Marek's Disease (MD), a lympho-proliferative disease of chickens, was first described by a Hungarian Professor, Joseph Marek, in 1907. In Nigeria, the disease was reported by Hill and Davis in 1962. A serological study carried out between 1975 and 1984 in Ibadan (Adene 2003) reported two peaks of MD outbreaks in 1977 and 1983 in chicks as young as 8 weeks of age, though mainly 12-24 week old

ones. Although vaccines are available for the control of the disease, it has been observed that MD remains one of the most important causes of losses in the Nigerian commercial poultry industry.

Foot and Mouth Disease (FMD)

The first reported outbreak of FMD in Nigeria was in 1924 and was caused by the FMD Type O virus, a type that was last recorded in Nigeria in 1963. Between 1964 and 1974, Types A, SAT1 and SAT2 were prevalent in the country, with Type A being the most prevalent for ten years. SAT1 made its first appearance in Nigeria in 1968 when about 60 outbreaks of the disease were recorded in the north-east and north-west, Benue-Plateau, and Kwara states. SAT 2 was first recorded in 1973 -1974 from western, north-central, north-east, Kano, Kwara and Lagos states.

Contagious Bovine Pleuro-pneumonia (CBPP)

Contagious Bovine Pleuro-pneumonia (CBPP), caused by Mycoplasma mycoides subsp. Mycoides, is endemic in Nigeria. The disease was probably brought under control in the early 1960s, but later emerged probably from Chad, Niger and Cameroon. Outbreaks continued to rise in occurrence and by 1989, an estimated 10,000 cattle had been affected. A retrospective study of the incidence of the disease in Adamawa state between 1991 and 1995, showed that 0.54% of 43,810 cattle that were slaughtered during the period had CBPP lesions. A more recent study by Aliyu, Obi and others in 2002 reported 0.29% prevalence in Kano, Borno, Bauchi, Adamawa and Sokoto states between 1988 and 1998 based on abattoir records. The study showed that about 30 outbreaks were reported annually during the period and that total losses from CBPP in the five states were estimated at N 498,192,497.

Peste des Petits Ruminants (PPR)

Peste des petits ruminants is a severe, fast-spreading disease of domesticated and sometimes wild, small ruminants characterised by the sudden onset of depression, fever, oculo-nasal discharges, stomatitis, pneumonia, diarrhoea and death. The disease was first reported in Coite d'Ivoire in 1942 by Gargadenec and Lalane who, because it resembled Rinderpest (Peste bovine; Bovine plague), gave it the name *Peste des Petits Ruminants* (Small Ruminant Plague). The first confirmed outbreak of PPR in Nigeria was in Ibadan in 1963 (Hill et al1963) and later in Nsukka in 1965 (Nduaka and Ihemalandu (1973). The disease has been confirmed in Benin Republic, Senegal, Ghana, Togo, Chad, Burkina Faso, Niger, Mali, Cameroon, Guinea and Guinea-Bissau. Outside West Africa, PPR is now known to be prevalent in other countries in sub-Saharan Africa including Ethiopia, Sudan, Egypt and the Central African Republic, as well as in the Middle-East in Saudi Arabia, Oman, United Arab Emirates, Lebanon, Israel, Palestinian Autonomous Territories, Kuwait, Jordan, Iran, Yemen, Turkey and Iraq. Outbreaks of PPR are equally common in India, Pakistan, Nepal, Bangladesh and Afghanistan.

A study in southern Nigeria (Obi et al 1983) showed antibody prevalence of 52% in sheep and 47% in goats, while 62% morbidity and 54.5% mortality morbidity were recorded. The precise monetary impact of PPR is yet to be documented despite the fact that the disease is said to be the single most important disease handicap to intensification of small ruminant production in the country.

African Swine Fever (ASF)

African Swine Fever (ASF) is a highly contagious viral disease of domestic pigs characterized by fever, hyperaemia of the skin, incoordination, diarrhoea and pneumonia. It may cause high morbidity and mortality, and is a serious transboundary animal disease with the potential for rapid international spread.

First described by Montgomery in 1921 in Kenya, ASF has subsequently been reported in most countries in southern and eastern Africa, including Kenya, Namibia, Botswana, Zimbabwe and northern South Africa, Angola, the Democratic Republic of the Congo, Uganda, Zambia, Malawi, northern Mozambique and probably the Congo (Brazzaville), Rwanda, Burundi and Tanzania and Madagascar. In West Africa, ASF has been endemic in Cameroon since the first reported outbreaks in 1982. It is endemic in southern Senegal, Gambia and probably Guinea Bissau and the islands of Santiago and Maio in the Republic of Cape Verde.

In Nigeria, the first reported outbreak of ASF occurred in 1973 in a piggery in Abeokuta, Ogun State where all 3000 pigs in the farm died from the disease. In September 1997, the disease surfaced in free-ranging pigs in four local governments of Ogun state, areas of Nigeria that have common borders with Benin Republic. The disease was first seen in villages alongside the lagoon passing into Nigeria from Benin Republic. Dead pig carcasses were seen in the lagoon, and there was evidence that boats were travelling along the lagoon selling pig meat in the Badagry market and nearby villages. By December 1997 ASF was reported in Badagry in Lagos state, Nigeria and from the Lagos and Ogun state foci, the disease eventually spread to the Osun, Oyo, Ondo, Ekiti, Edo, Delta, Anambra, Enugu, Abia, Rivers, Bayelsa, Akwa-Ibom, Cross-River, Benue, Kaduna and Plateau states of Nigeria. By October 1998, about 125,000 pigs had died of the disease in nine states, resulting in an estimated loss of ₦1.0 billion (Obi 2007).

Table 7.6 Status of selected important poultry and livestock diseases in Nigeria

	Presence	Prev.	Public control	Private control	Effective
Low pathogenic AI	No	None	None	None	Not applicable
Newcastle disease	Yes	Yes	Yes	Yes	Moderately so
Gumboro disease	yes	Yes	Yes	Yes	Effective
Poultry Campylobacter					
FMD	Yes	Little	None	Yes	Not effective
CBPP	Yes	Yes	Yes	Yes	Yes

Threats and/or incidence of HPAI in the country (if any) and incidence over time and across regions

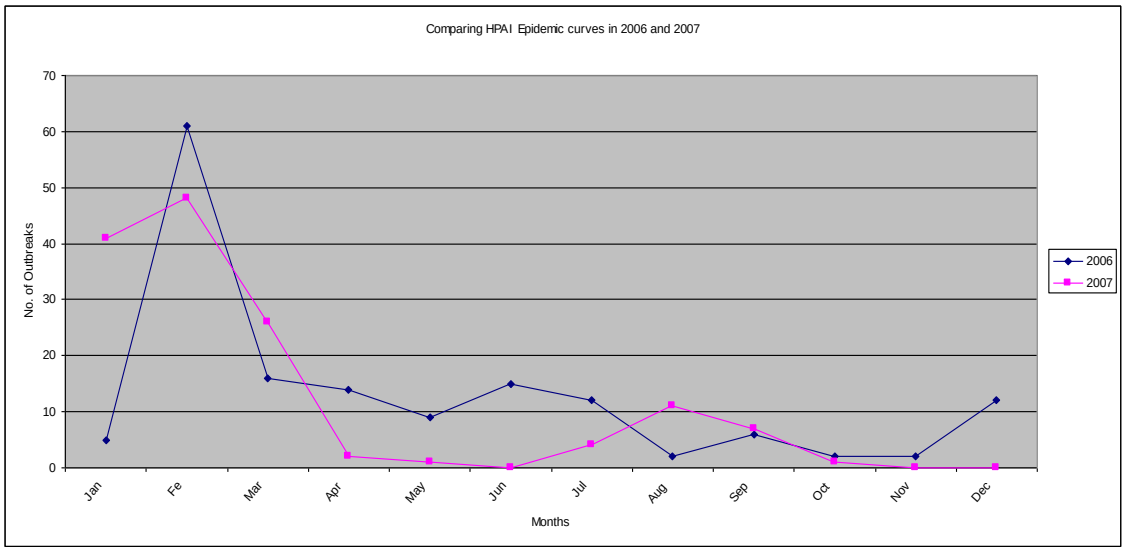
A disease suspected to be HPAI was first reported on January 22, 2006 in Sambawa form in Kaduna state, Nigeria. It was confirmed by both the National Veterinary Research Institute (NVRI), Vom and the OIE World Reference Laboratory, Padova, Italy on Febuary 7, 2006. By March 8, 2006, the disease had spread to 11 states of the country and by July 2006, HPAI had been confirmed in 14 States and the Federal Capital Territory (FCT), with a total of 35 Local Government Areas (LGAs) out of the 774 LGAs in the country.

The States, FCT and corresponding Local Government areas where the disease had been confirmed as of July 26, 2006 were Kaduna State (Igabi, Kaduna- North, Kaduna-South ,Sabongari and Chikun); Kano State (Kumbotso, Janguza, Nasarrawa and Gezawa); Jigawa State (Hadejia); Plateau-Muncipal and Bwari); Nasarawa State (Kokona and Akwanga); Benue State (Oturkpo); Anambra State (Idemili-South); Lagos State (Agege, Ojo,Ikorodu, Alimosho); Taraba state (Ibi); Rivers State (Portharcourt); Ogun State (Ifo) and Yobe State (Nangere). The latest update showed that since the emergence of HPAI in Nigeria, the disease was confirmed in 25 states and the FCT, as shown in Table 7.8. The last confirmed outbreak of HPAI occurred in the town of Nsugbe in Anambra-East LGA of Anambra states on October 6, 2007.

Table 7.7 Essential features of the first five outbreaks of HPAI in Nigeria

	Outbreak 1	**Outbreak 2**	**Outbreak 3**	**Outbreak 4**	**Outbreak 5**
Date of outbreak	16/1/06	Started 16/1/06, reported 9/2/06	30/1/06	11/2/06	17/2/06
System affected	Respiratory, alimentary systems	Alimentary and respiratory systems	Nervous, Respiratory, Alimentary systems	Nervous, respiratory systems	Nervous, Respiratory, Alimentary systems
Areas affected	Sambawa farm, Jaji, Kaduna state	Janguza farms Kano, Kano state	Sovet farms, Kano	Yankari farms, Toro	Jigna farm, Usman Dam, Abuja
Diagnostic test used	HI, AGID, Virus isolation, PCR	HI, AGID, Virus isolation, PCR	HI, AGID, Virus isolation, PCR	HI, AGID, Virus isolation, PCR	HI, AGID, Virus isolation, PCR
Diagnostic test result	Positive	Positive	Positive	Positive	Positive
Numbers affected	46,000 chickens, 180 Ostriches, 2 Geese	2,000	23,000	9,000	7 Geese, 350 ducks
Numbers died		1,600	Not stated		2 geese, 20 ducks
Numbers culled	153 Ostriches, 2 Geese	Not stated			
Numbers vaccinated	None	None	None	None	None

Figure 7.1 The pattern of occurrence of HPAI in Nigeria in 2006-2007.



Source: NADIS, FDL&PCS Abuja.

