Report of the protocol for epidemiological surveys LoA PR 37212 between FAO and CIRAD

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Summary

Highly pathogenic avian influenza (HPAI) H5N1 virus was first reported in Africa in February 2006 in Nigeria and subsequently infected ten other countries producing considerable socioeconomic losses. The epidemiological characteristics of HPAI H5N1 outbreaks seem to differ from those observed in Asia and this unexpected behaviour has hindered efforts for surveillance and control of the disease. The aim of this study is to improve the understanding of the epidemiology of HPAI in Africa by assessing risk factors for introduction, spread and persistence of HPAI outbreaks in seven infected countries (Burkina Faso, Cameroon, Egypt, Ivory Coast, Niger, Nigeria and Sudan). Standardised methods will be used to review existing HPAI-related information, conduct retrospective HPAI outbreak investigations with biological sample collection, compare infected and non-infected areas, and collect risk factor information at the national level. Collected data and samples will be analysed to provide a standardized description of HPAI situation and outbreak patterns in the seven infected African countries included in the survey, to assess risk factors related to introduction, spread and persistence of HPAI, and to predict, to the best of the available knowledge, areas with the highest likelihood of occurrence of HPAI. Activities will be conducted by a team of national experts (one national survey consultant specifically recruited for the survey in each participating country, agents of the national veterinary services and national veterinary diagnostic laboratories) and international experts from CIRAD, FAO, FLI, IZS, RVC and ULB. The final outcome will be the writing of recommendations to enhance the efficiency of HPAI prevention and control strategies in Africa.

List of acronyms

AGAH	Animal Health Service of the Animal Health and Production Division at FAO
CIRAD	French Agricultural Research Centre for International Development
EPIAAF	Epidemiology of avian influenza in Africa
FAO	Food and Agriculture Organization of the United Nations
FLI	Friedrich Loeffler Institut
HPAI	Highly pathogenic avian influenza
IBAR	Inter-African Bureau of Animal Resources
IATA	International Air Transport Association
IZS	Istituto Zooprofilattico Sperimentale delle Venezie
OFFLU	OIE FAO network on avian influenza
OIE	World Organisation for Animal Health
NSC	National survey consultant
RVC	Royal Veterinary College of the University of London
ULB	Université Libre de Bruxelles
WHO	World Health Organisation of the United Nations

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1. Introduction

Highly pathogenic avian influenza (HPAI), caused by avian influenza virus subtype H5N1, has severely affected poultry production in Southeast Asia since 2003. In July 2005, HPAI H5N1 virus spread in a north-westerly direction in both domestic poultry and wild birds to Russia, Mongolia and Kazakhstan. By the end of 2005, this HPAI virus had spread progressively to Europe and Middle Eastern countries. The first outbreak on the African continent was reported in Nigeria on February 8, 2006 in domestic poultry. In the next three months, seven other African countries were also infected: Egypt, Niger, Cameroon, Burkina Faso, Sudan, Côte d'Ivoire and Djibouti. In 2007, three Western African countries became infected: Ghana, Togo, and Benin. The introduction of HPAI had a tremendous negative socio-economical impact in these countries. Poultry is an important source of protein for vulnerable households which still rely largely on subsistence agriculture. Poultry farms are also one of the key industries in the incipient agro-industrial sector, with a rapidly growing demand. Losses due to HPAI were reported as over 700,000 birds either culled or dead in Nigeria and over 30 million in Egypt. Moreover in Africa, 40 human cases of HPAI infection (38 in Egypt, 1 in Djibouti and 1 in Nigeria) have been reported to WHO as of 12 December 2007, with 16 (15 in Egypt and 1 in Nigeria) resulting in death.

International and sub-regional trade of poultry and poultry products, whether legal or illegal, seems to have played a major role in the introduction of the disease in Africa and its diffusion among countries (Squarzoni et al. 2006). In Nigeria, phylogenetic analyses of strains isolated from two farms in Lagos state suggested multiple independent introductions (Ducatez and al, 2006). The role of wildlife in the introduction and dissemination of HPAI in Africa is still debated. A large-scale surveillance campaign of wild water birds in twelve African countries found avian influenza viruses but no HPAI H5N1 (Gaidet et al. 2007). Mortality of wild birds presumably due to H5N1 has been reported in several African countries but actual isolation of HPAI H5N1 virus from wild birds was only performed from one whistling duck in Malapé in Cameroon. Both movements of poultry/poultry products and wild birds are considered as having the capacity to further spread HPAI infection in the African continent.

