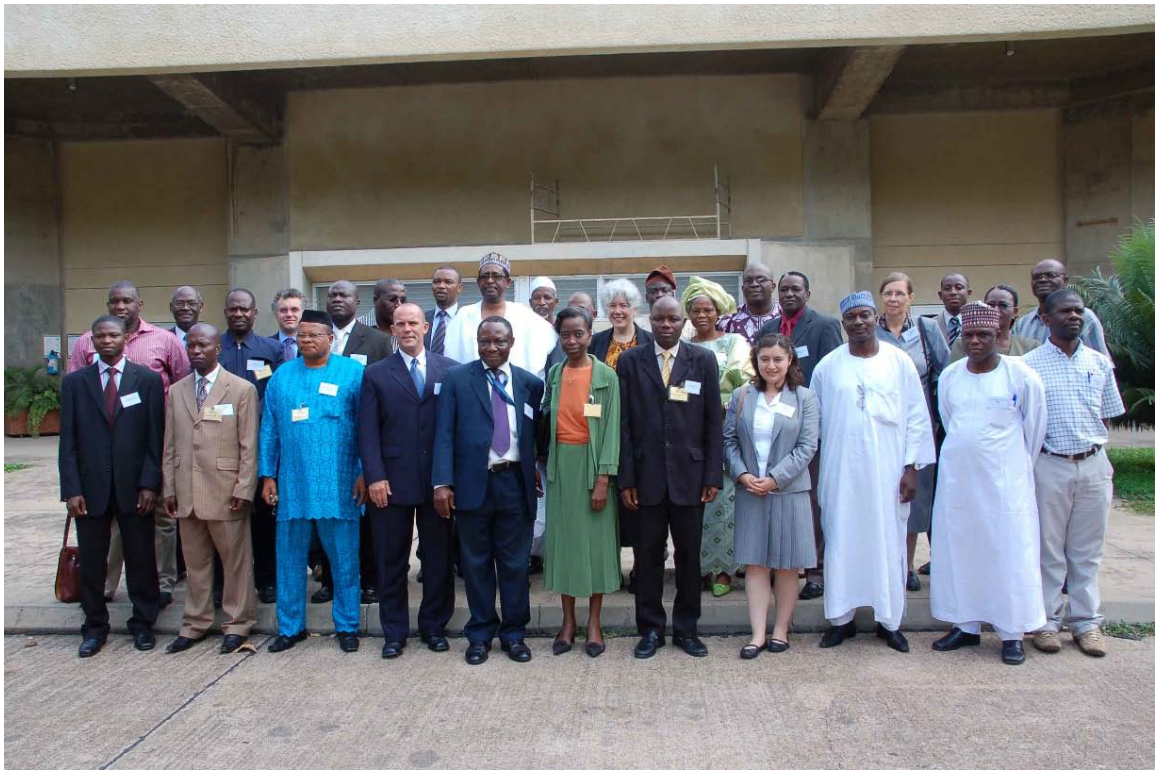
Nigeria Pro-poor HPAI Risk Reduction Strategies Project

Multi-stakeholder Workshop



Ibadan, Nigeria
June 17-18, 2008

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1. Background

Many human diseases have emerged from the infections of wild and domesticated animals. Highly Pathogenic Avian Influenza (HPAI) is the most recent example. The spread of HPAI, its actual impacts on agriculture and its potential impacts on human health, put this disease at the forefront of global human safety and development policy dialogues. While there is fear that the virus may mutate into a strain capable of human-to-human transmission, the greatest impacts to date have been on the highly diverse poultry industries in affected countries. Recent infections of HPAI have resulted in the destruction of more than 140 million birds in South East Asia alone, with costs estimated to be in excess of US$ 10 billion (World Bank 2006[1]). If a one year pandemic were to occur it could lead to global economic losses in the region of US $800 billion (World Bank 2006).

Much of the effort to date has focused on implementing prevention and eradication measures in poultry populations. Much less emphasis has been placed on the assessment of the effects of these mitigation strategies on the livelihoods of smallholder farmers and their families in affected countries.

2. Overall Project Description

The **Goal** of the proposed programme of research on HPAI is to help African and Asian governments and international organisations to be prepared to make informed decisions should need arise and to limit the spread of HPAI, while minimising the impact on different socio-economic groups, particularly the poor.

The **Purpose** 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 enhance livelihoods, particularly of smallholder producers in developing countries. Information generated through the project is expected to assist decision makers in both the short-run when HPAI is acute, and the long-run when it is endemic.

Overall project implementation is through **four inter-linked output clusters** namely; i) disease risk, ii) economic & livelihood impacts, iii) institutions & mitigations, and iv) synthesis.

3. Progress with the Nigeria Component

Preliminary project activities started in Nigeria in January 2008 with consultations held between staff of the Federal Department of Livestock (FDL) on the side of the Government of Nigeria (GoN) and ILRI and IFPRI staff on the other. The meetings led to buy-in from the FDL and GoN and were followed by the identification of three national collaborators who were engaged in February to write background paper on the current situation of poultry and HPAI in Nigeria. The national collaborators are Prof Timothy Obi (Veterinary Epidemiologist, University of Ibadan), Dr Garba Maina (Veterinary Epidemiologist, State Ministry of Agriculture, Kebbi State) and Mr Adewale Oparinde (Social Scientist, University of Cambridge, UK). The aim of the background paper is to document all the available existing information (published and grey literature, reports, etc.) pertaining to the poultry sector and HPAI in Nigeria, and consequently to identify knowledge gaps, so as to determine the focus of the project in Nigeria. Prior to the multi-stakeholder workshop reported in this document, the national collaborators had produced a draft background paper which was circulated in advance to all potential participants for comments. The

[1] World Bank 2006. Avian Flu Economic Analysis: Global Program for Avian Influenza and Human Pandemic.

comments were further debated during the workshop and incorporated to produce a near-final version submitted to IFPRI for editing. The final background paper and the related documents will soon be available to download from the project website: http://www.hpai-research.net/index.html

4. Nigeria Workshop

The Nigeria workshop was held at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria during 17 and 18 June 2008.

4.1 Workshop Objectives

Three main objectives of the workshop were:

1. To introduce the project and secure buy-in from a broad range of stakeholders in the poultry industry in Nigeria
2. To agree on major research gaps on HPAI control strategies and set pro-poor research priorities to better inform decision makers
3. To map institutional linkages and mechanisms for effective communication and implementation of pro-poor HPAI control strategies in Nigeria

4.2 Workshop participants

The workshop was attended by 32 participants drawn from the Poultry Association of Nigeria (PAN), Fowl-sellers Association of Nigeria (FAN), The Chief Veterinary Officer (CVO) of Nigeria, public and private sector veterinarians, National Veterinary Research Institute (NVRI), USAID, World Bank, FEWSNET, National Bureau of Statistics (NBS), Universities, the Nigeria Avian Influenza Control Project (AICP). The three national collaborators responsible for the background paper were present; so also were representative of ILRI, IFPRI and FAO (see below).

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4.3 Workshop Summary

An agenda to achieve the workshop objectives was drafted and circulated in advance to participants. Suggested amendments were incorporated and workshop ran for 2 days following the amended agenda below.

Day 1: June 17	
08.30 hrs	Registration
09.00 hrs	Opening by Dr. J Maina, Director, FDLPCS
09.20 hrs	Workshop agenda and objectives – Dr. I Okike, ILRI Country Programme Manager
09.30 hrs	Self introductions of participants
09.45 hrs	Presentation by Dr J Maina (CVO of Nigeria) on the current HPAI situation in Nigeria
10.15 hrs	Introduction of the Pro-Poor HPAI Risk Reduction Strategies Project, status of the project in Nigeria – Dr Clare Narrod
10.45 hrs	Coffee break
11.00 hrs	Presentations of the background paper: Summary of Key findings, Background paper team (Prof. Tim Obi, Dr. Garba Maina and Mr. AO Oparinde)
12.00 hrs	Viewpoints of development partners working on AI in Nigeria (USAID – Dr. Thomas Easley; The World Bank – Dr. S. Ehui; FAO – Tesfai Tseggai; UNICEF)
13.00 hrs	Lunch
14.00 hrs	Impact of HPAI from the smallholder perspective, chaired by Prof. J Olawoye. Presentations by President, Poultry Association of Nigeria; President, Fowl Sellers Association of Nigeria
15.00 hrs	Coffee break
15.30 hrs	Feedback of stakeholders and participants on background paper and presentation and understanding on research gaps identified

	Parallel session 1: Group Discussion on disease risk and vet institutional findings to be facilitated by Dr. J Maina (Nyager) and Dr. I. Okike Parallel session 2: Group Discussion on economic and livelihoods findings to be facilitated by Prof. J Olawoye and Dr. E Birol
17.30 hrs	Summary of key points of the group discussion on the epidemiology and veterinary findings – Dr. J. Nyager and Dr. P. Duarte
18.00 hrs	Summary of key points of the group discussion on economic and livelihoods findings – Prof. J Olawoye and Dr. E Birol
18.30 hrs	Close day 1
19.00 hrs	Conference dinner
Day 2: June 18	
09:00 hrs	Discussion on the way forward with HPAI research in Nigeria chaired by Dr J. Nyager and Dr C. Narrod
11:00 hrs	Stakeholder mapping including coffee break Parallel session 1: Mapping and Institutional analysis of public and private disease response capacity, facilitated by Dr Paulo Duarte. Parallel session 2: Mapping of the market and value networks in Nigeria, facilitated by Dr Ekin Birol.
13.00 hrs	Lunch
14.00 hrs	Presentations of the network maps, feedback from the participants and mapping of the entire poultry network with all the stakeholders
16.00 hrs	Workshop résumé
17.00 hrs	Closing stakeholders' workshop

As the agenda of the workshop shows, plenary and parallel sessions were deployed as necessary. In particular, the first plenary session served to secure the buy-in of stakeholders and clarify matters related to project design and implementation strategies as well as the project's pro-poor focus.