Table 7.8 The Names of States and Local Government Areas in Nigeria where HPAI had been confirmed as of 30/3/2008

State	LGAs	Number of LGAs
Adamawa	Girei, Metropolis, Jimeta, Lamorde, Numan	5
Anambra	Idemili, Awka South, Aguata, Aniocha, Onitsha South, Anambra East	6
Bauchi	Toro, Katagun, Tafawa Balewa, Bauchi Metropolis, Missau	5
Benue	Otorkpo	
Borno	Metropolis, Jere	2
Delta	Ugheli North, Isoko South	2
Edo	Benin, Oredo, Ikpoba-Okha, Etsako-West, Egor	5
Enugu	Nsukka, Igbo-Eze	2
FCT	Bwari, Kuje, Municipal	
Jigawa	Hadeija, Auyo, Jahun, Dutse	4
Kaduna	Igabi, Kaduna North, Kaduna South, Chikun, Sabo Gari, Giwa	6
Kano	Kumbotso, Tofa, Gezawa, Municipal, Ung-Kudu, Sabo gari, Giwa	9
Katsina	M/Fashi, Kankara, Daura, Municipal, Maiadua, Batagarawa, Dutsinma, Kaita, Bakori	9
Kwara	Ilorin West	1
Lagos	Ojo, Agege, Ikorodu, Alimosho, Badagry, Eti-Osa, Amuwo-Odofin, Ifako-Ijaiye, Shomolu.	9
Nasarawa	Akwanga, Kokona, Lafia, Karu	4
Niger	Minna	1
Ogun	Ifo, ijebu-Ode, Remo, Ado-Odo-Ota, Obafemi-Owode, Ewekoro	6
Oyo	Afijio, Iddo	2
Plateau	Jos-North, Jos-South	2
Sokoto	Kebbe, bodinga, wamako, Metropolis	4
Rivers	Munnicipal	1
Taraba	Ibi, Wukari	2
Yobe	Nangere, Damaturu, Potiskum	3
Zamfara	Bugundu, Gusau	2
Ekiti	Ado	1
Total 25+FCT		97

Two new outbreaks of HPAI in Nigeria were reported on 16 July 2008 on two poultry farms in Kano and Katsina States by the Veterinary Service (VS). In addition, as part of the FAO / NADIS active surveillance program in live-bird markets, two positive duck samples were diagnosed in live-bird markets in Gombe and Kebbi States. Virus isolates from latter were of the EMA3 strain, not found previously in sub-Saharan Africa. About 8,000 poultry were culled and compensation will be paid.

Economic impacts of HPAI (due to actual outbreaks or alarms)

The recent HPAI outbreaks in Nigeria have had serious impacts at both macroeconomic and microeconomic levels affecting all categories of poultry farmers, feed millers, marketers and employees. It represents a significant threat to the livelihood of the rural poor and the future growth

of the poultry sub-sector in the country. There are only a few published works on the socio-economic impacts of HPAI in Nigeria, the first being a limited assessment in Kwara state, and the second a UNDP-funded study involving the administration of questionnaires and structured interviews in 16 of the 35 states and the Federal Capital Territory (FCT). The initial study by UNDP (2006) focused on both macro and micro–economic perspectives, but utilised only a rapid appraisal method (RRM), which is subject to a number of limitations. Rural and urban poor form a higher percentage of total human population in Nigeria, and a large percentage of rural households engage in free-range poultry production as an additional or main source of economic rent and family protein, while many urban poor are also involved in backyard poultry production. Since poor households comprise a very significant share of the poultry-sub sector in Nigeria, a RRM will only generate data that are not accurate representations of the whole population. Also, there are no reliable household survey statistics which could properly aid in determining the micro-impact of HPAI in Nigeria at the surface using a RRM. For example, there are no national livestock statistics on free-range poultry in the country. Hence, a 'free-range poultry mapping' may be required for adequate assessment of impact of HPAI on the livelihood of the poor in Nigeria.

The UNDP-funded study also showed that in overall microeconomic terms, the impact was not very severe. The official confirmation of HPAI in Nigeria caused initial panic, resulting in the total boycott of poultry and poultry products. Within two weeks, egg and chicken sales declined by 80.5% and up to 4 months after, prices had not recovered up to 50% pre-HPAI levels. There was about an 82% drop in prices of poultry feed and it was calculated that approximately one million birds had died or were destroyed as a result of HPAI as of the time this study was carried out. In addition, 80% of the workers of affected farms and 45% of those of un-affected farms had lost their jobs. Overall, the rural village poultry and backyard and medium scale farmers were most severely affected by the HPAI outbreaks. The report gave limited attention to the livelihood of smallholders. The survey results show that even though commercial farms witnessed the highest bird mortality rates, smallholders were more severely affected because of the lack of assets for recovery and because they posses insignificant entitlement for compensation (especially village extensive poultry producing households). Affected backyard producers suffered up to a 100% income loss, while non-affected producers also witnessed a 68.2% income loss.

In Kwara state, according to the study by Obayelu (2006), HPAI caused a drop in the prices of chickens from a pre-outbreak level of ₦700.0 to a post-outbreak level of ₦300.0. The disease outbreak-induced alarm caused 80% of households to stop the purchase and consumption of poultry products out of fear of being infected, and about 75% of poultry farmers had stopped ordering new supplies of birds and were prepared to opt out of poultry farming for alternative jobs. The author claimed that small commercial and backyard poultry farmers suffered more losses as a result of HPAI. Other negative impacts included a marked drop in prices of poultry and poultry products and job losses.

A study that was jointly carried out by UNICEF and AED on Participatory Action Research on Avian Flu communication in Nigeria, though not an economic impact study, highlighted many negative impacts of HPAI on the livelihood and food security of the poor sector of the Lagos and Kano communities. The study showed that there were massive losses of jobs of poultry attendants, livestock feed millers, transporters and veterinary drug vendors. In Kano, the price of chicken in the markets dropped from 500 naira to 50 naira, while in Lagos the price fell from 800 naira to 150 naira.

To further illustrate the impact, the report claimed that "a poultry raiser lost all of his 4,000 birds and sold his car to begin life all over. A woman who had 3,000 layers and 500 broilers lost everything to the outbreak. She now works as a poultry attendant instead of as the proprietor of a poultry farm". Moreover, the negative impact of HPAI outbreaks on family incomes reduced the ability to meet family demands like payment of school fees, medical bills and social obligations.

Table 7.9 Summary of depopulation and Compensation February 2007-January 2008, (FDL&PCS)

State	Affected LGAs	No of Beneficiaries	Depopulated 2006	Depopulated 2007	Total Depopulated	Total Compensation (Naira)
Adamawa	4	211	0	14974	14974	3381200
Anambra	4	5	1465	4111	5576	5401170
Bauchi	5	50	117042	4369	121411	36726625
Benue	1	0	0	0	0	0
Borno	2	8	256	890	1146	1028795
Delta	1	1	0	1784	1784	1294500
Edo	4	5	30	4004	4034	4097700
Ekiti	1	1	0	1088	1088	979200
Enugu	2	0	0	0	0	0
FCT	3	609	206	28287	28493	11415100
Jigawa	2	4	0	12965	12965	17923145
Kaduna	8	113	47378	45411	92789	69114950
Kano	17	147	229781	235053	464834	129101480
Katsina	6	35	4905	87300	92205	120586345
Kwara	1	2	4610	0	4610	1152500
Lagos	9	89	50985	13234	64219	25857740
Nasarawa	5	895	22023	1062	23085	12659770
Niger	1	1	0	27	27	210600
Ogun	6	25	88302	54893	143195	72587325
Oyo	2	1	0	11482	11482	10649800
Plateau	2	33	62916	48011	110927	49211380
Sokoto	2	2	0	29542	29542	42571295
Rivers	1	376	12446	0	12446	2144000
Taraba	2	74	1018	0	1018	362710
Yobe	3	44	0	5846	5846	1665500
Zamfara	2	2	0	2649	2649	2955050
Total	97	2733	643,363	606,982	1,250,345	623,077,880
Summary	Federal Govt.	1712				172,797,590
	World Bank	1021				450,280,290
	Total	2733				623,077,880

Records available from the World Bank funded Avian Influenza Control programme showed that up until the end of 2007, a total of 1,250,345 birds had been slaughtered as part of HPAI control measures. Of this number, 643,363 were slaughtered in 2006 and 606,982 in 2007. Compensation paid to the owners of these slaughtered poultry amounted to ₦623,077,880 (six hundred and twenty three million, seventy seven thousand eight hundred and eighty naira). No information is currently available on the cost of culling, diagnostic testing of samples, cost of cleaning and disinfection and other administrative costs disaggregated by production systems and location. Similarly, changes in the numbers of commercial, semi-commercial and backyard production systems before and after the outbreaks remain un-quantified.

The Government of Nigeria had been under considerable pressure from the FAO/OIE to augment its HPAI control response with some form of vaccination. Although the Government did not adopt a vaccination policy, it is known that some commercial farms in Lagos and Plateau states were carrying out some forms of vaccination. Investigations showed that the vaccine used was an inactivated H5N2, A/Chicken/Mexico 232/94, low pathogenic strain oil emulsified vaccine. Information from some farmers in a co-operative farm in Lagos (Obi 2008) put the cost of the vaccine at ₦ 15/bird for one injection (Thirty naira for two shots). The above price did not include labour and logistic costs.

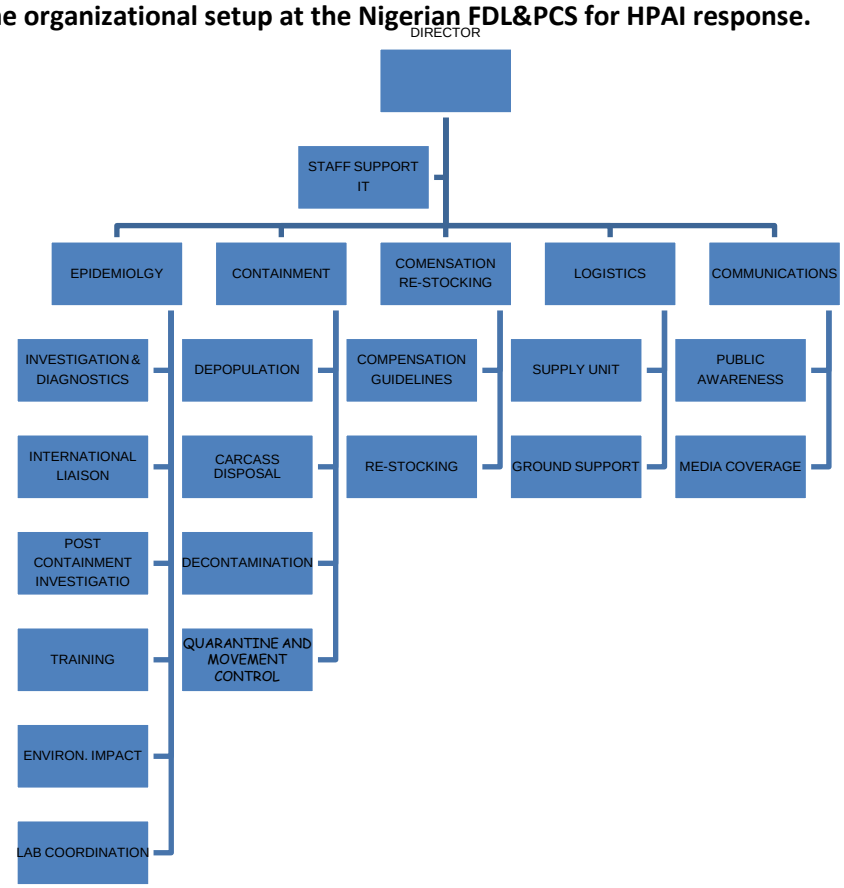
Ministries and public institutions responsible for poultry sector and HPAI management

The main ministries responsible for the poultry sector in Nigeria are the Federal and State Ministries of Agriculture and Water Resources, who are responsible for issues pertaining to animals, including poultry disease control, as well as poultry feeds and housing. The Veterinary Service in Nigeria is headed at the federal level by the Director Federal Department of Livestock and Pest Control Services (FDL&PCS) of the Ministry of Agriculture and Water Resources, and at the state level by the Director of State Veterinary Services. The FDL&PCS is divided into eight divisions, namely: Animal Health, Quarantine Services, Veterinary Public Health, Livestock Development, Planning and Research, Pastoral Resources, NLPD as well as the Pest Control Division. The FDL&PCS has field offices at the various state capitals, while each state veterinary service is supposed to have area offices at the local government headquarters. This present setup is designed to enable efficient and early collection of information on TADs, including HPAI. Although by law the State Directors of Veterinary Services are in-charge of animal disease control, emergencies arising from major TADs, such as HPAI, come under the overall command of the DFDL&PCS. The organizational setup for the management of HPAI in Nigeria is summarized in Figure 7.2.