The behaviour of the disease in Africa differs from what has been observed in Asia. With the exception of Egypt and Nigeria, where industrial and semi-industrial farms were highly affected and where outbreaks are still on-going, HPAI outbreaks were mostly reported from backyard or small-scale farms and did not spread extensively, sometime in spite of a long delay between case-confirmation and stamping out. This lack of dissemination may be linked to the climatic conditions of the affected zones. Very high temperatures (above 40°C in the shade) and low humidity (less than 20%) are for example typically encountered in Sahelian countries during the dry season. Other factors such as reduced consumption and trade of poultry, or on-site slaughter of sick animals, may also have contributed to limit the spread of the disease before official control measures were implemented by veterinary services.

Unlike Asia where domestic ducks were far less sensitive than chicken, mortality in Africa has been reported from chickens, ducks, guinea fowls, turkeys, geese and pigeons (Squarzoni et al. 2006). Moreover in some foci (Niger, Cameroon), chickens in contact or in close vicinity of infected ducks did not contract the disease. Clinical signs encountered in chicken were also sometime less significative than those reported in the same species in Asia.

In conclusion, many knowledge gaps need to be filled for the epidemiology and behaviour of HPAI in Africa in order to refine and adapt prevention and control strategies.

2. Survey background and links to previous FAO projects

In response to the westward expansion of H5N1 virus from its Asian cradle, FAO implemented five Technical Cooperation Programmes (TCP) in Eastern Europe and Caucasus, in the Middle East, and in Eastern, Western and Northern Africa. These projects aimed at improving epidemiological surveillance of HPAI, with a strong emphasis on surveillance of wild birds which were then thought to represent the major contributor to the worldwide dissemination of HPAI H5N1. Between January and May 2006, field campaigns were conducted in 14 countries, mostly in Africa, including recently infected countries. In total, 5,256 samples were collected in large wetland areas where Eurasian and Afro-tropical water birds congregate. A majority of these samples were collected from Afro-tropical ducks and Eurasian ducks, while other samples originated from waders, gulls and rails. The overall prevalence for avian influenza viruses detected by RT-PCR was 3.3%, with no positivity for H5N1 virus. Low Pathogenic Avian Influenza (LPAI) viruses were detected and isolated in both Eurasian and Afro-tropical bird species, indicating that low pathogenic viruses had been circulating in Africa during the northern winter and that they had the potential to be perpetuated year round in wild bird populations. Results of a second campaign conducted in 17 countries between October 2006 and March 2007 are pending and will help further decipher the role of wild birds in the epidemiology of avian influenza.

Additionally, FAO funded a preliminary study on identification of risk factors for HPAI. Five countries which had had HPAI outbreaks in 2005-2006 (Egypt, Jordan, Nigeria, Romania and the Sudan) were compared with six countries (Benin, Ethiopia, Kenya, Republic of Moldova, Syrian Arab Republic and Tunisia) which had had no outbreak and which were geographically close to the selected five infected countries. Information on poultry production and environmental variables was extracted from FAO databases and tested for association with HPAI occurrence. Statistical analyses found a significant impact of landuse (proportion of cropland) but despite the potential of these analytical tools, the results had to be considered with caution owing to the limitations of the data used for analyses (small number of observations, low level of spatial resolution, missing values and potential selection bias).

The lack of good baseline data on HPAI outbreaks in Africa has indeed been a major constraint when trying to decipher the behaviour of the disease in the continent and trying to formulate epidemiological hypotheses. Although surveillance activities and capacities of veterinary services and veterinary diagnostic laboratories have been significantly increased through a series of national projects implemented by FAO, no standardised protocols have been used to collect comparable data in all countries and risk factor information has not been systematically collected.