4.3.1 Buy-in by stakeholders

4.3.2 The status of HPAI in Nigeria (up to June 07)

The CVO's report on the status of HPAI in Nigeria, up to May 2008, indicated that there had been 298 HPAI outbreaks involving 2735 farmers/farms in 97 Local Government Areas (LGAs) in 26 States of Nigeria including the Federal Capital Territory (FCT). To contain those outbreaks, over 1.3 million birds were culled and N632 million paid out in compensation. At the time of the workshop, he reported that there had been a seven-month period (October 07 to May 08) with no further outbreaks.

4.3.3 Disease risk, socio-economic and livelihood implications, lessons learnt

On disease risk, the CVO indicated that the GoN had learnt important lessons concerning HPAI spread pattern e.g. spread was mainly between commercial farms; live bird markets were a major source of infection; fomites and animal health service providers contributed to spread the virus, poor siting of farms and risks associated with mega-cities (Lagos & Kano). Control of movement of poultry and poultry remained an important strategy to control HPAI spread. On the socio-economic side, the outbreaks led to sharp drops in sale of poultry and poultry products and have had multiplier effects beyond the

poultry sector. However, the extent of impacts is not easily quantifiable due to paucity of data. He thought that farmers needed an exit plan in terms of livelihood diversification; and concluded that at national level there was the need to strengthen the existing surveillance system and continue capacity build of staff in collaboration with development partners.

4.3.4 Summary of background paper and research gaps

The national collaborators led the discussions by summarising the findings and research gaps in the background paper on i) disease risk, ii) veterinary institutions, and iii) socio-economic and livelihood impacts. These were then discussed and agreed upon. In this section, the summaries, research gaps and follow-up discussions are presented based on each of the three sub-headings above.

Disease risk (summary of findings – Prof Obi & Dr Maina):

A review of the available literature and studies that have 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 good 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 showed it is common practice for mixed species of poultry to be sold together and in many cases housed 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 being 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, 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 de-beaking. These services are provided by qualified animal health specialists. In rural extensive poultry system 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.

Institutions (summary of findings – Prof Obi and Dr Maina):

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 the rural poultry has little or no access to veterinary services. Although it seemed as overall, the rural village poultry and backyard and medium scale farmers were most severely affected by the HPAI outbreaks, the initial study by UNDP 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 the poor households take very significant share of the poultry-sub sector in Nigeria, a RRM will only generate data that are not good representative 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 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 poor's livelihood 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 include trace forward and backward 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 combination of ecological conditions, and 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 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 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 as well as the role of LBMs in the spread and maintenance 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 part of these. These include 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, 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. There is also the National Biosafety Guidelines of 1994. Overall none of the above laws is specifically targeted to 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.

Socio-economic and livelihood impacts (summary of findings – Mr Oparinde):

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 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. The process of killing chickens as sacrifices to deities common in the south is risky because of the likelihood of HPAI animal-human transmission.

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.

Gaps identified by national coordinators:

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.

5. Workshop Discussions

5.1 Result of Discussions on disease risk and institutions

- Structure of the poultry industry – the consensus was that the dataset from which inferences on the structure of the poultry industry was made is dated, since the census was conducted in 1991. As such, there was the need for another census and more accurate date. The argument on the size of backyard poultry was not resolves as some felt that 60% was too much.
- Better definitions of poultry systems classification (backyard etc.). This is related to the paucity of reliable data as above.
- Compensation and insurance:
  - There were comments that behaviour change, insurance etc are good but might not work and compensation should continue even though resources are limited. The group identified the need for alternatives, insurance might be the best way to go. Cooperative insurance for smallholders might be a good way to insure small/backyard producers. Many in the group do not trust/believe in the insurance strategy. There were suggestions to tie insurance with compensation.
- The role of susceptible mammals (pigs, dogs, etc.) in the spread of HPAI and possible trigger of a pandemic was found to be missing from the report. This was thought to be theoretically possible but was it a realistic issue to pursue? It was suggested that they may be more important as fomites.

- Sacrificed for religious purpose might pose a risk to humans – group agreed that might be a risk for humans but not for animals.
- Political will for risk communications
  - Involving religious leaders might be effective. Some say the communication should start 'before' the actual event.
  - Local vs. state government: Federal Government had more political will but some states were quite committed. For example, Kano state committed additional funding for compensation.
- The issue of mixing species and how to avoid it was raised but difficult to address. Education/information suggested as the possible pathway.

5.2 Results of Discussions on Economic and Livelihood Impacts

- Are there any data sources and/or studies that have not been included in the background papers?
  - Data sources
    - 1976 study on poultry production in Nigeria by Ikpi et al.
    - 1990-1991 RIM Livestock census
    - Access to raw data from NBS Nigeria Living Standards Survey (2004) and NBS Livestock Survey (2006) available at the www.nigerianstats.gow.ng
  - Some other stakeholders to interview
    - Contact World poultry Science Association Nigeria Branch and the Animal Science Association of Nigeria
  - Other studies that should be included
    - Some journals not captured include, the Nigerian poultry journal, World poultry Science journal, local journals should capture 70% of the PhD/Msc theses, FAO Newsletter International Network for Family Poultry Development (AI special issues)
    - Some grey material not captured include, Small study on cost of production by Prof Dafwang, FEWSNET and Dr Garba Maina, quick study on Avian Flu, NAPRI socio-economics documents, NGO actively involved chicken multiplication and production system, documents from the Nigeria Institute for Socio-Economic Research (NISER).
- Addition to findings in the background paper
  - Issues on export (not much due to domestic demand and SPS conditions specified by WTO)
- Additional knowledge gaps
  - Also look at economic and livelihood impacts on households with 1-2 birds, poor households who don't rear poultry, urban poultry producers, other actors in the chain (feed millers, vet drug sellers, transporters etc.) and consumers of poultry.

- At the household level also investigate impact of HPAI on food security, level of recovery since outbreak, i.e. in addition to various sources of income, access to food and food expenditure
- Based on a value chain approach, investigate influence of actors other than producers/farmers (e.g., processors/marketers, toll millers reusing bag) on AI spread and management) as well as behaviours in live bird production, marketing, processing and consumption

5.2.1 Initial proposals to fill gaps

- Country wide qualitative and quantitative data collection in selected sites through structured household surveys, focus group discussions and participatory poverty assessment, KAP surveys, anthropometric measures and food consumption data.
- Data collection should be implemented in all six geopolitical zones, selecting sites depending on several criteria (role of rural poultry production, HPAI status (control and eradication measures), distance from the HPAI outbreak).

5.2.2 Sampling and Logistics

- Data collection and sampling support from NBS
  - 4 agro-ecological zones (NE/NW, Middle belt, SW, SE) some convergence with socio-cultural factors
  - Purposeful sampling of sites
  - States selected according to HPAI status (eradication and control measures)
  - Administrative areas within states to be selected depending on various criteria (e.g., HPAI status, time, distance, compensation
  - Qualitative data to be collected on selected sites within these

6. Net-Mapping of Value Network and HPAI Information Flow in Nigeria

On Day 2 of the workshop, Dr Ekin Birol facilitated the parallel session to net-map the poultry market and value networks in Nigeria while Dr Pualo Duarte facilitated the net-mapping of HPAI information flows and public and private institutional capacities for disease response.

6.1 Net-map analysis of poultry value network in Nigeria

Ekin Birol and Adewale Oparinde drafted the outcome of the session on net-map analysis of poultry value network in Nigeria as presented below:

6.1.1 Introduction

The aim of this net mapping exercise was to draw the live poultry value chain/network, specifically to answer the following questions:

- What formal and informal actors, private/public are involved in the live poultry value chain?
- How does live poultry flow between various actors?
- How does communication of information about HPAI flow in the value chain?
- Who in the value chain is influential in the communication of information about HPAI?

- Where and how could project findings help inform decision making in the value chain?
- How should research findings be communicated?

The net-map exercise was implemented on June 18th, during the second day of the two day multi-stakeholder workshop of the DFID funded HPAI Risk Reduction Strategies project. 10 participants took part in the net-mapping exercise. These were members of various poultry related associations, Ministry of Agriculture, Directory of Veterinary Services officials and poultry sector experts from research centres and universities.