In dealing with HPAI, the FDL&PCS established five units, namely the Epidemiology, Containment, Compensation and Restocking, Logistics and Communication units. The epidemiology unit, which is essentially incorporated into the national Animal Disease Information and Reporting System (NADIS), has responsibilities including HPAI disease investigation, International liaison, post-containment investigations, training, and laboratory diagnostic laboratory coordination. The containment unit handles issues relating to depopulation, carcass disposal, decontamination, quarantine as well as movement control. The compensation unit prepares compensation guidelines as well as pays out compensation and handles issues relating to re-stocking. Supplies of items needed for containment of the disease, including ground support, is overseen by the logistics unit, while the communication unit handles public awareness efforts and media coverage of HPAI control related matters.

The National Veterinary Research Institute (NVRI), Vom has the national mandate for the diagnosis and investigations into animal/poultry diseases, animal/poultry disease vaccines and research into various aspects of animal/poultry disease epidemiology and control. The National Animal Production Institute is responsible for issues relating to the utilization of modern and improved techniques/technologies for increased and more efficient animal /poultry production in Nigeria. The Institute, through enabling research, developed an improved poultry breed for the country (Shika Brown).

Figure 7.2 The organizational setup at the Nigerian FDL&PCS for HPAI response.



Source: The National Avian Influenza Emergency Preparedness Plan.

Government efforts are augmented by expert and technical support from public and private Institutions, such as the Animal Science/Production Departments of various Federal, State and Private Universities and the Faculties of Veterinary Medicine in the Universities in Ibadan, Zaria, Nsukka, Maiduguri, Sokoto, Makurdi, Umudike and Abeokuta. The Poultry Association of Nigeria (PAN) has members drawn from poultry farmers. Input suppliers and other stakeholders help in the regulation and management of poultry production activities in the country.

The country has five University veterinary faculties that produce graduate veterinarians and at present there are about 4,586 registered veterinarians in addition to 7,810 livestock scientists, laboratory technologists and animal health auxiliaries in the country. The country, therefore, has sufficient of manpower to be able to detect and control most TADs. Nevertheless, there is the need for continuing education and workshops in HPAI disease recognition, diagnosis and control.

At present, the only laboratory statutorily charged with livestock disease diagnosis is the NVRI, Vom. With the emergence of HPAI, efforts were intensified to upgrade the capacity and capability off the institute for H5N1 diagnosis. Laboratory equipment and reagents were provided and specialized training in diagnostic techniques were carried out with the support of the UN system and development Partners and the GON World bank credit facilities. The NVRI has now been designated a regional Laboratory for HPAI and other TADs for West and Central Africa. The GON is making efforts to upgrade the diagnostic capacity of five Veterinary Teaching Hospitals in Zaria, Ibadan, Nsukka, Maiduguri and Sokoto Universities for H5N1 virus.

Current policies, laws and regulations relating to the poultry sector

Although there are no specific laws and regulations directed strictly to the poultry sector in Nigeria, there are policies, laws and regulations relating to animal disease and production, which include the poultry sector. The policy on food safety, production and standardization are reflected in the:

- Meat Inspection and Hygiene Act of 2002 which has provisions for the control of meat hygiene and inspection services, control proper transportation, slaughter and disposal of animal carcasses in Nigeria.
- Meat Hygiene Legislation of 1969 which defines unsafe meat as meat unsafe for human consumption as a result of disease, putrefaction and decomposition.
- Animal Disease Control Act of 1988 which has provisions for the control and prevention of infectious and contagious animal diseases among animals, hatcheries and poultry establishments.
- With respect to Food Safety, production and standardization, regulations and laws are covered under the:
- National Agency for Food, Drugs Administration and Control (NAFDAC) established in 1993.
- The Food and Drugs decree of 1999 which makes it compulsory to register any drugs, processed foods, medical devises, packaged water and chemicals before manufacture, importation and exportation, distribution and sale.
- The Standard Organization on Nigeria which is vested with the authority to specify, elaborate standards and provide quality assurance for commodities imported from outside Nigeria.

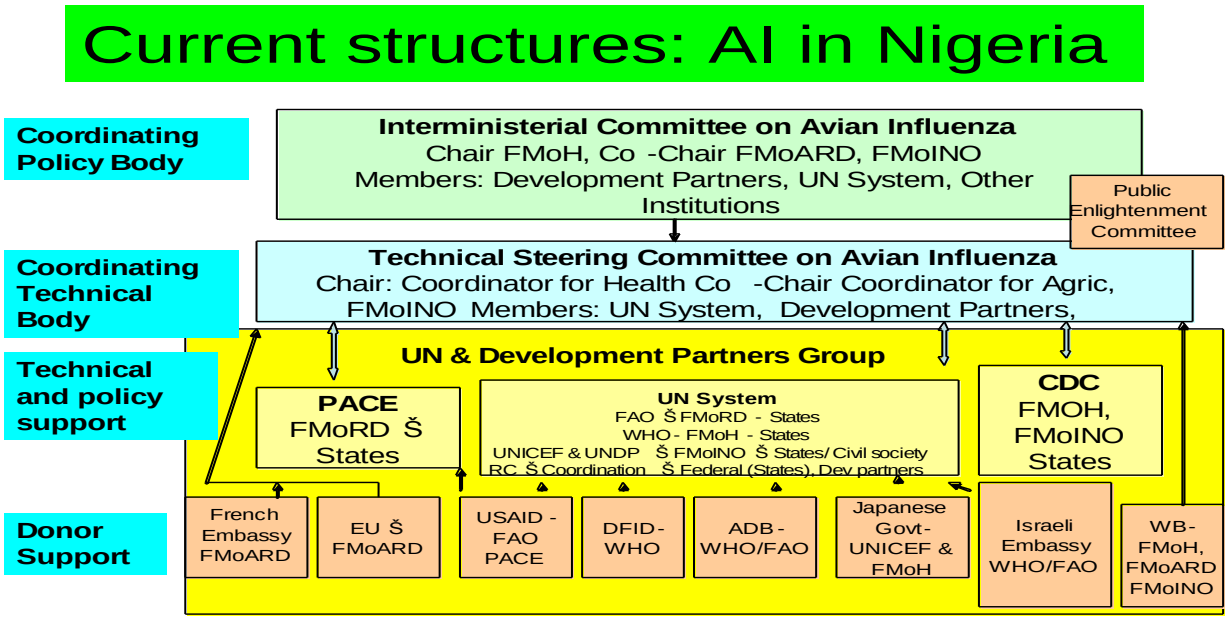
- The National Bio-safety Guidelines of 1994 deals with the characteristics and risks of bio-technology products used in Agriculture, medical, pharmaceutical and industrial production.
- Laws and regulations for environmental protection are covered under the National Environmental Standards and Regulations Enforcement Agency decree of 2007 and the Environmental Protection Agency decree of 1988.

Overall, none of the above laws is specifically targeted to the poultry industry and no attention is given to the rural poultry sector, which forms the greater part of Nigerian poultry. Enforcement of the laws is generally poor and sometimes non-existent.

Country-level organizational structure for HPAI management

Following the confirmation of HPAI in early February 2006, an Avian Influenza Crisis Management Centre (AICMC) was set up to coordinate activities and disseminate information on the prevention and control of Avian Influenza. Three committees, the Steering Committee jointly chaired by the Honourable Ministers of Health (FMOH) and Agriculture and Rural Development (FMOARD), the technical Committee jointly chaired by the Honourable Ministers of State for FMOARD, FMOH as well as the Communication Committee were immediately set up in the AICMC. These Committees met weekly and later bi-weekly to deliberate on various aspects of the national HPAI response initiatives. As a result, a working structure for HPAI response involving the FMOAWR, the FMOH, Federal Ministry of Information and Communication (FMOIC), the development partners, the UN System in Nigeria, was developed, as shown in Figure 7.3.

Figure 7.3 Working structure for the management of HPAI in Nigeria



The United Nations family, the Development Partners and Foreign Governments have played very prominent roles in the HPAI response in Nigeria by providing materials for containment and decontamination to the Government of Nigeria (GON), laboratory equipment and reagents to the NVRI, Vom, organization and funding of training workshops for field as well as laboratory staff in

various aspects of H5N1 diagnosis and HPAI containment and control. The activities by these Foreign Governments, the UN and Development partners are summarized below.

The Food and Agriculture Organization (FAO)

The Food and Agriculture organization of the UN is the lead agency in the UN on issues concerning HPAI containment and control in poultry. It has provided technical support to the GON through fielding technical experts to the country since the outbreak of the disease in February 2006. The FAO has sought for funding, reagents and equipment for the GON from the Development Partners for HPAI response. These included reagents and equipment for the diagnosis of H5N1 to the National Veterinary Research Institute, Vom and personal protective equipment and equipment for decontamination and disinfection after depopulation of affected farms. FAO has joined with the FDL&PCS, implementing a nation-wide HPAI active disease surveillance and a targeted disease surveillance in selected live-bird markets (LBMs) in Nigeria. The organization has also provided training of GON Animal Health staff in various aspects of HPAI response.

The United Nations' Children Educational Fund (UNICEF)

Among the UN agencies in Nigeria, UNICEF is the lead agency for Avian Influenza Communication. UNICEF works closely with the Federal Ministry of Information & Communications (FMIC) and States Ministries of Information to plan and implement AI communication activities. UNICEF support to AI communication activities are implemented through four field offices located in Enugu, Lagos, Kaduna and Bauchi and its Country Office in Abuja. Each field office has an AI Communication Consultant while the Country Office has an Information/Media Specialist and a Programme Communication Specialist. These individuals provide technical support to all national, State and local government AI communication structures and promote decentralization of AI communication activities.

UNICEF has supported the FMIC to develop a national AI Communication strategy. The overall aim of the communication strategy is to inform the public about the presence of the H5N1 virus in Nigeria in order to reduce the risk of the disease and contribute towards mitigating the danger posed by the virus acquiring the capacity for human-to-human transmission. UNICEF has provided support to the FMIC and State Ministries of Information to set up and strengthen the capacity of AI Public Enlightenment Committees (PECs) to serve as the clearinghouse for the planning, coordination and implementation of AI communication activities at all levels. UNICEF helped in the training of 350 members of the 38 PECs in strategic communication planning and implementation, advocacy, community mobilization, community surveillance, community dialogue, interpersonal communication skills, materials development and testing and to partner with the media for effective AI reporting. It also established strong partnerships with the Nigerian Guild of Editors, Broadcasting Association of Nigeria, African Independent Television, BBC World Service Trust, National Orientation Agency departments, and Community Development Officers at LGA.

UNICEF assisted with the development of the National communication strategy and Action Plan for Avian Influenza and Human Pandemic, which is being used as the basis for the design and implementation of AI communication activities. It also assisted with the development of a risk communication strategy that was shared with key stakeholders. UNICEF also supported the National Technical Committee and Steering Committee to develop the communication component of the

Integrated National Response plan. A Community Surveillance manual was developed and is being used as a reference manual for the training of LGA and community resource persons, as well as guide for the development and implementation of community surveillance activities. It also developed a Training of Trainers manual for training community resource persons in community dialogue, interpersonal communication and communication surveillance. UNICEF has assisted with the development of Multi Media IEF materials and press media AI kits, as well as the training of 500 journalists in interactive radio programme production, which incorporates the community voices and initiatives in programmes produced and broadcast in partnership with African Independent Television, or three 125- minute interactive programmes promoting positive behaviour practices.