The current survey has been designed to jointly address the need for improved and standardised data sources and the need for identifying risk factors associated with the introduction, spread and persistence of HPAI outbreaks in infected countries. Originally entitled “Highly Pathogenic Avian Influenza’s parameters explaining disease introduction, spread and persistence in Africa”, the survey has been given a more generic and shorter name: EPIAAF (Epidemiology of avian influenza in Africa) to account for its general objective which is to improve the understanding of the epidemiology of HPAI in Africa.

3. Objectives

3.1 Overall objective

The overall objective of the EPIAAF survey is to improve the understanding of the epidemiology of HPAI in Africa with the final aim of providing recommendations for enhanced surveillance and control of the disease.

3.2 Specific objectives

This survey aims at:

- Providing a standardized description of HPAI situation and outbreak patterns in the seven infected African countries included in the survey
- Assessing risk factors related to introduction, spread and persistence of HPAI in the seven infected countries included in the survey
- Predicting, to the best of the available knowledge, areas with the highest likelihood of occurrence of HPAI in the seven infected countries included in the survey

4. Survey design

The epidemiological survey design has been extensively discussed during a series of meetings held in Rome in January 2007, in London in March, in Cairo in April (meeting funded by FAO with participation of representatives of six of the seven countries included in the survey), in Montpellier in May, in Paris in October and in London in December.

4.1 General methodology

Three types of epidemiological studies will be used to fulfil the three specific objectives.

Descriptive studies

This type of studies aims at answering the fundamental questions of what happened, where, when, how and to who? However simple these studies may seem, they provide basic but essential epidemiological knowledge. They are at the source of the formulation of hypotheses concerning risk factors for diseases.

Analytic studies

Analytic studies are used to study determinants of a disease: causes and risk factors. They are designed to test hypotheses concerning the relationship between a suspected risk factor and an outcome, and they imply a comparison among two or more groups. In our case the outcome of interest is H5N1 HPAI infection and the two groups which will be compared are infected and non-infected sites or areas.

Predictive studies

Predictive studies basically build on knowledge gathered by descriptive and analytic studies. They can also incorporate methods developed by the decision-making sciences to palliate for scarcity of field data. They use risk analysis, mathematical and spatial modelling tools to predict disease occurrence and to answer “What if” questions.

4.2 Descriptive studies

In each country involved in the survey, descriptive studies of HPAI infection will be conducted at two levels: the national level and the local level.

Descriptive studies at the national level

Information on HPAI outbreaks has already been produced in each infected African country but this information is generally scattered and non-standardised. Information contained in all reports from veterinary services, from wildlife services, from poultry farmers’ associations, from Ministries of health, from HPAI inter-ministerial cells, from national and international consultants, from regional or international organisations (IBAR, OIE, FAO), from non-governmental organizations, etc will be reviewed and synthesised into a format-standardised report and then fed into the database specifically build for the project.

Descriptive studies at the local level

Descriptive studies at the local level will consist of retrospective outbreak investigations in HPAI infection foci. They will be conducted with three objectives in mind:

- Fine-tune information gathered at the national level and assess potential discrepancies
- Investigate introduction, persistence, and spread risk factors at the local level
- Provide data corresponding to the presence of the disease, for subsequent comparison of infected and non-infected sites (see 4.3 Analytic studies)

Depending on the situation in each country (number, geographical distribution, and field accessibility of infection foci) and the latest data available on the situation of the epidemic, the affected populations and the most recent epidemiologic hypotheses, a number of sites for investigation will be selected. A site is the epidemiologic unit chosen for the survey and corresponds to a village and its immediate surroundings. At least two previously infected sites should be investigated. If possible and if allowed by national veterinary authorities, one site of on-going infection should also be investigated for currently infected countries (Egypt, Nigeria).

In each outbreak investigation site, a standardised questionnaire (Annexe 1) will be used to collect extensive information on outbreak patterns and HPAI virus introduction, persistence and dissemination risk factors. Among all this information collected, the most important variables (see list in Annexe 2) will be extracted and fed into a database specifically built for the survey. GPS position of all points of epidemiological interest (farms, ponds, roads, markets, etc) will be recorded for each investigation site using decimal degree measures and the datum WGS 84.

Also in each outbreak investigation site, biological samples will be collected from a random sample of backyard poultry. Samples from other birds in the close vicinity of the site (such as birds from market, commercial and semi-commercial farms, commensal or wild birds) may also be sampled if relevant.