Table 6.1 List of participants

	Name	Designation/Organization
1.	Prof A Ikpi	Professor, Department of Agricultural Economics, University of Ibadan
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3.	Mr Samson Akinoso	President, Poultry Association of Nigeria
4.	Mr JO Akeredolu	Communications Coordinator , Avian Influenza Control Project
5.	Prof Istifanus Dafwang	Professor, NAERLS, Ahmadu Bello University
6.	Dr Simeon Ehui –WB	Sector Leader, Sustainable Development, World Bank
7.	Dr BC Okpukpara	Agric Economist, Centre for Entrepreneurship & Development Research, University of Nigeria
8.	Dr. (Mrs) Oni-Orisan	Deputy Director of Veterinary Services, Min. of Agric., Natural Resources & Rural Development
9.	Dr AT Adebisi	National Bureau of Statistics
10.	Prof Omotesho AO	Dept of Agricultural Economics and Farm Mgt, University of Ilorin,

6.1.2 Actors and Links

Actors in the poultry value chain and those actors that provide information about HPAI risk and risk minimisation were identified by the net map participants. A list of actors and their abbreviations is presented below:

Table 6.2 List of actors in the poultry value network and those who inform them about HPAI

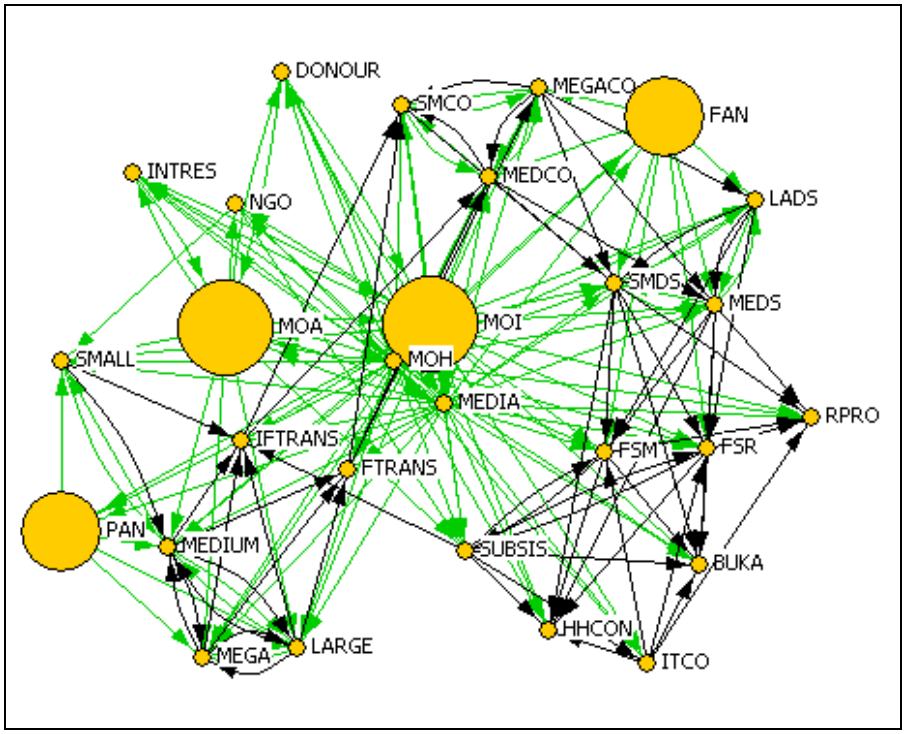
Poultry producers	
	Mega scale poultry producers, sector 1 biosecurity more than 50000 birds (MEGA)
	Large scale poultry producers, sector 2 biosecurity between 20000 and 50000 birds (LARGE)
	Medium scale poultry producers, sector 3 biosecurity between 5000 and 20000 birds (MEDIUM)
	Small scale, backyard commercial poultry producers, sector 4 biosecurity between 1000 and 5000 birds (SMALL)
	Small scale, backyard commercial poultry producers, sector 5 biosecurity less than 100 birds. (SUBSIS)
Transporters	
	Formal transporters with capacity of maximum 1500 birds/vehicle (FTRANS)
	Informal transporters with capacity of maximum 700 birds/vehicle (IFTRANS)
Collectors	
	Mega collectors, 3000-6000 birds/day (MEGACO)
	Medium collectors, 1500 to 2000 birds/day (MEDCO)
	Small collectors, 100-500 birds/day (SMCO)
	Itinerant collectors, 10-20 birds/day (ITCO)
Distributors	
	Large scale distributors, 200-300 birds/day (LADS)
	Medium scale distributors, 100-200 birds/day (MEDS)
	Small scale distributors, 20-50 birds/day (SMDS)
Fowl sellers	
	Fowl sellers at the market (FSM)
	Fowl sellers on the road (FSR)
Consumers	
	Roadside processors (RPRO)
	Household consumers (HHCON)
	Bukaterias (BUKA)
Information sources	
	Ministry of agriculture(MOA), especially extension officers
	Ministry of Information (MOI)
	Ministry of Health (MOH)
	Poultry Association of Nigeria (PAN)
	Fowl Sellers Association of Nigeria (FAN)
	NGOs
	International donours (DONOUR)
	International research/technical support. (ITRES)

Two links were identified in this value chain – information network. These are flow of live birds and flow of information on HPAI disease risk and risk management. In addition to these, the most influential actors in the dissemination of information were identified.

6.1.3 Net-Map and analysis:

Net-map of HPAI information flow (green) and live bird (black) flow links, as well as the actors' influence levels, as represented by the size of their node, is depicted below. The following subsections explain each link into greater detail.

Map 1 Information flow and live bird flow



Size of node= influence of actor in the network

6.1.3.1. Flow of Live Poultry

Flow of live poultry in the value chain is as follows: Mega, large and medium scale producers buy from and sell to each other; small scale commercial/backyard producers sell poultry to medium scale producers and small scale backyard subsistence/village extensive poultry keepers mainly sell to and restock from the market, roadside fowl sellers and other village extensive producers.

Mega, large and medium scale producers use the formal transporters, whereas informal transporters are used by all producers. Sometimes small scale backyard subsistence/village extensive poultry keepers go to the fowl sellers (market and roadside) directly and sometimes they go to the consumers (households, other small scale backyard subsistence/village extensive poultry keepers, bukaterias and roadside processors directly).

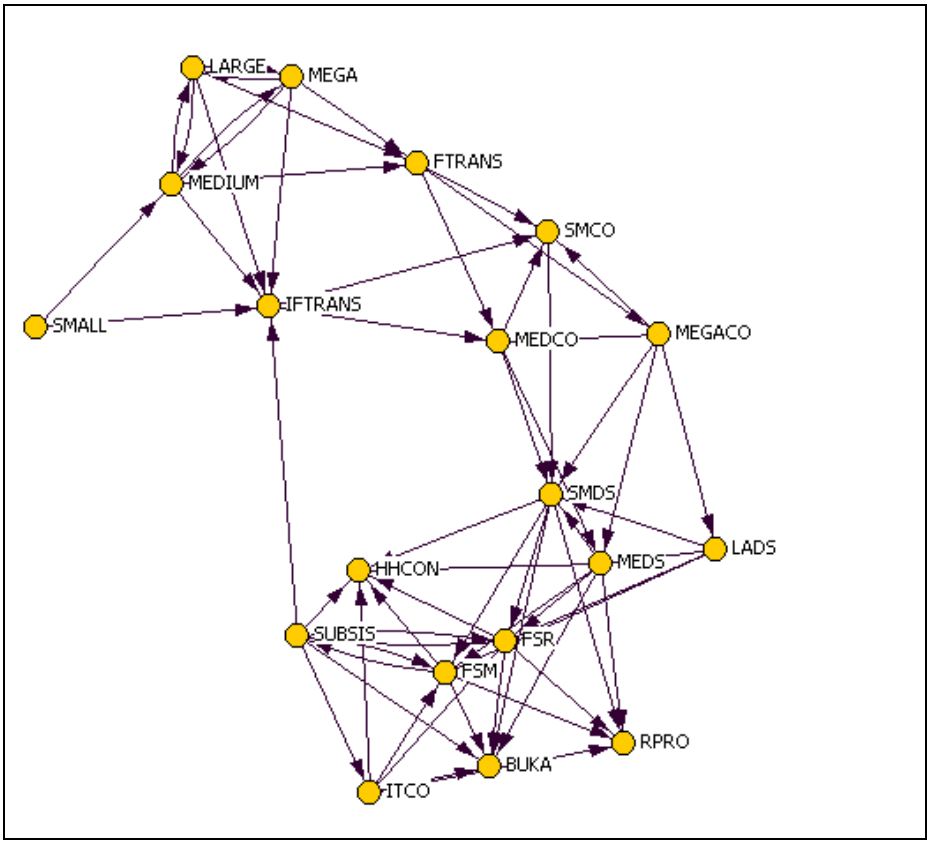
Formal transporters supply birds to small, medium and mega scale collectors, whereas informal transporters mainly supply to medium and small scale collectors. Itinerant collectors on the other hand supply their poultry from small scale backyard subsistence/village extensive poultry keepers directly.

Mega collectors sell birds to medium and small collectors, whereas medium collectors also sell to the small collectors. Large scale distributors are supplied by mega collectors, whereas medium scale distributors are supplied by mega and medium scale collectors, and small scale collectors are supplied by mega, medium and small scale collectors. Large scale distributors also supply medium and small scale distributors.

Fowl sellers at the market and road side very rarely get their poultry from the large scale distributors. Fowl sellers are generally supplied by small and medium scale distributors. Fowl sellers can also be supplied directly by the small scale backyard subsistence/village extensive poultry keepers or through the itinerant collector.