World Health Organization (WHO)

The WHO has provided technical support to the government of Nigeria through the Federal Ministry of Health. The WHO has funded training workshops on various aspects of pandemic influenza response plans and together with CDC provided reagents and equipment for Ministry of Health diagnostic laboratories. It continues to play the role of the lead agency in matters relating to Human aspects of Avian and Pandemic Influenza response plans.

United Nations Development Program (UNDP)

The UNDP has actively supported FAO in its efforts to provide technical and professional support to the GON in its Avian Influenza response activities. To this effect, the UNDP provided funding for the recruitment of eight United Nations Veterinary Volunteers (UNVVs) who were posted to eight states of Nigeria to assist with the organization, supervision and implementation of the daily activities for the control of Avian Influenza, as well as with active disease search and surveillance, information gathering on AI and other major transboundary animal diseases in those states. The UNDP also funded a study on the Socio-Economic Impact of HPAI in Nigeria and for the preparation of the Nigeria National Integrated Avian and Pandemic Influenza Preparedness Plan.

International Organization for Migration (OIM)

The OIM has been involved in the Avian and Pandemic Influenza Preparedness for Migrants project, which is funded by the Japanese Government and Social mobilization of migrant poultry workers, traders, and transporters in Nigeria funded by the Government of Norway. The overall objective of the project was to create awareness amongst key government institutions and other stakeholders contributing to AI preparedness in Nigeria on the need to include migrants and mobile populations in existing AI national preparedness plans. The OIM also aims at utilizing existing AI communication strategies in Nigeria to enlighten migrants and mobile population on how to avoid bird flu by adopting healthy behavioural practices.

In this respect, the organization has held informal consultations with relevant government and UN partners to introduce the project and identify priority target groups for IOM's intervention. Advocacy visits to leaders of identified migrants communities, fowl sellers, transporters and nomads were carried out and orientation workshop for government and UN partners on mainstreaming migrant populations in the National Avian and Pandemic Influenza Response Development had been done. Other activities include distribution of IEC materials (T-shirts, Face caps, Car-stickers, posters,

information sign boards) to target groups as well as mapping of migrants and mobile populations in the FCT.

The project on Social mobilization of migrant poultry workers, traders and transporters in Nigeria covering Lagos, Anambra, Borno and Kano states was designed to conduct an avian influenza and pandemic preparedness Knowledge, Attitudes, Practices, Beliefs, (KAPB) survey among migrant poultry workers, traders and transporters and to map and identify migratory routes of this target population. The project also aimed at trying to implement Avian and Pandemic Influenza Preparedness social mobilization activities among poultry workers, traders, and transporters at the state level in Nigeria. Presently IOM is in the process of recruiting a staff to support project implementation and networking with relevant partners.

The United Nations Resident Coordinator (RC)

Although each Agency in the UN house has its specific role and related activities with regard to HPAI control, primarily the FAO for Animal health, WHO on human health and UNICEF on communication, the Office of the Resident Coordinator provides needed coordination and synergies in response activities and initiatives. Areas of coordination include the preparation of the UNCT Pandemic Plan, issues related to staff health and safety in the event of a pandemic, technical and financial assistance to the GON in the development of a National integrates Avian and Pandemic Influenza Plan, which has been approval by the highest national ruling body. To ensure effective coordination, the RC organizes bi-weekly meetings of the UN system and the development partners to receive updates on activities, review various GON control strategies and to help identify areas of further need and assistance to the government.

Table 7.10 Summary of Assistance to the GON by the UN and the Development Partners

	Types of Assistance to GoN			
Donor/Development Partners	Technical	Material	Financial	Capacity Building
ADB			xxx	
AU-IBAR	xxx			
CDC	xxx			
Chinese Government		xxx		
DFID		xxx		
EU		xxx	xxx	xxx
Israel		xxx		
FAO	xxx	xxx		xxx
France	xxx			xxx
OIE	xxx			
South Korea		xxx		
UNDP			xxx	
UNICEF	xxx			
USAID		xxx	xxx	xxx
USDA-APHIS	xxx	xxx		xxx

With respect to Animal health delivery, apart from the Animal health staff of the Federal department of livestock, veterinarians are employed by each of the states in the country. In addition, by law each local government area is also supposed to have a Veterinarian for purposes of animal disease

investigation and control, including HPAI. There are also private veterinarians in each of the states, a majority of whom are in poultry related practice. An indicative estimate of the distribution of veterinarians according to various states is shown in Table 7.11.

Table 7.11 The distribution of veterinarians in various states of Nigeria (NVC Register, 2007)

STATE	NUMBER OF VETERINARIANS				
	State Services	Federal services	Private	Research Insti	University
Abia	7	2	10	1	4
Adamawa	31	2	8	1	7
Anambra	10	-	30	-	1
Akwa Ibom	35	1	4	1	5
Bauchi	15	4	3	-	9
Bayelsa	2	-	-	-	-
Benue	7	2	13	1	14
Borno	64	-	-	-	-
Cross River	6	2	7	-	5
Delta	21	2	12	-	-
Ebonyi	9	1	2	2	-
Gombe	15	-	5	-	-
Jigawa	8	-	-	2	-
Kano	23	6	36	1	4
Katsina	12	4	-	-	-
Kebbi	12	3	-	5	-
Kogi	11	2	6	1	-
Kwara	14	-	-	-	-
Nasarawa	5	2	5	-	3
Niger	23	6	9	-	-
Ogun	14	6	21	-	2
Ondo	16	2	13	3	5
Plateau	10	3	47	6	-
Sokoto					26
Taraba	32	3	8	-	7
Yobe	18	2	1	1	-
Zamfara	8	-	-	-	-
Kaduna					70
Oyo					75
Enugu					51

Information awareness and reporting

The Federal Minister of Information and Communications under the organizational structure is responsible for information dissemination and mobilization at all levels. In response to communication issues, FMOI is expected to liaise with State and Local government levels in the dissemination of information regarding HPAI. The Ministry also identifies and determines communication action plans which it monitors and evaluates for impacts on the general public. At the advent of the HPAI emergency in Nigeria in February 2006, an inter-ministerial committee comprised of FMOH, FMAWR and FMOI was set up.

Generally, information on HPAI in Nigeria is managed by the AICP communications component and the NADIS communication department in collaboration with the development partners (UNICEF, AED, AI.COM, USAID etc).

The Government of Nigeria, through the Federal Ministry of Information and National Orientation, initiated the Community Dialogue System (CDS), which involves an integrated approach to consultation and involvement at the community level through participatory approaches. In this approach, community leaders are trained in identifying risky behaviours, attitudes, perceptions and beliefs before, during and after avian influenza outbreaks. This system also integrates animal and human surveillance teams at community levels.

Table 7.12 Information Sources for Poultry Farmer

Information Sources	Previous Study (%)[a]	Study Finding (%)[b]
Extension agent	22	
NGO	27	
Farmer Magazine	32	
Television	68	46
Veterinary Personnel	52	28
Hand Bill	47	
Radio	43	53
Colleagues		15
Other		20

Source: adapted from AICP National baseline survey (NBS) [a]Fawole (2005), [b] AICP NBS (2007)

There is information on AI, according to the findings of the UNICEF/AED study in October-November 2006 in Lagos and Kano states, which revealed that information was available to members of the community, but the amount was different in urban and rural areas. Urban communities had wider access to sources of information, which included TVs, newspapers, government agents, religious leaders and professional groups. In the rural communities, other sources included public gatherings, such as ceremonies, religious activities and town meetings. An AICP baseline survey (2007) found radio (53%) and television (46%) as the major sources of information for the poultry groups investigated, which comprised of transporters, processors and traders as well as poultry farms. Similarly, a previous study (Fawole, 2005) that investigated poultry farmers' access and utilization of extension information, found that poultry farmers obtained information from a variety of sources with television being the most prominent (68%), as summarized in the table below adapted from an AICP baseline survey.

According to NADIS, information is disseminated through radio and television, and most of the farmers are informed through this means. However, rural farmers mostly get their information by radio, with 55-60% informed, while urban farmers are reached by both radio and television, with more than 60% of them well informed about HPAI.

General disease information

In terms of disease information, UNICEF and AED community based participatory action research in urban and rural areas of Kano and Lagos states also reveals that there is much knowledge about the

disease in the groups assessed, although no ranking was provided among the different groups studied. The AICP baseline survey reported that there is a general awareness about HPAI, 40.2% respondents first heard of the disease in 2005 while 46.1% heard of it in 2006. The high awareness level is likely due to the current level of information dissemination. There are a few local names for the disease: “onwu-okuko” in Ibo; “lukuluku-eiye”or “otutu-eiye” in Yoruba and “matsarsaran sunsaye,” in Hausa. However, the most common name used was “bird flu”. Among the respondents surveyed in the poultry sector, knowledge of the avian influenza disease was relatively high. The majority of the respondents (61%) believed that AI can be contracted through contact with infected birds and that AI could result in the mass death of poultry. However, 47.6% of the respondents were unaware that the disease could be transmitted to human beings and could also result in their death. According to NADIS, 75-80% of urban poultry farmers, 40% of rural poultry farmers and 10% of the general population are aware of the symptoms of the disease.

Knowledge and attitude

In terms of knowledge and attitude, AICP survey findings indicate that among the interviewees, only 60.6% indicate that they could identify a bird infected with AI. The majority (71.3%) of the poultry “groups” respondents believe it is inappropriate for infected birds to be sold to consumers. Almost half (49.5%) of respondents were unaware that AI could impact their businesses (farms, transport, trade, processing). About 73% of the respondents were worried about the possibility of the disease occurring in their communities. A good number (51%) believed that the disease was politically motivated and many (73%) agreed it should be a national priority.

Another study conducted by Yakubu and Musa (2008) assessed avian influenza (AI) awareness among 102 rural households randomly selected from 13 local government areas across Nasarawa state in Nigeria. They used a structured questionnaire for eliciting information about knowledge of avian influenza, symptoms of the disease, biosecurity measures, public health hazards and prevention or control measures. Their results show that 67.7% of households are found to be aware of AI, but that households generally have inadequate knowledge on biosecurity and prevention/control measures. Also, their results reveal that the level of education and number of sources of information on AI positively and significantly contributed to the AI awareness among sample households. Radio was found to be the best source of AI information. Contrary to expectations, they found that closeness to the nearest livestock/veterinary health authority does not contribute positively to AI awareness among rural households.

Informational campaigns

The Government of Nigeria, through the Federal Ministry of Information and National Orientation in collaboration with ministries of Agriculture and Information at all levels (Federal, State and LGA), has a communication strategy for different target groups. These strategies include meetings, workshops, seminars, rallies, public gathering, print and electronic media as well as a Community Dialogue System (CDS). Depending on the group, the strategy involves an integrated approach to consultation and involvement at the community level through participatory approaches and farm visitations by information personnel, veterinary and human health officials to launch awareness campaigns. In 2005, the government set up a Public Enlightenment Committee that implements HPAI communications strategy and action plans at all levels (Federal, State and LGA). Table 7.13,

adapted from an AICP baseline survey from 2007, summarizes awareness campaigns launched in at risk regions.

Table 7.13 Awareness Campaign Launched In At-Risk Regions

State	Campaign Launched
Abia, Akwa Ibom, Anambra, Bauchi, Benue, Borno, Cross River, Ebonyi, Edo, Ekiti, Enugu, Abuja, Imo, Taraba, Yobe, Zamfara, Jigawa	0
Adamawa, Bayelsa, Gombe, Osun, Kaduna.	1
Delta	3
Nassarawa	6
River	10
Plateau	23

Source: AICP National Baseline Survey 2007

The major means of communicating information to poultry farmers are via posters, leaflets, stickers T-shirts, face-caps, radio and television jingles. NADIS also reported that from 2006-2008, it has carried out community dialogue in grazing reserves in 9 states and also in six communities in 3 states with funding from GON, ADB, MDG and the EU. Also, communication and information surveillance among poultry farmers has been carried out in 6 communities in Bayelsa, Ekiti and Sokoto states and also a communication and information surveillance among fowl sellers in collaboration with IOM for fowl sellers, transporters and pastoralists in FCT in 2007.