- Tracheal swabs and cloacal swabs will be collected from each randomly selected bird to detect the eventual presence of AI virus. The objective is to test the hypothesis that HPAI virus might be circulating while undetected (possible absence of clinical signs in some species, possible presence of uncharacteristic clinical signs confused with other diseases). Tracheal and cloacal swabs will also be tested for the presence of Newcastle disease virus because of the high similarity of clinical signs for these two diseases;
- Blood samples will also be collected from each randomly selected bird. The objective is to detect the eventual circulation of antibodies against AIV virus, especially of the H5 and H7 subtypes, and Newcastle disease virus, and to verify vaccination status (when vaccination has been performed). Correlation between serological and virological status will also be assessed;
- The number of poultry to be sampled will be calculated based on a 95% confidence of detecting HPAI virus – if still present -, the estimated number of poultry for each site, a 94% sensitivity and 98.4% specificity for the diagnostic test (data provided by the FAO reference laboratory for avian influenza in Padova), and a minimum expected prevalence of 5%;
- All samples will be duplicated (two tracheal swabs and two cloacal swabs collected from the same bird; blood centrifuged and serum aliquoted in two) in order to provide one set of samples to the FAO reference laboratory for avian influenza in Padova (IZS Padova) and another set of samples to the national veterinary diagnostic laboratory;
- Information on each individual bird sampled will be collected through a standardised form (Annexe 3)
- In order to ensure proper cold chain during sample collection and transportation, cryotubes containing the transport medium for HPAI virus will be stored at -20°C (in freezers), and kept at +4°C or less for transport to sites where tracheal and cloacal swabs will be collected (using fridges and cool boxes containing ice). Once the swabs have been collected, cryotubes will be placed in stockings of two colors (beige for samples to be sent to IZS Padova, black for samples to be sent to the national diagnostic laboratory) and the stockings will be stored in liquid nitrogen containers until they are transported to the national veterinary diagnostic laboratory. The set of samples in the beige stockings will then be shipped to IZS Padova by air cargo in cryopacks containing dry ice, in compliance with IATA and OFFLU guidelines;
- Swab samples sent to IZS Padova will be pooled and tested by PCR for type A avian influenza and PCR for Newcastle disease. If one pool is PCR-positive, then samples will be analysed separately with subsequent isolation and typing for PCR-positive individual samples. Additionally, serum samples will be tested by hemagglutination inhibition for the detection of antibodies against H5, H7 and H9 avian influenza viruses and against Newcastle disease viruses. This will enable to have standardised analyses for all seven countries involved in the survey. National veterinary diagnostic laboratories of each country will analyse their set of samples by performing the tests they use in routine. They will be encouraged to compare their results with those from IZS Padova;

- If an on-going outbreak is included in the investigation sites for currently infected countries (Egypt, Nigeria), biological samples will eventually be collected from premises (villages, farms, markets) and commensal or wild birds located around the infection site undergoing stamping out.

All information collected will be stored in a standardised database built with Access® and accessible to all collaborators (see chapter 6.6).

4.3 Analytic studies

Analytic studies at the national level

Information on different variables which may be risk factors for HPAI outbreaks (see list in Annexe 4) will be collected from various sources, including FAO databases, Ministry of Agriculture, National Bureau of Statistics, poultry farmers' associations, etc. The objective will be to obtain this information at the lowest possible administrative unit (the highest possible spatial resolution), that is at least at the province level (or whichever name the first-level administrative unit has: governorate, region, etc), and whenever possible at the district level (or whichever name the second-level administrative unit has: commune, county, etc). Whenever available, geographic layers corresponding to the variables of interest will also be collated.

All information collected will be stored in a standardised database built with Access® and accessible to all collaborators.

Characteristics of infected and non-infected administrative units will then be compared to explore potential risk factors associated with infection. A qualitative or quantitative assessment of risk factors will be performed depending on the number and level of data available.

Analytic studies at the local level

Similarly to field investigations conducted in HPAI infection sites within the frame of the descriptive studies at the local level (see chapter 2.2), field investigation will also be conducted in a number of non-infected sites. The objective is to compare characteristics of infected and non-infected sites to explore potential risk factors associated with infection. Conclusions which will be drawn from this case-control comparison approach will depend on the level of data available and on an appropriate selection of "control" non-infected sites.