Medium and small scale distributors may also supply directly to the consumers (households, bukaterias and roadside processors). Fowl sellers at the market and road side supply to consumers (households, bukaterias and roadside processors).

Map 2 Flow of live bird



Node centrality measures for live bird flow are reported for degree centrality, closeness centrality and betweenness centrality. Degree centrality results reveal that small and medium scale distributors, fowl sellers and small scale backyard subsistence/village extensive poultry keepers exhibit the highest degree centrality. Small scale backyard subsistence/village extensive poultry keepers and small and medium scale distributors are crucial in outflow of live birds, therefore they should be the first points of surveillance for HPAI.

Table 6.3 Degree centrality: Number of links per actor in the value chain

Node	Degree	InDegree	OutDegree
SMDS	10	5	5
MEDS	9	3	6
FSM	9	5	4
FSR	9	5	4
SUBSIS	8	2	6
MEDIUM	7	3	4
IFTRANS	7	5	2
MEGA	6	2	4
LARGE	6	2	4
MEGACO	6	1	5
MEDCO	6	3	3
FTRANS	6	3	3
ITCO	6	1	5
HHCON	6	6	0
BUKA	6	6	0
SMCO	5	4	1
LADS	5	1	4
RPRO	5	5	0
SMALL	2	0	2
MOA	0	0	0
MEDIA	0	0	0
NGO	0	0	0
MOI	0	0	0
MOH	0	0	0
DONOUR	0	0	0
INTRES	0	0	0
PAN	0	0	0
FAN	0	0	0

Closeness and farness show how many steps an actor would need to take to reach everybody in the value chain. High closeness value means that the actor is closer to other actors (fewer steps to reach other actors) and hence if they are contaminated, they might be epicentres of HPAI risk spread. Those actors with the highest closeness centrality are small distributors, followed by medium collectors, medium distributors and informal transporters. Therefore any efforts to minimise HPAI risks (e.g., awareness raising, biosecurity measures) should target these actors.

Table 6.4 Closeness Centrality of actors in the value chain

Node	Farness	Closeness
SMDS	30.0	0.033
MEDCO	31.0	0.032
MEDS	31.0	0.032
IFTRANS	31.0	0.032
SMCO	32.0	0.031
SUBSIS	32.0	0.031
MEGACO	33.0	0.030
FSM	33.0	0.030
FSR	33.0	0.030
HHCON	35.0	0.029
BUKA	35.0	0.029
LADS	37.0	0.027
FTRANS	38.0	0.026
ITCO	39.0	0.026
MEDIUM	41.0	0.024
RPRO	41.0	0.024
MEGA	42.0	0.024
LARGE	42.0	0.024
SMALL	46.0	0.022
MOA	0.0	-1.000
MEDIA	0.0	-1.000
NGO	0.0	-1.000
MOI	0.0	-1.000
MOH	0.0	-1.000
DONOUR	0.0	-1.000
INTRES	0.0	-1.000
PAN	0.0	-1.000
FAN	0.0	-1.000

Betweenness centrality measure indicates that the nodes that occur on many shortest paths between other nodes have higher betweenness than those that do not. In this network, informal transporters have the highest betweenness centrality followed by small scale backyard subsistence/village extensive poultry keepers and small scale distributors.

Table 6.5 Betweenness centrality of actors in the value chain

Node	Betweenness
IFTRANS	41.959
SUBSIS	28.059
SMDS	20.148
FTRANS	14.622
MEDCO	13.455
MEGACO	11.381
MEDS	11.245
SMCO	6.385
FSM	5.460
FSR	5.460
MEDIUM	2.890
HHCON	1.863
BUKA	1.863
ITCO	1.631
LADS	1.521
RPRO	1.196
MEGA	0.431
LARGE	0.431
SMALL	0.000
MOA	0.000
MEDIA	0.000
NGO	0.000
MOI	0.000
MOH	0.000
DONOUR	0.000
INTRES	0.000
PAN	0.000
FAN	0.000

6.1.3.2. Flow of Information

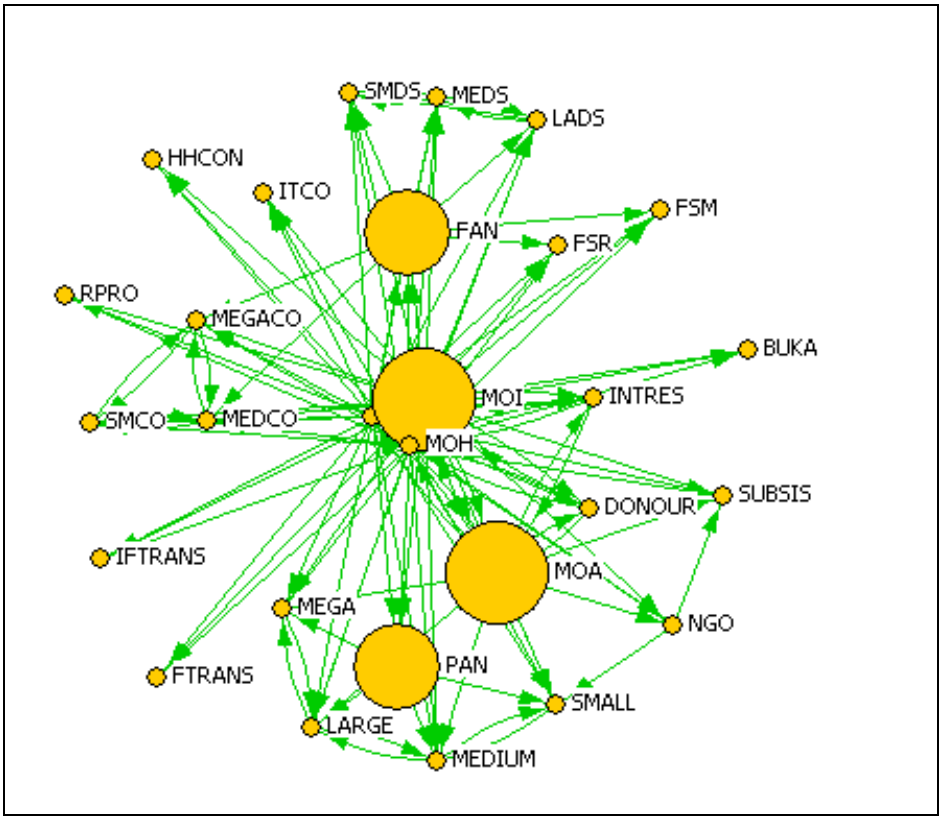
Information on HPAI comes from institutions outside the value chain. Ministry of Agriculture and PAN communicate with the poultry producers. PAN reaches out to its membership which consists of mega, large, medium scale producers and small scale commercial/backyard producers. Whereas MOA communicates about HPAI risk and risk minimization with all poultry producers. Within the different size producers there is some exchange of (informal) information between mega, large, medium scale producers and small scale commercial/backyard producers, however communication between mega, large, medium scale producers and small scale backyard subsistence/village extensive poultry keepers is very weak.

Similarly to PAN, FAN also communicates about AI to their members. FAN's membership constitutes collectors, distributors and fowl sellers.

Ministries of Information and Health, as well as mass media communicate about HPAI to everyone in the value chain. Finally, MOA, MOH, International donors and researchers communicate between each other and inform mass media and NGOs.

The most influential actors in communicating HPAI risks and risk minimization information are MOA and MOI. These are followed by PAN and FAN. Net-map of information links is depicted below. According to this figure, MOI, MOH are in the centre of information dissemination, MOA and PAN inform poultry producers, whereas FAN informs actors further down the value chain (collectors, distributors and sellers). Producers, transporters, collectors, distributors and consumers are in the outer circle of the information network.

Map 3 Flow of information



Size of node= influence of actor in the network

Node centrality measures for formal information dissemination are reported for degree centrality, closeness centrality and betweenness centrality. Degree centrality reveals that all the actors in the information network are linked. In terms of outdegree centrality, i.e., giving information, MOI, MOH and media have the highest number of links (27 each), followed by MOA (11) and FAN (7) and PAN (4), whereas 10 actors have an out degree of zero (subsistance farmers, fowl sellers, consumers and transporters).

Table 6.6 Degree Centrality of actors in the information network

Node	Degree	InDegree	OutDegree
MOI	32	5	27
MOH	32	5	27
MEDIA	30	3	27
MOA	16	5	11
FAN	10	3	7
LARGE	9	7	2
MEDIUM	9	7	2
SMALL	8	7	1
MEGACO	8	6	2
MEDCO	8	6	2
MEDS	8	6	2
MEGA	7	6	1
SMCO	7	5	2
LADS	7	5	2
SMDS	7	6	1
DONOUR	7	4	3
INTRES	7	4	3
PAN	7	3	4
NGO	6	4	2
SUBSIS	5	5	0
FSM	4	4	0
FSR	4	4	0
FTRANS	3	3	0
IFTRANS	3	3	0
ITCO	3	3	0
RPRO	3	3	0
HHCON	3	3	0
BUKA	3	3	0

In this network media, MOI and NOH s have the highest betweenness centrality followed by MOA and FAN.