Prior to the HPAI outbreaks, NADIS and NVRI produced posters on various aspects of HPAI information and symptoms that where translated to many Nigerian languages and distributed through the veterinary departments nationwide for circulation among the general public and poultry farmers. The posters and information pamphlets also covered other major poultry diseases, such as NCD and Infectious Bursal Disease (IBD).

In 2007, the AI logo and radio and television jingles were approved and adopted. They have been aired to remind the public of the dangers of HPAI, what to do and where to report disease. The Avian Influenza Crises Management Centre also disseminates information on AI. Most of the information dissemination campaign strategies are similar to the methods employed for Rinderpest, CBPP, NCD, HIV/AIDS and polio eradication campaigns.

Infrastructure

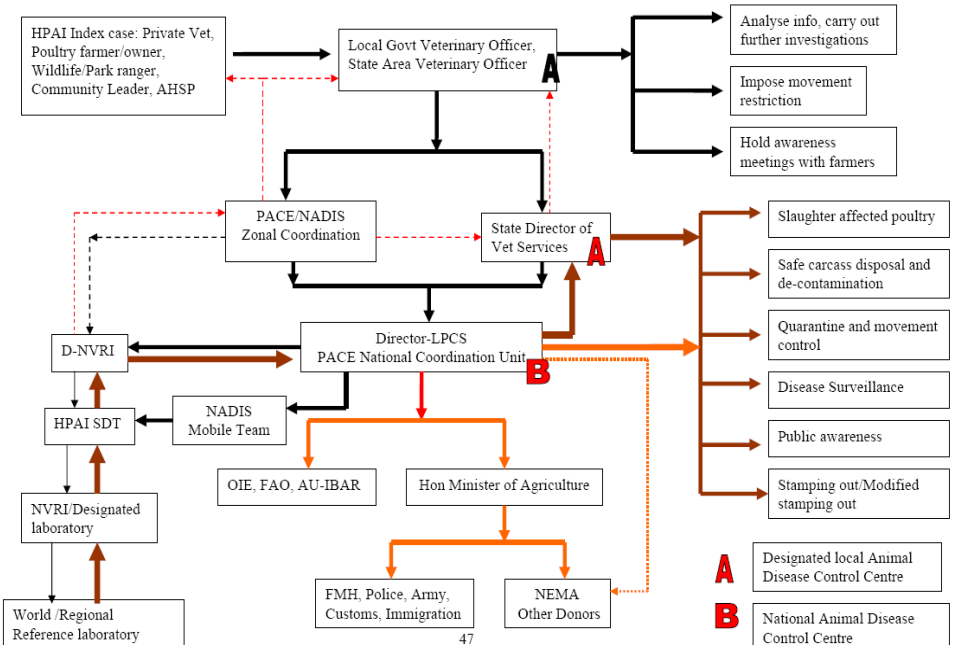
In most of the urban and peri-urban areas where a majority of the commercial, semi-commercial and large scale integrated farms are located, there is a good road network with cellular technology and Internet/email facilities. The major areas where there are poor road networks are in the rural areas, where most of the rural poultry are situated.

Reporting

Reporting of HPAI and other TADs has involved a bottom up approach. The simplest form of representation is that the farmer reports any disease incidents to the nearest veterinary authorities, local government agric department, private veterinarian or animal health worker within his vicinity at the community level and the information is then passed through the zonal office to the state

veterinary authorities and the federal veterinary authorities. The HPAI scheme of reporting from the field to both federal and state veterinary services is as shown in Figure 7.4.

Figure 7.4 The Route of reporting for HPAI in Nigeria Source: The Nigeria National Emergency Preparedness Plan for HPAI).



Compensation

On February 8, 2006, when the first case of the H5N1 virus isolation was confirmed at Sambawa farms in Kaduna State, the Federal Government of Nigeria immediately instituted a compensation scheme to serve as an immediate relief to affected farmers. This was initially based on a flat rate payment for different species of poultry as enumerated in the table below. However, the flat rate compensation scheme was not attractive enough for farmers and therefore led to concealment of infection and the sale of infected birds to unsuspecting members of the public. In view of the risk of the spread of the infection and the attendant human exposures, there was an upward review of the rates using the WB funds available to the AICP project. The Table below summarizes the old and new compensation rates paid to poultry farmers.

For a farmer to be eligible for compensation, he has to report any disease incidence to the nearest veterinary authorities, who will subsequently take immediate steps to manage the outbreak and take samples and inventory of the birds on the farm. This is followed by appropriate documentation by the authorities in the presence of other witnesses, which includes representatives of the Federal, State, LGA, traditional authority and the state security agents. The farmer is only compensated for birds that are culled by the veterinary authorities and not for all dead birds. This system ensures that farmers promptly report any disease incidents without delays because failure to do so means that they will incur the cost of the dead birds.

One of the major constraints encountered in the payment of compensation by the government is undue delays between culling and compensation by the government.

Table 7.14 Initial and revised rates of compensation per bird in Naira (N)

Species	Initial compensation	*Range of Revised Compensation
Chickens (commercial)	250	350 to 1,500
Eggs (commercial)	-	15
Chickens (free ranging, rural)	250	100 to 750
Guinea fowl	250	100 to 500
Pigeons (fully grown)	250	250
Ducks and geese	1,000	100 to 700
Turkeys (local)	2,500	300 to 1,600
Emus		10,000
Ostriches	20,000	15,000 to 100,000
Ostrich eggs		4,000

*Rates based on level of production and growth status of the bird.
Source AICP, 2007.

8. Risk Factors and Risk Assessment

The only risk assessment of HPAI that has been done in Nigeria was qualitative and was carried out by the Expert Committee headed by Prof. Timothy Obi. It prepared the National Emergency Preparedness plan for HPAI in December 2005 before the disease officially was reported in the country. The committee identified risk factors that may aid in the introduction of the disease into the country, such as the fact that Nigeria lies in the East Africa/West Asia fly ways and the North Atlantic flyway of migratory birds, increased trade and human traffic between countries where the disease was known to exist and Nigeria, the expanding HPAI disease outbreak areas due to globalisation and relative ease of movement and transportation. The assessment also pointed out that Nigeria's long porous borders and informal livestock movement/trading across the borders, especially at border markets, further increased the risk of introduction of the disease into Nigeria.

It was equally suggested that in the event of HPAI being introduced into the country, the factors that may aid sustenance and maintenance of the disease include the structure of the poultry industry in Nigeria, consisting predominantly of backyard poultry with little or no bio-security, and peri-urban and urban commercial poultry production with minimum to moderate bio-security, as well as constant introduction of new birds from relatively unknown and unverifiable sources. Other factors included the rearing of flocks of different species and ages of poultry together, uncontrolled livestock and poultry movement within the country as a result of lack of enforcement of animal disease control laws and regulations in the country and increased close contact between poultry and humans. The expert group also identified a lack of an organised poultry marketing system, the existence of open live poultry markets characterized by interspecies mixing and poor sanitary conditions. In a study that was jointly carried out by the FAO and the FDL&PCS on HPAI in LBMs, it was observed that over 445 of the marketers did not disinfect poultry cages, about 51% practised sale of sick birds while 63% practised salvage slaughter of such sick birds for human consumption to minimize losses from disease. These practices help in the spread and sustenance of HPAI in the country. Other risk factors included the deteriorating animal health delivery services due to inadequate funding and inefficient re-structuring programme of the veterinary services.

Risk of introduction and spread through migratory birds

It is well known that Nigeria lies in the East Africa/West Asia fly ways and the North Atlantic flyway of migratory birds. At the early stages of the outbreaks in Nigeria, experts from Wetlands International opined that the origin of the disease was unlikely to be traceable to migratory birds based on the timing of the outbreaks. However, results of molecular characterization of the first set of Nigerian H5N1 viruses seemed to indicate that the 2006 disease outbreaks were introduced into the country through three independent routes, most likely through migratory birds. This position was further strengthened by the findings of the FAO funded investigations into the role of wild-birds, wetland and domestic ducks in the introduction of HPAI into Nigeria.

Nigeria has, in addition to the Lake Chad Wetlands, other wetlands, namely the Apoi Creek Wetlands in Bayelsa state, Baturiya Wetland in Kano, Dagona Sanctaury Lake in Yobe, Foge Islands in

Niger, Lower Kaduna-Middle Niger Floodplain in Kwara, maladumba Lake in Bauchi, the Oguta Lake in Imo, Pandan and Wase Lakes in Nasarawa and the Upper Orashi in Rivers States.

The Lake Chad Wetlands (607354 hectares, 13^{O}04'N 013^{O}48'E) in northeast of Nigeria is home to the internationally well-known Hadeja-Nguru Wetlands, which is an important habitat for a great variety of Palearctic migratory waterbirds, including the marbled Teal.

The Apoi Creek Forests, (Bayelsa, 29,213 ha;05°47'N 004°42'E) is a tidal freshwater, lowland swamp-forest located in the Central Niger Delta that is composed mainly of marshes, mangrove forests and fresh water swamps. The *Baturiya Wetland* (Kano; 101,095 ha; 12°31'N 010°29'E) is a natural wetland of the Sudano-Sahelian biogeographical region comprised of ponds and seasonally flooded land that is replenished by the annual flooding of the Kafin Hausa River. It supports a great diversity of flora and fauna and is particularly important for its water-birds. A wide range of resident and migratory water-birds depend on this wetland - the Yellow billed stork, Knob-billed goose and the African Grey Hornbill (Wetlands International 2008).

The Dagona Sanctuary Lake (Yobe; 344 ha; 12°48'N 010°44'E) is a large, natural, seasonally flooded oxbow lake that falls in the section of the Hadejia-Jamaare River floodplain within the Chad Basin National Park. The site supports over 25 bird species and is one of the most important sites in the Hadejia-Nguru wetlands for wintering Palaearctic and inter-African migrant water-birds. It also provides a breeding site for the Grey heron and Little Egret.

The Foge Islands (Kebbi, Niger State 4,229 ha; 10°30'N 004°33'E) is a wetland in the guinea-Savanna woodland of Nigeria. Records available from Ramsar shows that it supports over 180 species of birds. Similarly, the Lower Kaduna-Middle Niger Floodplain. Kwara, Niger State (229,054 ha; 08°51'N 005°45'E), is an extensive alluvial wetland on the floodplain of the mid-section of River Niger and the lower course of River Kaduna, a main tributary of the Niger. The wetlands support a significant number of bird species that are restricted to the Sudan-Guinea Savanna biome.

The Maladumba Lake (Bauchi, 1,860 ha; 10°24'N 009°51'E) is representative of the natural wetlands of the Sudan savanna in Nigeria. It supports a large number of migrant bird species, such as the Grey Heron, white-necked stork and the Green Fruit Pigeon. On the other hand, the *Oguta Lake*, Imo (572 ha; 05°42'N 006°47'E) is the largest natural, freshwater lake in south-eastern Nigeria, located in a natural depression within the floodplain of the River Niger. Its water surface area varies from 180 to 300 ha depending on the season, and its average depth is 5.5m. It receives perennial drainage from the Rivers Njaba, Utu and Awbuna and the lake drains into River Orashi. Information on the species of migrant wild-birds found in this wetland area is not available.

The Pandam and Wase Lakes (Nasarawa, 19,742 ha; 08°42'N 008°58'E) are characterised by two tributaries draining into each of the lake's arms, and the lake being separated from River Dep by a swamp which extends along both of them. The lake supports large numbers of resident and migrant birds, with about 217 birds species recorded in the area. It supports large flocks of White-faced Whistling Duck (*Dendrocygna viduata*) during the dry season and provides a breeding ground for the Long-toed Lapwing. The lake and the adjoining Wildlife Park support endangered species such as the West African manatee.

The Upper Orashi, (Rivers State, 25,165 ha; 04°53'N 006°30'E) is a freshwater swamp forest in the central Niger Delta, inundated from September to November by floodwaters of the River Orashi,

resulting in siltation and soil fertility augmentation. The site is a roost for the Grey Parrot (*Psittacus erithacas*) and also hosts a significant number of water-bird species whose distribution is confined to the Guinea-Congo Forest biome.

Records available from Wetlands International lists the following species of wild-birds that migrate from Europe and Russia to wintering areas in West Africa, including northern Nigeria, and return in spring in the opposite direction:

Black-crowned Night Heron *Nycticorax nycticorax*, Squacco Heron *Ardeola ralloides* , Little Egret *Egretta garzetta*, , Grey Heron *Ardea cinerea*, Purple Heron *Ardea purpurea*, White Stork *Ciconia ciconia*, Glossy Ibis *Plegadis falcinellus*, Eurasian Wigeon *Anas penelope*, Common Teal *Anas crecca*, Garganey *Anas querquedula*, Northern Pintail, *Anas acuta*, Northern Shoveler, *Anas clypeata*, Common Pochard *Aythya ferina*, Ferruginous Duck *Aythya nyroca*, Tufted Duck *Aythya fuligula*, Eurasian Coot *Fulica atra*, Black-winged Stilt *Himantopus himantopus*, Pied Avocet *Recurvirostra avosetta*, Collared Pratincole *Glareola pratincola*, Black-winged Pratincole *Glareola nordmanni,* Little Ringed Plover *Charadrius dubius*, Great Ringed Plover *Charadrius hiaticula*, Kentish Plover *Charadrius alexandrinus*, Jack Snipe *Lymnocryptes minimus*, Common Snipe *Gallinago gallinago*, Great Snipe *Gallinago media*, Black-tailed Godwit *Limosa limosa*, Common Redshank *Tringa totanus,* Spotted Redshank *Tringa erythropus*, Common Greenshank *Tringa nebularia*, Marsh Sandpiper *Tringa stagnatalis*, Wood Sandpiper, *Tringa glareola*, Green Sandpiper *Tringa ochropus*, Common Sandpiper *Actitis hypoleucos*, Curlew Sandpiper *Calidris ferruginea*, Temminck's Stint, *Calidris temminckii*, Little Stint *Calidris minuta*, Ruff *Philomachus pugnax*, Black-headed Gull *Larus ridibundus*, Lesser Black-backed Gull *Larus fuscus*, Gull-billed Tern *Sterna nilotica*, Caspian Tern *Sterna caspia*, Whiskered Tern *Chlidonias hybrida*, White-winged Black Tern *Chlidonias leucoptera.* A few additional species that adopt this migration pattern but have a largely or entirely coastal distribution outside the breeding season have been excluded (for example, Ruddy Turnstone, *Arenaria interpres*, Sanderling *Calidris alba* and Red Knot *Calidris canutus*.

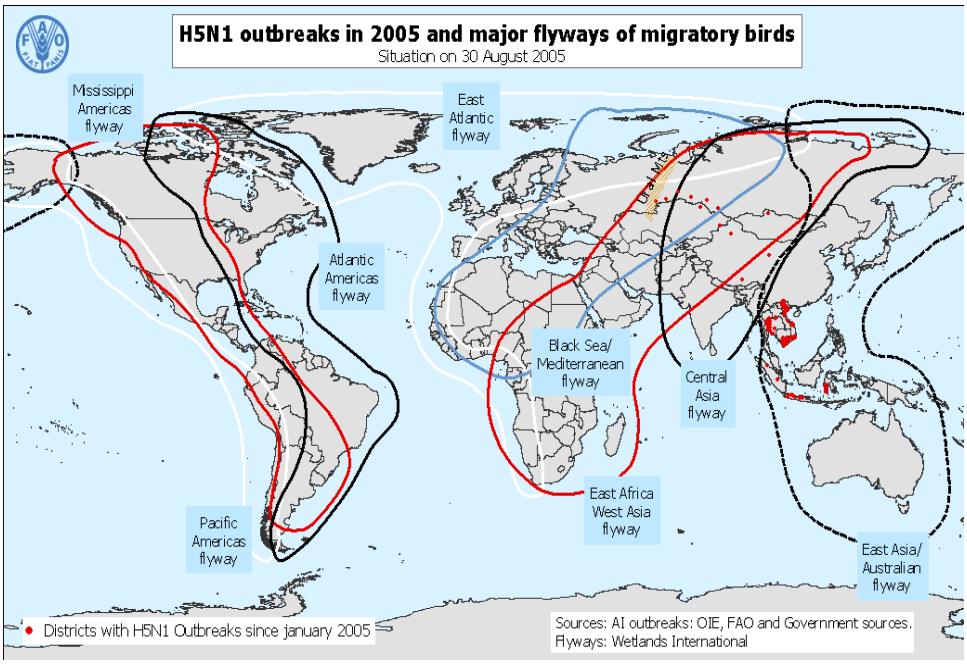
Of the above, three species are considered of higher risk for carrying HPAI because of their migration patterns, gregariousness, habitat preferences, tendency to mix with other species and history of occurrence of HPAI known to migrate to Northern Nigeria from Europe and Russia. These are the **Garganey** *Anas querquedula*, **Northern Pintail** *Anas acuta* and **Northern Shoveler** *Anas clypeata* (Ilemobade et al 2008). The wild-birds that are known to visit the Hadejia-Nguru wetlands in Nigeria include the Garganey ducks, White and Black Storks, Cormorants, Black-winged Stilt, Avocets, Alpina, African jacana, Yellow wagtail, Purple swan hen, Moorhen and the Purple heron.

The population of Garganey wintering in West Africa is estimated at 2 million, and these birds are concentrated in the Sahel zone from Senegal to Chad. The population of Northern Pintail wintering in West Africa has a similar distribution and was recently estimated at fewer than 500,000 individuals. Northern Shovelers are much less numerous with perhaps 15,000 spending the winter in West Africa. The largest concentrations of these birds in West Africa are found at three very large wetland complexes: the lower Senegal River Basin in Senegal/Mauritania, the Inner Niger Delta in Mali and Lake Chad in Chad, North-East Nigeria, Northern Cameroon and Eastern Niger. Wild waterfowl counts in the Hadejia-Nguru wetlands during the last 10 years gave the figures for the population of Garganey ducks between 70,000 and 150,000[3] depending on the year (Ilemobade et al

2008). A population of approximately 100,000 Ruffs (*Philomachus pugnax*), a medium-sized wader, was the largest during the most recent survey carried out in 2004.

Most large-scale movement between the Black Sea/Mediterranean region and Sahelian Africa is thought to occur between August and November, and the months of January and February are the period when populations are thought to be most sedentary. In Nigeria, it is claimed that the arrival of the Wild bird at the wetlands takes place between October and February. Two well known wild-bird flyways, the East Africa/West Asia and the Blacksea/Mediterranean Flyways, pass through Nigeria (Figure 8.1). A recent study involving satellite tracking of transmitter-fitted Garaney (*Anas querquedula*), the white-faced whistling ducks (*Dendrocygna viduta*) and the Comb ducks (*Sarkidiornis melanotos*) by the joint FAO/CIRAD efforts will throw more light on the flyways of these wild-birds.

Figure 8.1 Major Flyways of migratory birds as of 30 August 2005 (FAO).



Although detailed reports of the countries from which migratory birds seen in Nigeria originate from are not readily available, it is believed that many of them come from western and eastern Europe and the Mediterranean. Rings on wild birds that had been found dead in the country show that the birds originated from Britain, Finland and Germany (Figures 8.2, 8.3, & 8.4).

Figure 8.2 A homing Pigeon from Britain caught at Sagbama, Bayelsa, Nigeria. (courtesy Dr K. A. Majiyagbe)

Figure 8.3 Picture of a dead migratory bird of prey from Germany found at Makurdi, Benue State.

Figure 8.4 A migratory falcon from Finland caught at Sokoto showing leg tags

Conditions favourable for the mixing of migratory wildbirds and domestic poultry, such as local ducks and chicken, in the wetlands are abound. A lot of agricultural activities like the growing of millets, guinea corn and rice that are carried out in these wetlands, such as the Hadejia-Nguru wetlands, result in a lot of food residues post-harvest. These attract both migratory wild birds and local scavenging local chickens and ducks, resulting in close contact between the two groups. Many of the farmers in these wetlands also raise considerable numbers of ducks in homesteads and backyards or any location where water bodies exist, such as dams, artificial lakes or stagnant pools, which are common in Kano state. This often leads to the mixing of local poultry with migrant wildbirds. In the Hadejia-Nguru wetlands, large drakes of Muscovy ducks are known to join flocks of wildbirds for mating, thus increasing the chances of HPAI transmission.

In addition, there is illegal hunting of wildbirds, such as Whit-Stork (the most sought-after because of its large size), White-faced tree ducks, fulvous ducks, Abdim's stork and the Spur-winged birds and geese. It is equally common for pastoralists to leave the wetlands in October-November with their possessions, including domestic ducks. According to Ilemobade et al (2008), one route used by the pastoralists crosses the wetlands in northern Jigawa state to Katsina and Niger state. Another route is south-south through Bauchi to the Plateau states.

Wild non-migratory birds

There are no data on the evidence of H5N1 virus in non-migratory wild birds in Nigeria. In addition, the susceptibility of these wild-birds to the virus is unknown. It is quite common to find cattle Egrets in Poultry farms searching for maggots in poultry dropping dumping sites. Guinea fowls are also known to mix with village scavenging poultry. The susceptibility and the role of indigenous resident wild-birds and local breeds of poultry in the epidemiology of HPAI in Nigeria need attention.

Legal imports

The main legal ports for entry of poultry and poultry products into Nigeria include the sea ports in Port-Harcourt, Lagos and Warri while airports include the Murtala Mohammed International Airport, Lagos, Aminu Kano Airport Kano the Port Harcourt Airport and the Nnamdi Azikiwe international Airport Abuja. A substantial amount of trade in poultry and poultry products between Nigeria and its neighbours takes place by road through the borders. Products coming into the country include Day old chicks, Grand parent Stock, Parent Stock, dressed frozen chicken and feedstuffs. The major countries of origin include the Netherlands, Britain, USA, Egypt and China.

Table 8.1 Summary of HPAI status in countries bordering Nigeria (FAO, March 2008)

Country	Relative location	First outbreak HPAI	Last outbreak HPAI	Sp. Affected
Togo	West	6 June 2006	20 July 2007	Domestic poultry
Benin	West	7 Nov. 2007	15 Dec. 2007	Domestic poultry
Niger	North	6 Feb. 2006	1 June 2007	Domestic poultry
Cameroon	East	21 Feb. 2006	28 March 2007	Domestic/wild birds

The countries bordering Nigeria include Benin and Togo to the west, Cameroon to the East and Niger and Chad to the North. All Nigeria's neighbours have had confirmed outbreaks of HPAI, as shown in the Table 8.1.

There exists a National Veterinary Quarantine Services charged with, among other things, border regulation of animal/poultry movem**ents and ensuring that poultry and poultry products imported into Nigeria have no deleterious animal and** human health consequences. The study by Ogundipe (2002) on the National Veterinary Quarantine Services (NVQS) showed that the country has 44 functional International veterinary Control Posts in Nigeria's 4,857 km border length, 111 Inter-state Veterinary Control Posts and 905 State Veterinary Control Posts. In fact, there are 10 quarantine stations and only 34 control posts that have been gazetted, according to records from the FDL&PCS. Good infrastructure for both control and quarantine activities exists in Makurdi (Benue state), Jebba (Kwara state), Maigatari (Jigawa state), Illela (Sokoto state), Mubi (Adamawa state) and Gamboru/Ngala (Borno state). The functional efficiency of the NVQS may be assessed as high for revenue collection, medium for animal movement control but low for animal disease monitoring.