Table 6.7 Betweenness centrality of actors in the information network

Node	Betweenness
MEDIA	85.943
MOI	85.943
MOH	85.943
MOA	5.433
FAN	4.250
SMALL	0.593
PAN	0.533
LARGE	0.310
MEDIUM	0.310
MEGACO	0.200
MEDCO	0.200
NGO	0.200
MEGA	0.143
SMCO	0.000
LADS	0.000
MEDS	0.000
SMDS	0.000
SUBSIS	0.000
DONOUR	0.000
INTRES	0.000
FSM	0.000
FSR	0.000
FTRANS	0.000
IFTRANS	0.000
ITCO	0.000
RPRO	0.000
HHCON	0.000
BUKA	0.000

According to closeness centrality measure, media, MOI and MOH are the closest to all the other actors in the network, followed by MOA and FAN. High closeness value means that the actos is closer to other actors (fewer steps to reach other actors) and hence could be the most efficient and effective actor for disseminating information.

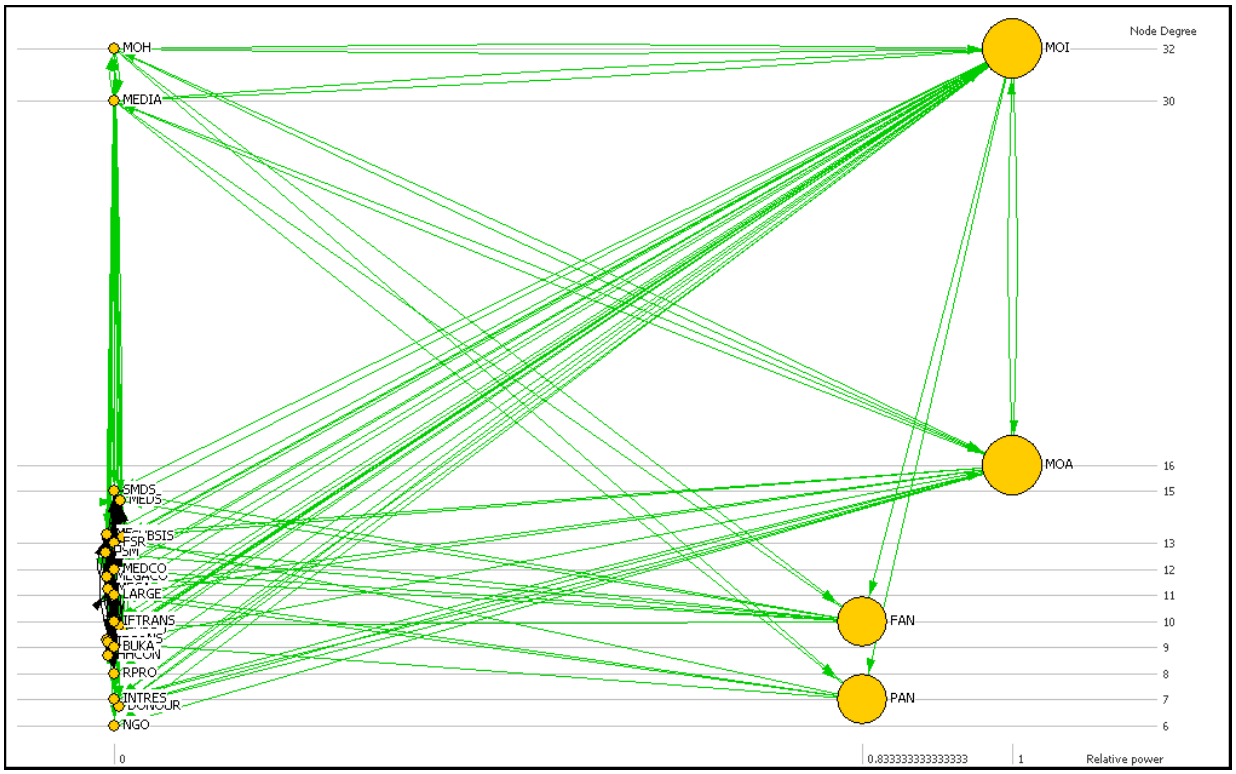
Table 6.8 Closeness centrality of actors in the information network

Node	Farness	Closeness
MEDIA	27.0	0.037
MOI	27.0	0.037
MOH	27.0	0.037
MOA	43.0	0.023
FAN	44.0	0.023
LARGE	47.0	0.021
MEDIUM	47.0	0.021
SMALL	47.0	0.021
PAN	47.0	0.021
MEGA	48.0	0.021
MEGACO	48.0	0.021
MEDCO	48.0	0.021
LADS	48.0	0.021
MEDS	48.0	0.021
SMDS	48.0	0.021
NGO	48.0	0.021
SMCO	49.0	0.020
SUBSIS	49.0	0.020
DONOUR	50.0	0.020
INTRES	50.0	0.020
FSM	50.0	0.020
FSR	50.0	0.020
FTRANS	51.0	0.020
IFTRANS	51.0	0.020
ITCO	51.0	0.020
RPRO	51.0	0.020
HHCON	51.0	0.020
BUKA	51.0	0.020

There are no cut off points in the information network, revealing that if some of the actors did not function, remaining actors could still get their information from other actors in the network.

The correlation between influence of actors and node degree centrality for information dissemination is weak (0.38), which indicates that actors that are influential in dissemination of information are not necessarily linked to all the other actors in the network. PAN and FAN (private institutions) are influential though not linked to many actors, whereas Ministries of Agricultural and Information are linked to more actors.

Figure 1 Correlation between node degree centrality and influence



Investigation of the centralities and influence for information dissemination reveal that the correlation between whether the actor belongs to the public sector and the height of influence is weak (0.58). The correlation between degree centrality and whether the actor is public is strong (0.74), especially for out degree centrality, revealing that most of the information regarding HPAI risk and risk minimization is disseminated from public authorities.

6.1.4. Dissemination of research results

According to the participants of the net-mapping exercise, research findings should be communicated to MOA and MOI first, and should be presented in the form of comprehensive written reports as well as short briefs. MOA and MOI are then responsible for the broad distribution of information in the form of posters, fliers, letters to relevant stakeholders. FAN and PAN should also be informed about the findings of the research project. Documents that the research project will generate should concentrate on simple explanation of the results and policy implications. The participants also asked for multi-stakeholder workshops to share findings with all the actors.

6.2 Net Map Analysis of the Institutions Associated with Surveillance and Control of Highly Pathogenic Avian Influenza (HPAI) in Nigeria

This session was facilitated by Paulo Duarte.

6.2.1 Introduction

The objective of this exercise was to identify the institutions and their relative influence associated with surveillance and control of HPAI in Nigeria, the flow of information for disease reporting among institutions, and the institutional responses to disease occurrence. The following questions were asked:

- What formal and informal institutions, private/public are involved in the disease surveillance system?
- Who is influential? Who are the core actors? What are their roles? How do they interact with each other? What are the links between institutions?
- How does information about disease risk get communicated in this system?
- What areas of the system should be improved to ensure efficient and effective communication of disease risk and surveillance?
- Where and how could project findings help inform decision making in the system?

The net-map exercise was carried out on June 18th, during the second day of the two day multi-stakeholder workshop for DFID funded HPAI Risk Reduction Strategies project. 15 participants took part in the net-mapping exercise, these included Ministry of Agriculture, Directory of Veterinary Services officials, poultry sector experts from research centres and universities, as well as a poultry producer.

Table 6.9 List of participants

	Name	Designation/Organization
1.	Dr. Joseph Nyager	Deputy Chief Veterinary Officer, Federal Department of Livestock, Federal Ministry of Agriculture and Water Resources
2.	Dr S Jibrin	Director of Veterinary Services, Kano State
3.	Dr SJ Akpa	Director of Veterinary Services, Plateau State
4.	Dr UO Ukoha	Director of Veterinary Services, Abia State
5.	Dr Garba. Maina	Ministry of Agriculture, Kebbi State
6.	Prof Timothy Obi	University of Ibadan
7.	EO Fatummbi	JOFAT Ventures Sales and Supplies of Live Poultry and Poultry Products
8.	Thomas Easley	USAID
9.	Mrs FA Oketokun	President of Fowlsellers' Association of Nigeria
10.	Prof Funso Sonaiya	Obafemi Awolowo University
11.	Dr TA Adejuwon	Director of Veterinary Services, Lagos State Ministry of Agric & Cooperatives
12.	Mr Niran Adegbamigbe	Animal-Care Services- Consult (Nig) Ltd.
13.	Dr Clement Meseko	Viral Research Department, National Veterinary Research Institute (NVRI)
14.	Dr I. Okike	ILRI
15.	Dr Clare Narrod	IFPRI

6.2.2 The Actors

The participants identified the following key actors in the HPAI disease risk surveillance and control system:

- Federal Ministry of Agriculture and Water Resources (FMAWR): responsible for the planning, implementation, and enforcement of agricultural programs and activities.
- Federal Department of Livestock (FDL): subordinated to the FMAWR and led by the Chief Veterinary Officer (CVO), it is responsible for planning, implementation, and enforcement of animal health programs and activities.
- National Animal Disease Information and Surveillance System (NADIS): subordinated to the FDL and responsible for disease information and surveillance activities. It is the epidemiology unit of the FDL and has a central office and 15 zonal offices (coordinators). Zones represent a group of a variable number of states. These zonal coordinators report to the national animal disease information surveillance unit at the federal level.
- National Veterinary Research Institute (NVRI) is the national reference laboratory for the diagnosis and investigation of livestock diseases**.** –Recently it has been upgraded to a BSL-3 testing facility where other countries in the region are also sending samples. It is subordinated to the FDL for disease control activities purposes and responsible for testing of samples. There are 5 regional support laboratories (Ibadan, Maiduguri, Nsukka, Sokoto, and Zaria) to NVRI with variable testing capacity (ultimately will be able to conduct PCR and serological testing). These support laboratories are associated with Veterinary Teaching Hospitals and are subordinated to the Ministry of Education. However, the majority of the HPAI testing is conducted by the NVRI.
- Avian Influenza Control and Human Pandemic Preparedness and Response Project (AICP) – It is a temporary structure funded by the World Bank focusing on promoting partnerships between both the animal and human health agencies to facilitate the control of HPAI and other possible zoonotic diseases in the future. It has 4 main focuses: animal health, human health, communication and monitoring and evaluation.
- It is under NADIS where its central office is located, and has offices in each state (36 and Federal Capital Territory) and local governments (774). The AICP state and local government offices are subordinated to the State Department of Veterinary Services.
- State Ministry of Agriculture (SMA): under the disease control act is responsible for the planning, implementation, and enforcement of agricultural programs and activities at the state level.
- State Department of Veterinary Services: subordinated to the SMA and led by the State Director of Veterinary Services, it is responsible for planning, implementation, and enforcement of animal health programs and activities.
- Local Government Animal Health Officer (LAHO): subordinated to the local government veterinary services, it is responsible for implementation and enforcement of animal health programs and activities. They are a total of 774. In addition, there is an AICP officer in each local government as described above.

In addition to the public (MAWR related) institutions, there are also private actors in the network. A list of all the actors in the disease surveillance and control network is presented in Table 2.

Table 6.10 List of actors in the disease surveillance and control network

Public actors	**Federal level**
	Federal Ministry of Agriculture and Water Resources (FMAWR)
	Federal Department of Livestock (FDL)
	National Animal Disease Information and Surveillance System (NADIS)
	Ministry of Health (MOH)
	Ministry of Communication and Information (MOI)
	National Veterinary Research Institute (NVRI)
	Avian Influenza Control and Human Pandemic Preparedness and Response Project (AICP)
	State level
	State Department of Veterinary Services (SDVS)
	AICP State Officer (AICPS)
	Ministry of Information and Communication State Level (MOIS)
	Ministry of Health State Level (MOHS)
	State Department of Veterinary Services (SDVS)
	Zonal coordination in each state (ZONCO)
	Local Government Level
	Local Government Animal Health Officer (LAHO)
Private actors	
	Farmer (FARM)
	Live bird market (LBM)
	Poultry association (PASS)
	Private veterinarians (PVET)
	Input provider (INP)
	Service provider (SERP)
	Traders (TRADER)
International Organizations	
	OIE
	FAO
	WHO

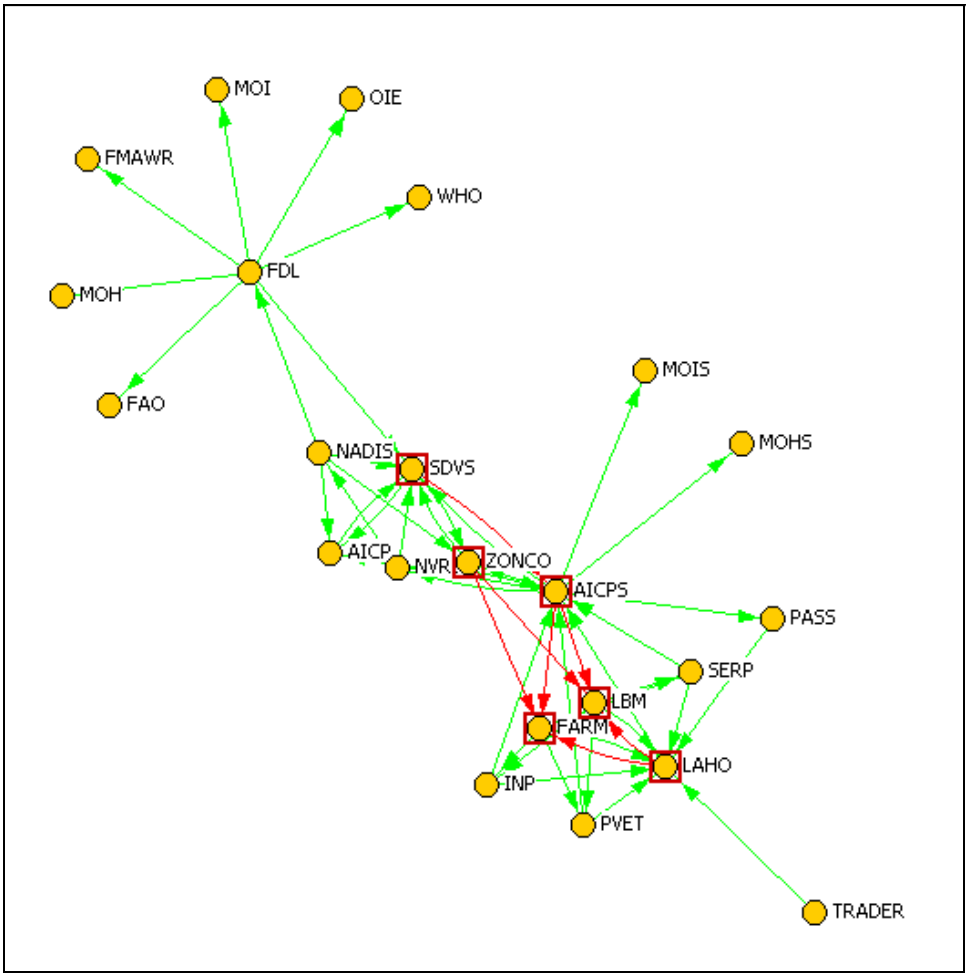
Two links were identified in this disease surveillance and control network. These are flow of information on HPAI disease risk and flow of response. In addition to these, the most influential actors in the flow of information on disease reporting and in the flow of information on disease reporting feedback, as well as influential actors in the disease response were identified.

6.2.3 Net-Map and analysis

Network of disease information and response links and all actors

Net-map of disease risk information flow (green) and response (red) is depicted below, and each link is explained in greater detail in the following sections.

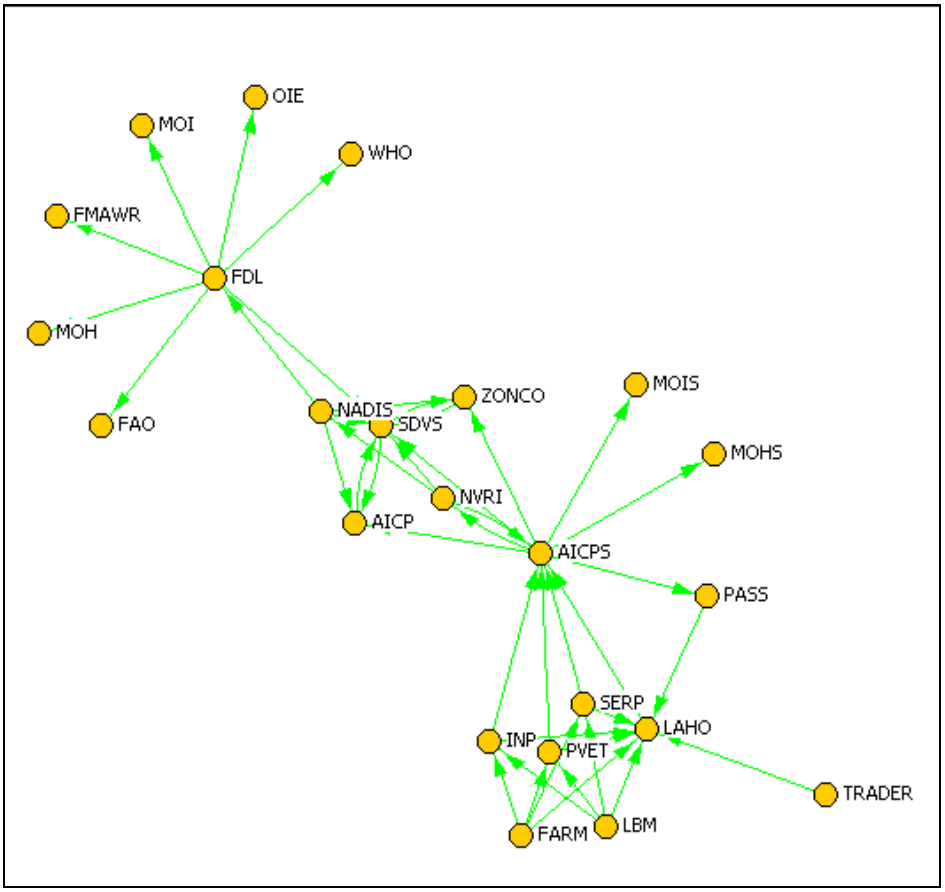
Map 4 Disease information and response networks



Flow of information of disease reporting

Net-map of disease risk information flow is depicted below.