Illegal and informal imports

There are many illegal routes of movement of poultry and poultry products into and out of Nigeria. This is mainly due to its rather porous borders and the difficulties inherent in close lingual and cultural ties between adjoining communities in neighbouring countries. Ogundipe (2002) estimated illegal entry points in Nigeria at 3,065, representing one per 1.13 km border.

Most of the illegal imports are day old chicken and frozen chicken meat. There is also illegal trade in live local chickens across the borders. The major motivation for illegal trade in poultry and poultry products under the village system is the close socio-cultural relationship between communities in neighbouring countries. In addition, the strength of the Nigerian naira when compared to the currencies in neighbouring countries makes such illegal trade attractive to neighbouring communities. It is not uncommon at major Christian and Muslim festivals to find increased volume of illegal trade.

Pathways for spread

The destinations of legal and illegal trade in poultry and poultry products are Benin, Togo and Niger Republics. Trade is mainly in dressed whole chicken and eggs. A list of animal/poultry markets in the country is presently unavailable.

Poultry and poultry products are transported mainly by road in commercial vehicles, as well as with motor-bicycles or by foot. A few companies operate vehicles with cold storage facilities for inter-

state transportation of frozen chickens. The routes of illegal movements are not clearly defined, especially for trade by foot and on motorcycles.

Current HPAI situation in Nigeria

On February 07, 2006 the Government of Nigeria (GON) confirmed the presence in Nigeria of Highly Pathogenic Avian Influenza (HPAI) caused by the virus strain H5N1. Between February 2006 and October 2007, there were 920 suspected cases HPAI, of which 298 were confirmed positive. A total of 1.3 million birds were depopulated and N560 million (approx. US$4.5 million) paid out in compensation over the same period. There has been one confirmed case of human fatality due to HPAI. In terms of spatial distribution, HPAI was officially confirmed in 97 LGAs in 25 states including the Federal Capital Territory (FCT) – see Figures 8.5 to 8.8. Between January 2007 and November 2007, there was a downward trend in the number of outbreaks per month, with three peaks in January (44 outbreaks), March (25 outbreaks) and August (12 outbreaks) – see Figure 8.9. In fact, from October 6, 2007 to date (July 08, 2008) there has been no reported outbreak of HPAI. The situation since the last outbreak on October 6, 2007 is shown in Table 8.2.

Table 8.2 The situation with HPAI suspected cases since October 2007

Months	Suspicions	Positive	Negative
Oct '07	46	1	45*
Nov '07	27	0	27
Dec'07	36	0	36
Jan'08	52	0	52
Feb'08	37	0	37
March'08	44	0	44
April '08	56	0	56
May '08	27	0	27
	325	**1**	**324**

Figure 8.5 Putative HPAI risk map (based on bird population density, human population density, road travel speed or market access, inland water bodies)

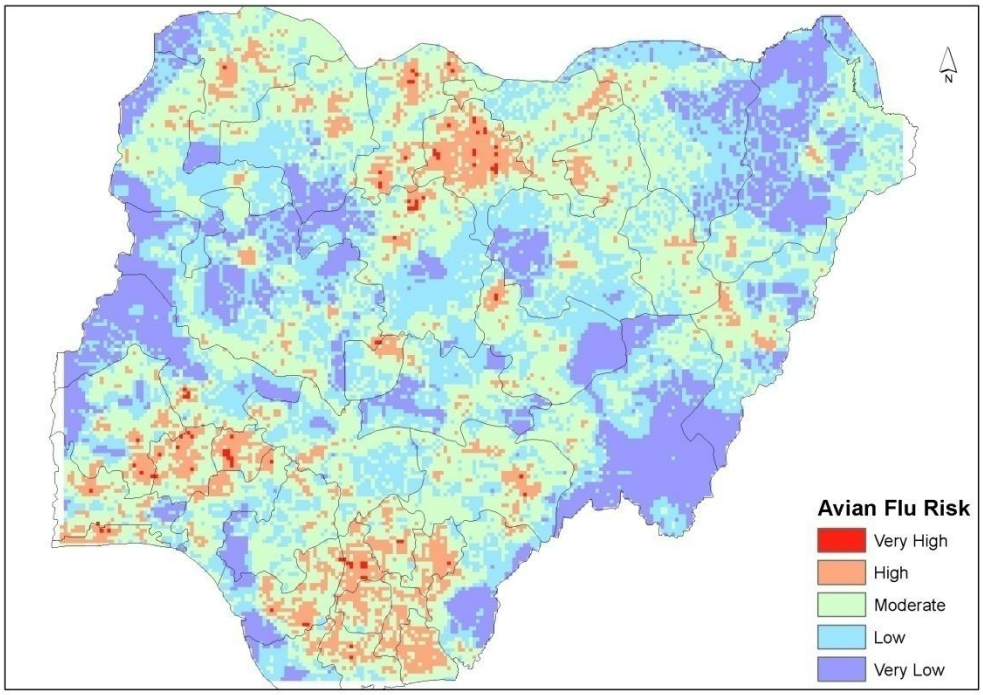


Figure 8.6 Putative HPAI risk map showing outbreak spots in 2006 and major roads network

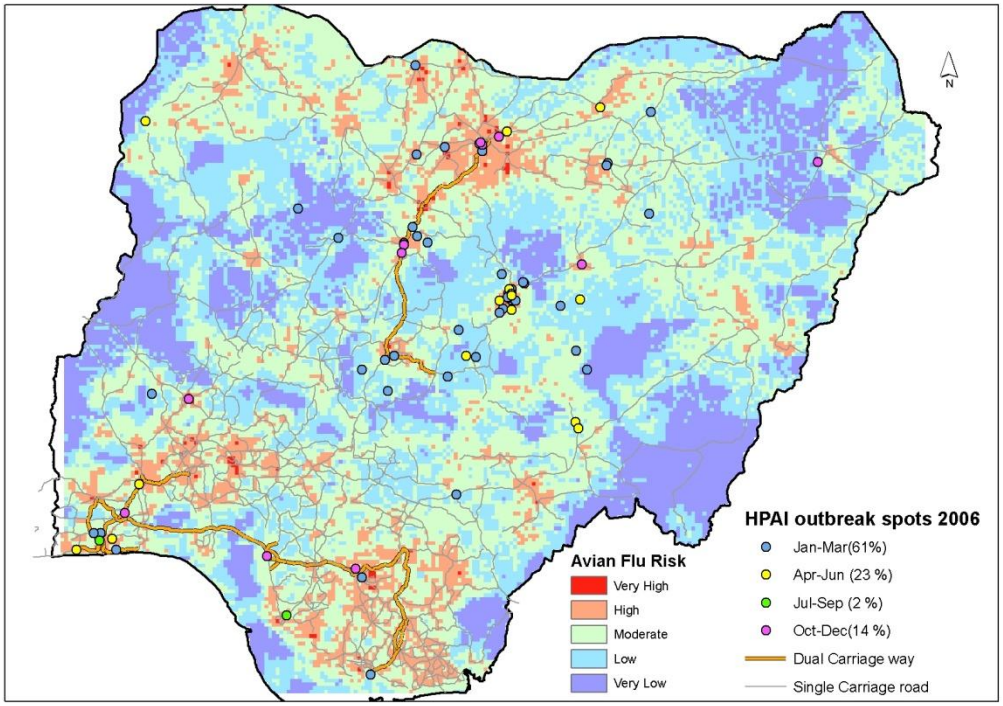


Figure 8.7 Putative HPAI risk map showing outbreak spots in 2007 and major roads network

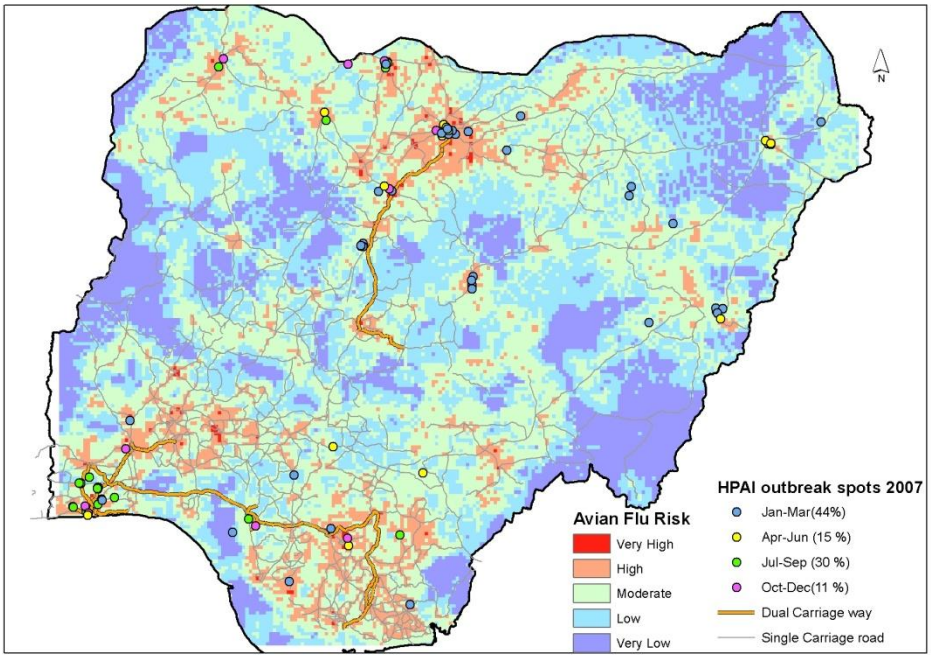


Figure 8.8 Putative HPAI risk map showing LGAs (Districts) where outbreaks occurred in 2006 & 2007 – no further outbreaks since 06 Oct. 2007