Map 5 Disease reporting information flow



The first official communication of a suspected outbreak or case of HPAI typically occurs at the LAHO or at the State AICP office. Cases can be reported directly by the farmer or through a private veterinarian or other service provider, or an input provider. Traders and poultry associations may also report suspected disease directly to LAHO or State AICP. Once the suspicion reaches LAHO or AICP, the State DVS office is communicated and the suspected premises is put immediately into quarantine (movement restriction). Following notification of the suspicion, the AICP state office organizes the collection of samples (blood and/or tracheal and cloacal swabs, and/or carcasses of any sick birds or recently dead animals) for testing which are submitted to the NVRI. After 24 hours of receiving the samples, and if positive, the NVRI transmit the results (via phone – text messages) to NADIS offices first and then to the State DVS, and State AICP officer. Then, NADIS transmit the results to the Federal Ministry of Health, Federal Ministry of Communications, and International Organizations (OIE, FAO, WHO). The AICP state office transmits the information to the State Ministry of Health, and State Ministry of Communications. NADIS also communicate with their AICP central office and their zonal coordinators which are also in close contact with the State DVS.

Node centrality measures for disease reporting are presented for degree centrality, closeness centrality and betweenness centrality measures. Degree centrality results reveal that state level AICP (AICPS)

exhibits the highest degree centrality, followed by FDL, state level DVS (SDVS) and local government animal health officer (LOHA). AICPS and FDL have higher level of out degree centrality, i.e., they disseminate the information, whereas SDVS and LAHO exhibit higher indegree centrality, i.e., they receive information.

Table 6.11 Degree Centrality of Flow of Information: Number of links per actor

Node	Degree	InDegree	OutDegree
AICPS	12	5	7
FDL	8	1	7
SDVS	8	6	2
LAHO	8	7	1
NADIS	5	1	4
AICP	4	3	1
ZONCO	4	3	1
NVRI	4	1	3
FARM	4	0	4
PVET	4	2	2
INP	4	2	2
SERP	4	2	2
LBM	4	0	4
PASS	2	1	1
FMAWR	1	1	0
MOH	1	1	0
MOI	1	1	0
OIE	1	1	0
FAO	1	1	0
WHO	1	1	0
MOIS	1	1	0
MOHS	1	1	0
TRADER	1	0	1

Closeness and farness show how many steps an actor would need to take to reach everybody in the network. High closeness value means that the actor is closer to other actors (fewer steps to reach other actors) and the information would be disseminated faster. Those actors with the highest closeness centrality are AICPS and SDVS, followed by AICP, ZONCO.

Table 6.12 Closeness centrality in the Flow of Information

Node	Farness	Closeness
AICPS	39.0	0.026
SDVS	41.0	0.024
FDL	49.0	0.020
AICP	50.0	0.020
ZONCO	50.0	0.020
NVRI	50.0	0.020
LAHO	50.0	0.020
NADIS	52.0	0.019
PVET	54.0	0.019
INP	54.0	0.019
SERP	54.0	0.019
PASS	56.0	0.018
MOIS	60.0	0.017
MOHS	60.0	0.017
FARM	68.0	0.015
LBM	68.0	0.015
FMAWR	70.0	0.014
MOH	70.0	0.014
MOI	70.0	0.014
OIE	70.0	0.014
FAO	70.0	0.014
WHO	70.0	0.014
TRADER	71.0	0.014

Betweenness centrality measure indicates that the nodes that occur on many shortest paths between other nodes have higher betweenness than those that do not. In this network, AICPS has the highest betweenness centrality followed by FDL and SDSV.

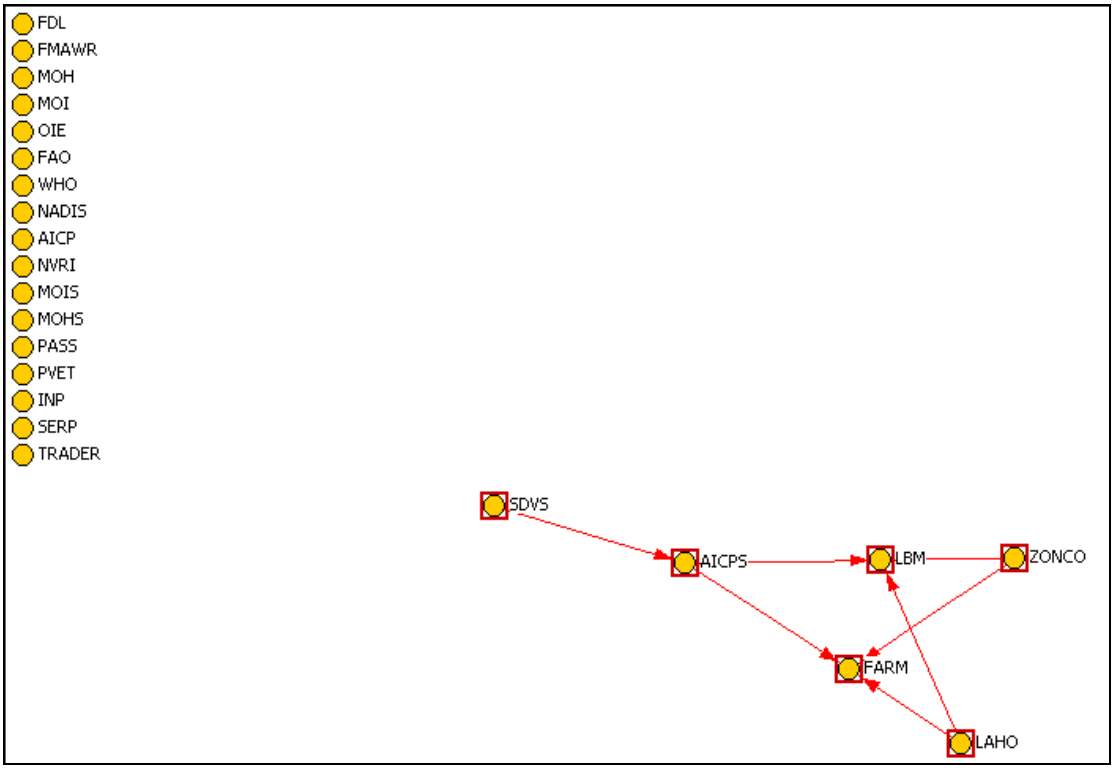
Table 6.13 Betweenness Centrality of Flow of Information

Node	Betweenness
AICPS	140.250
FDL	111.000
SDVS	91.250
LAHO	33.000
NADIS	11.500
PVET	7.750
INP	7.750
SERP	7.750
AICP	2.750
ZONCO	2.750
NVRI	2.750
FARM	0.750
LBM	0.750
FMAWR	0.000
MOH	0.000
MOI	0.000
OIE	0.000
FAO	0.000
WHO	0.000
MOIS	0.000
MOHS	0.000
PASS	0.000
TRADER	0.000

Responses

Net-map of disease response is depicted below.

Map 6 Disease response flow



Currently, the responses to HPAI in Nigeria include depopulation (and in-situ disposal) of the confirmed premises and of the surrounding premises in a variable radius but pre-determined to be, in principle, 3km. Bird owners are compensated for the birds slaughtered as a consequence of the depopulation program. Depopulation and compensation are coordinated by the State AICP office who leads a team that includes a local government representative and a NADIS representative.

Node centrality measures for disease response network are reported below. AICPS, FARM and LBM have the highest degree centrality. AICPS exhibit high outdegree centrality whereas farmers and live bird markets exhibit high in degree centrality.

Table 6.14 Degree Centrality of Responses

Node	Degree	InDegree	OutDegree
AICPS	3	1	2
FARM	3	3	0
LBM	3	3	0
ZONCO	2	0	2
LAHO	2	0	2
SDVS	1	0	1

In terms of closeness and betweenness centralities, AICPS, FARM and LBM are the most central actors.

Table 6.15 Closeness centrality of responses

Node	Farness	Closeness
AICPS	7.0	0.143
FARM	7.0	0.143
LBM	7.0	0.143
ZONCO	9.0	0.111
LAHO	9.0	0.111
SDVS	11.0	0.091

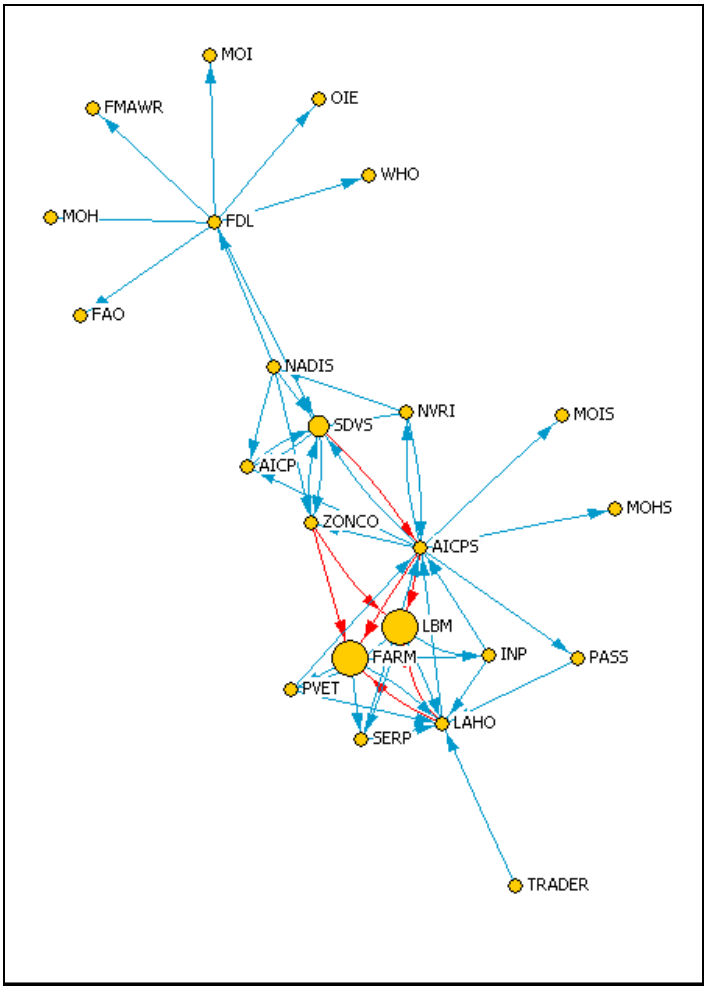
Table 6.16 Betweenness centrality of responses