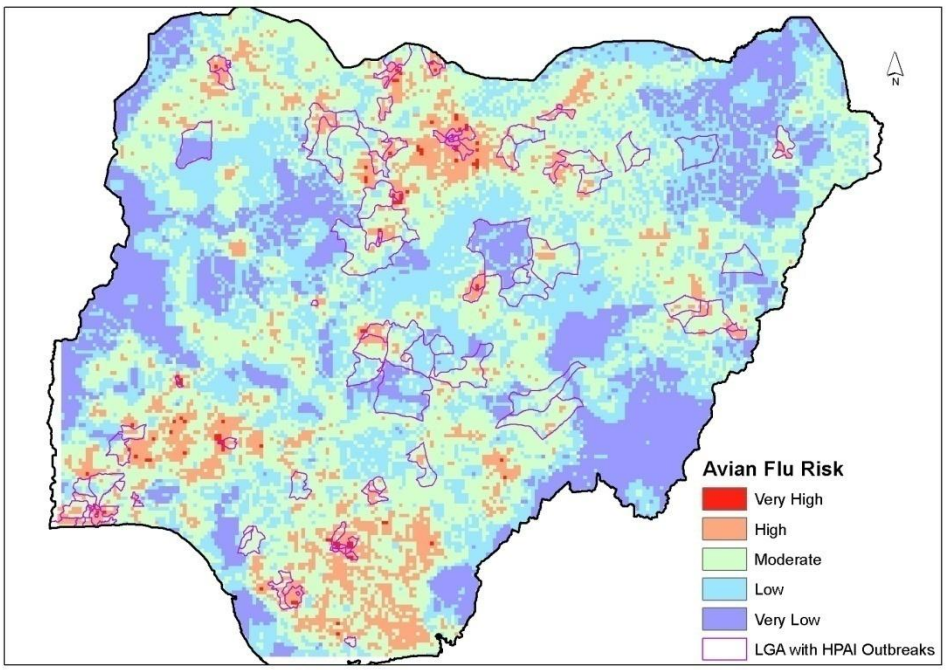
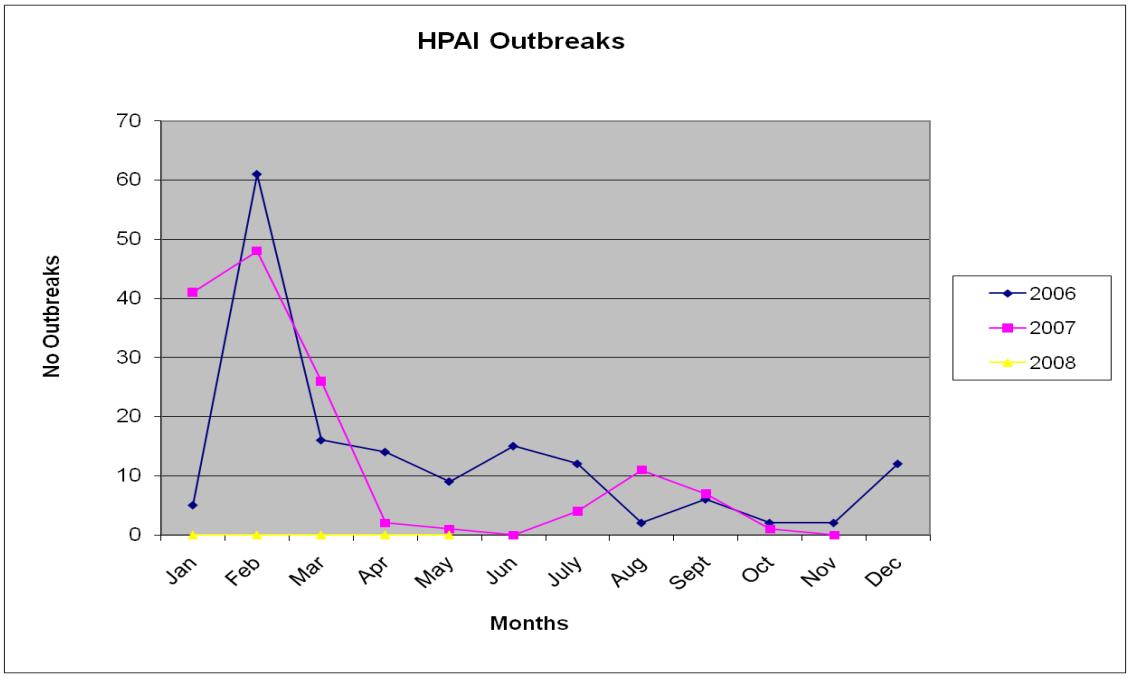


Figure 8.9 Trends in HPAI outbreaks from February 2006 to June 2008



The latest update showed that since the emergence of HPAI in Nigeria, the disease has been confirmed in 25 states and the FCT. The states are Adamawa, Anambra, Bauchi, Benue, Borno, Edo, Enugu, FCT, Kaduna, Kano, Katsina, Kwara, Lagos, Nasarawa, Niger, Ogun, Oyo, Plateau, Sokoto, Rivers, Taraba, Yobe, Zamfara, Ekiti and the FCT. The last confirmed outbreak of HPAI occurred in the town of Nsugbe in Anambra-East LGA of Anambra State on October 6, 2007.

9. Conclusions

This concluding chapter presents outlines of the main findings, current knowledge gaps and recommendations for the future.

Summary of the main findings

The main findings may be summarized as follows:

- From the limited data on poultry population in the country, is widely held that village poultry constitutes about 60% of the poultry sector in Nigeria.
- Poultry is a vital component of rural livelihood contributing to both income and nutrition.
- Women, in particular, derive significant income from poultry.

Although poultry is an important source of protein and micronutrients in the rural setting, there are still significant deficiencies.

- Preliminary research findings do indicate that HPAI outbreaks caused significant reduction in poultry prices, consumption, production and consequent losses in income and employment.

Results of HPAI surveillance in Live Bird markets in Nigeria showed that the H5N1 virus circulates in some LBMs without overt clinical disease, and therefore raised the issue of human exposure to the virus in LBMs.

- Many rural poor rely on LBMs as avenues foe selling birds as well as sources of replacement stock.
- About 75-89% of rural poultry production lack essential bio-security measures, thus increasing the risk of spread and sustenance of HPAI.
- The emergence of at least two reassortant H5N1 viruses in Nigeria may have been due to co-infection with viruses of different sublineages, a phenomenon that may resulted from poor biosecurity, particularly at the LBMs, and lack of movement control.
- There may be some relationship between migratory wild birds, floodplain agriculture, domestic ducks, illegal hunting of wild birds, the movement of pastoralists out of wetlands with their domestic ducks and the introduction, spread and sustenance of HPAI in northern Nigeria.

Current knowledge gaps

The current knowledge gaps that were identified include the following:

- There are a few studies on the contribution of poultry to household income and nutrition which were conducted in a few Local government Areas. A current uniform national database is lacking.
- Inaccessible/limited studies which estimated the impact of HPAI on rural livelihoods including incomes and nutrition.

- There is limited information on the intra-household dynamics of poultry production and gender specific information.
- Only a few documents provide information on the knowledge, attitude, and perception of rural households with regards to HPAI and the impact of the compensation schemes on household livelihoods and biosecurity practices.
- Absence of data on the impact of HPAI on food security and level of recovery of the poultry sector since the outbreaks.
- Lack of information on the role of other actors like poultry processors, marketers and tool millers on HPAI spread and management.
- Insufficient data/information on the role of various institutions/associations in the poultry system.
- Data on disease risks arising from cross-border movement and trade within the region.
- Lack of authentic data on the role of migratory and resident wild-birds in the epidemiology of HPAI in Nigeria with emphasis on rural poultry production system.
- The role of LBMs in the spread and sustenance of HPAI in Nigeria.
- The place of improper disposal facilities, the sale of diseased birds and the consumption of dead birds in the spread and sustenance of the disease.
- How community-based animal health services can be developed to improve HPAI surveillance in rural poultry.

Recommendations on the way forward

Based on the findings above, it is recommended that:

- Institutional analysis of the public and private response capacity (Surveillance, communication and response) be carried out.
- There is need for focussed group surveys on costs and incentives associated with success and failures to contain HPAI to date.
- Disease risk maps be prepared/developed.
- Pathway analysis of various potential spread mechanisms.
- There is a need to carry out simulation of potential spread scenarios given pathway analysis.
- Customised improved biosecurity measures for rural poultry be developed to limit spread and sustenance of HPAI in Nigeria.
- Studies to evaluate the feasibility and sustainability of poultry insurance scheme for rural **poultry owners and poultry marketers.**

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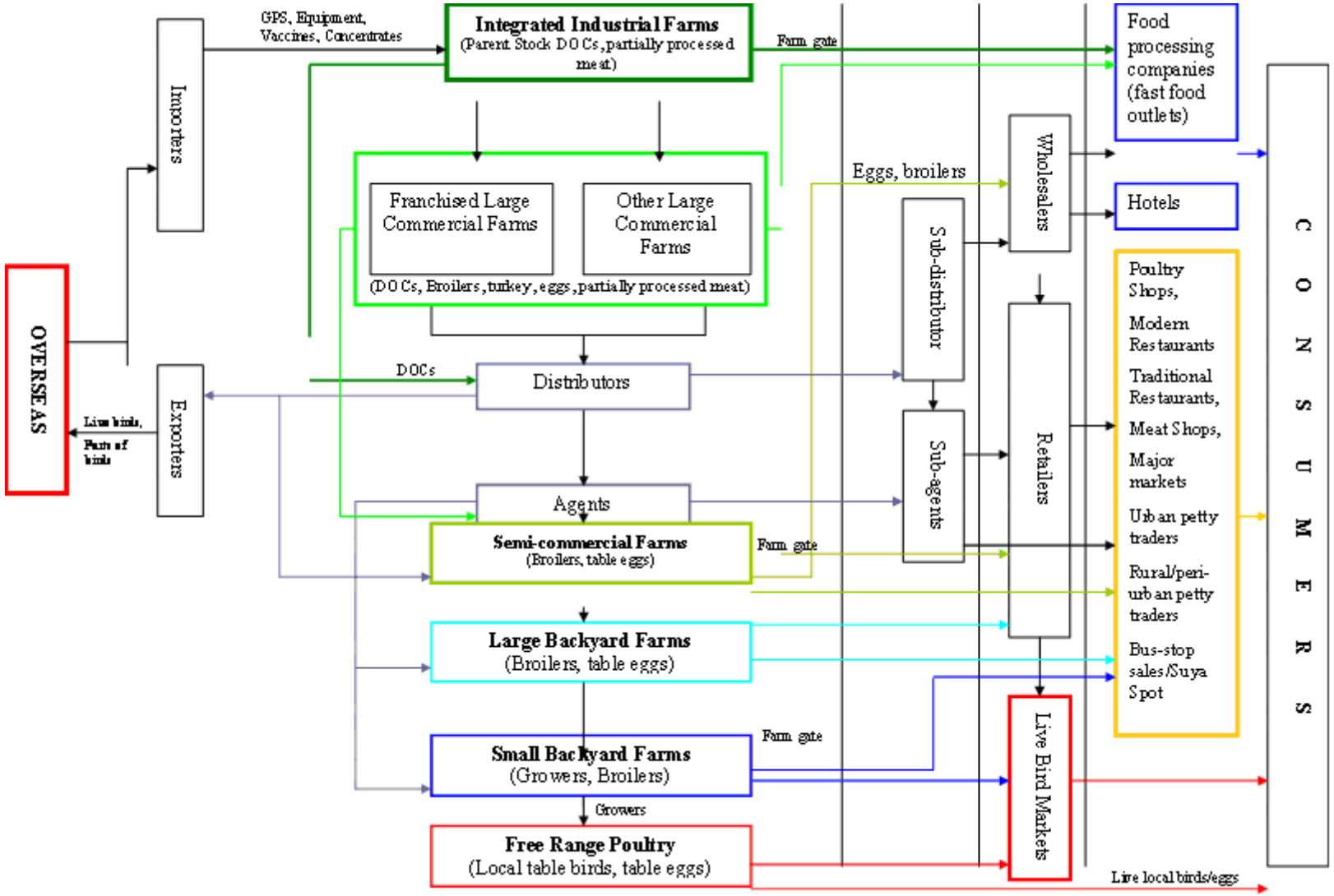
Appendix 1 Poultry value chain in Nigeria



Appendix 2 Overview of All Categories of Actors in the Poultry Sub-sector

Breeders	Score	Backyard poultry	Score	Support services	Score	Commercial sector	Score	Informal sector poultry sellers	Score	Informal sector egg sellers	Score
Pedigree pure lines	0	Poultry	7	Feed Mills	2	Parent stock	2	Producers	NA	Producers	NA
Great grand parents	0	Turkey	6	Feed transport	NA	Hatchery	2	Producers/retailers	NA	Producers/retailers	NA
Grand parents	2	Duck	5	Transport day old chicks	NA	Rearing	5	Wholesalers	NA	Wholesalers	NA
Parents	3	Geese	2	Firms transporting processing eggs	NA	Broiler production	4	Wholesalers/ retailers	NA	Wholesalers/retailers	NA
Layers	5	Guinea fowl	5	Transport broilers and spent layers to abattoirs	NA	Layer production	6	retailers	NA	retailers	NA
Broilers	5	Quail	3	Egg packing plant	NA						
		Pigeon	4	Meat processing plant	3						
		Song birds	NA	Abattoirs							
		Wild birds killed for meat	NA	Poultry vaccine producers	1						
		Other		Specialised poultry vets	3						

Key**:** 7: More than 1 million; 6: 100,000 to 1,000,000; 5: 10,000 to 99,999; 4 1,000 to 9,990; 3: 100 to 999; 2: 10 to 99; 1: 1 to 9; 0: None present in country; NA no information available