Node	Betweenness
AICPS	4.333
FARM	2.500
LBM	2.500
ZONCO	0.333
LAHO	0.333
SDVS	0.000

Influential actors and Constraints

The most influential actors in terms of flow of information for disease reporting were identified as the farmer followed by the local animal health office and the state AICP office.

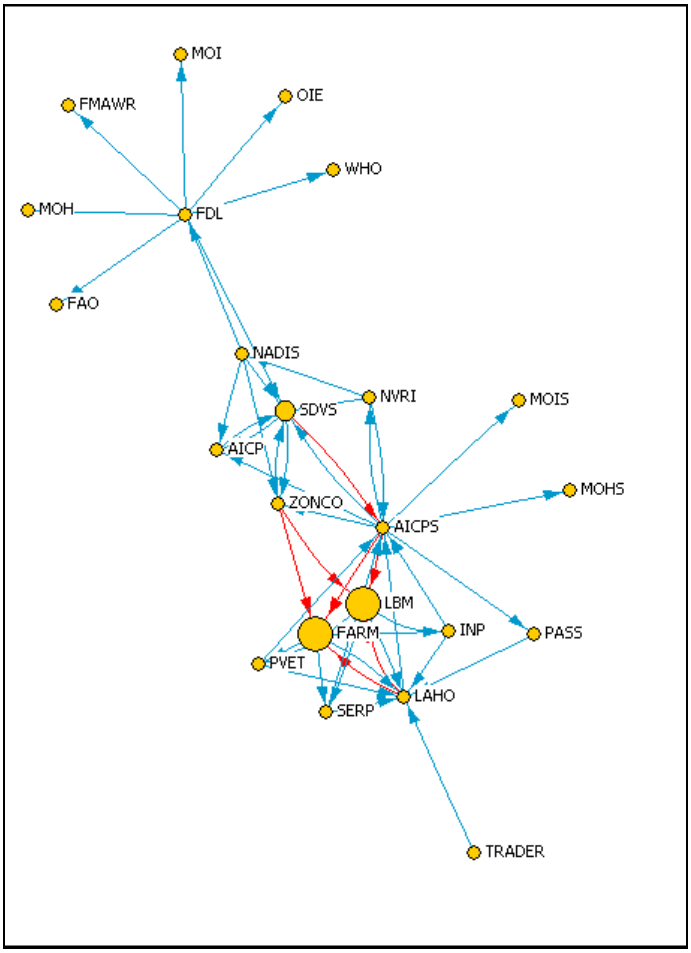
Map 7 Disease reporting information flow influential actors



Size of node = influence of actor in disease reporting

In terms of feedback and dissemination of information (test results) the main actor identified was NADIS followed by the AICP state office.

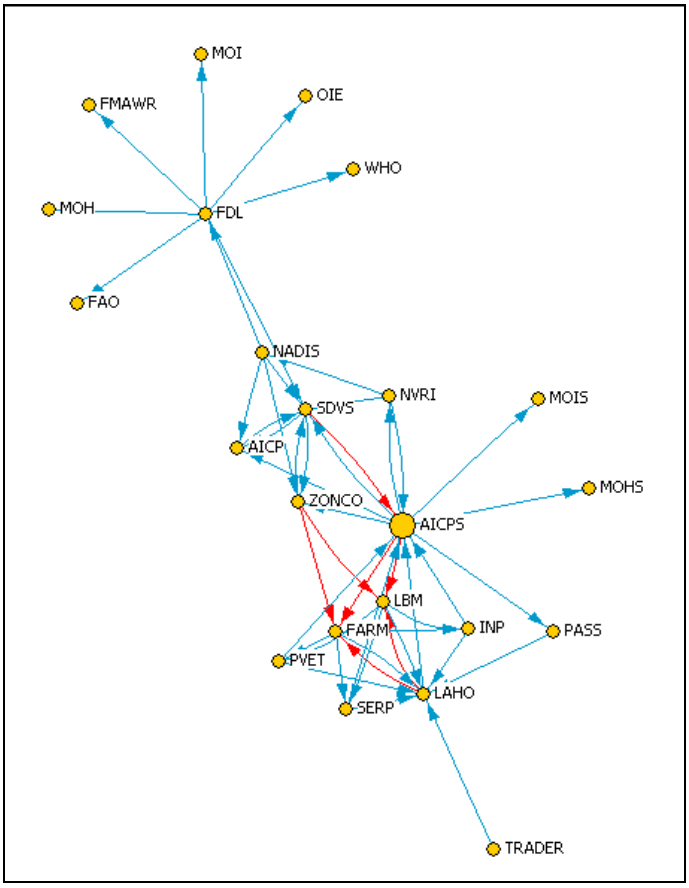
Map 8 Disseminating information on test results influential actors



Size of node = influence of actor in dissemination of test results

The key actor for response activities was identified as the AICP state office that coordinates all response activities, and the farmer who has to cooperate with the implementation of activities.

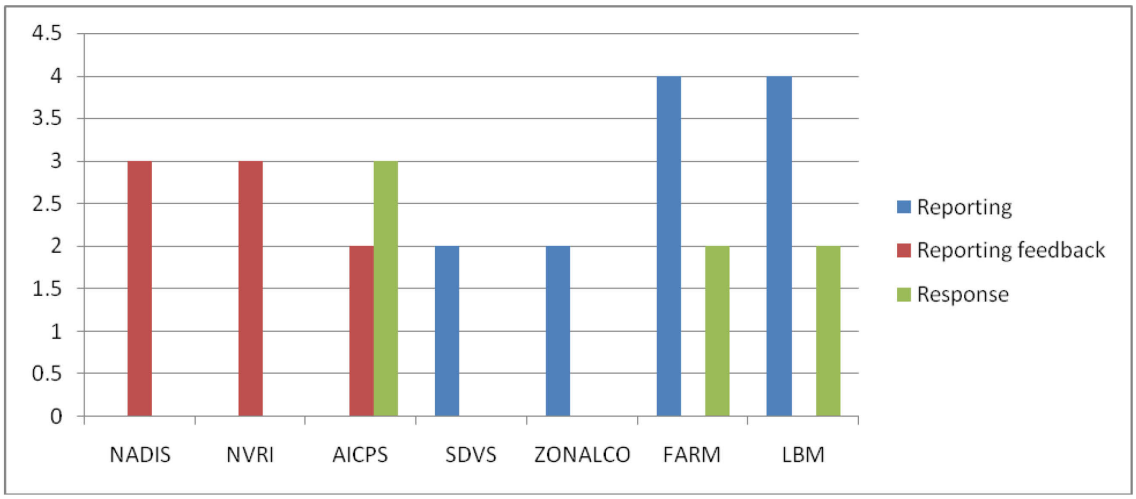
Map 9 Disease response influential actors



Size of node = influence of actor in response

Actors' influence on disease reporting, reporting feedback and response are also depicted in the graph below:

Figure 2 Influential actors in reporting, feedback ad response



No correlations were found between the different measures of influence and whether or not the actor is a public entity, and between the different measures of influence and degree centrality.

The main constraints identified refer to a delay in reporting of test negative samples and overall lack of feedback to those not directly involved with the outbreak, specifically, traders and poultry associations. They typically learn about the problem through word-of-mouth or education campaigns.

7. Workshop Closure

The workshop closed at the end of Day 2 (18 June 2008). On 19 & 20 June, there was follow up research planning meeting involving VS people to further discuss the membership of Nigerian collaborators on the project. A tentative list was agreed for the various clusters (but will not be published here as it might change and persons dropped might take offence). Further meetings were held in an attempt to streamline the livelihood research aspects of this project with a proposed UNDP-funded FAO project in Nigeria. The discussions were geared towards joint development of questionnaires and selection of sites that will incorporate all the components of interest to both the DFID and UNDP projects. These were agreed in principle but proved rather difficult to coordinate other thoughts and implementation plans of a wider group of interested persons. This project continues to pursue its fieldwork independently. Site selection for fieldwork will be broadly based on four agro-ecological zones in Nigeria. Within each zone, there will be contrasting scenarios of where HPAI has occurred and where HPAI has not occurred.