Depending on the situation in each country (number, geographical distribution, and field accessibility of infection foci) and time availability, a specific number of non-infected sites will be selected for investigation. A site is the epidemiologic unit chosen for the survey and corresponds to a village and its immediate surroundings. At least one "control" non-infected site should be selected for each "case" previously infected site investigated. In order to limit bias, it is suggested, whenever possible, to choose the "control" site in the surveillance zone which surrounded the infection zone (based on national stamping out procedures), to make sure that the "control" site would have been detected as a "case" site if it had been infected.

In each “control” site, the same standardised questionnaire as the one used for retrospective outbreak investigation of infected sites will be used, with the exception that there will be no information on outbreak pattern to collect. GPS position of all points of epidemiological interest (farms, ponds, roads, markets, etc) will also be recorded using decimal degree measures and the datum WGS 84.

Also in each “control” site, biological samples will be collected from a random sample of backyard poultry.

- Tracheal swabs and cloacal swabs will be collected from each randomly selected bird to detect the eventual presence of AI virus. The objective is to test the hypothesis that HPAI virus might be circulating while undetected (possible absence of clinical signs in some species, possible presence of uncharacteristic clinical signs confused with other diseases). Tracheal and cloacal swabs will also be tested for the presence of Newcastle disease virus because of the high similarity of clinical signs for these two diseases;
- Blood samples will also be collected from each randomly selected bird. The objective is to detect the eventual circulation of antibodies against AIV virus, especially of the H5 and H7 subtypes, and Newcastle disease virus, and to verify vaccination status (when vaccination has been performed). Correlation between serological and virological status will also be assessed;
- The number of poultry to be sampled will be calculated based on a 95% confidence of detecting HPAI virus – if still present -, the estimated number of poultry for each site, a 94% sensitivity and 98.4% specificity for the diagnostic test (data provided by the FAO reference laboratory for avian influenza in Padova), and a minimum expected prevalence of 5%;
- Similarly to samples from outbreak sites, information on each individual bird sampled will be collected through a standardised form (Annexe 3), all samples will be duplicated with one set of samples sent to IZS Padova and another to the national veterinary diagnostic laboratory, with proper cold chain maintained throughout sample collection and transportation. Laboratory analyses will be the same as for samples from outbreak sites.

All information collected will be stored in a standardised database built with Access® and accessible to all collaborators.

4.4 Predictive studies

Using information collected at the national level and compensatory approaches based on decision making sciences (similar to those used by Clements et al. 2006), a knowledge-driven spatial model identifying suitability areas for HPAI occurrence at the national level will be built.

5. Collaborators

5.1 National experts

A national survey consultant (NSC) will be recruited by FAO for four months in each country to implement activities of the survey. He or she will be the main contact person of the survey in each country and will be liaising closely with the national veterinary services, the national veterinary diagnostic laboratory, other national institutions, FAO, and the international experts. The terms of reference for the NSC are provided in Annexe 5. National veterinary services are currently in the process of providing three curriculum vitae in adequacy with the above-mentioned terms of references to the general headquarters in Rome where the choice of the national survey consultant will be made.

The role of the NSC will be extremely important in the survey as he or she will have the responsibility of collecting all information at the national level and as the success of field epidemiological investigation missions will greatly depend on prior preparation and facilitation work by the NSC.

In each country, national veterinary services, national veterinary diagnostic laboratories, and other national institutions involved in HPAI surveillance and control will be closely associated to all components of the survey: collection of information at the national level; design, organisation, and conduct of field surveys; analyses of samples collected; and report writing.

5.2 International experts

A number of research institutes with experience on HPAI epidemiology and diagnostic, together with epidemiologists and ecologists from FAO will be associated for the scientific and technical coordination of the survey. These institutes include CIRAD (French Agricultural Research Centre for International Development) based in Montpellier France, FLI (Friedrich Loeffler Institut) based in Isle of Riems Germany, IZS (Istituto Zooprofilattico Sperimentale delle Venezie) based in Padova Italy, RVC (Royal Veterinary College of the University of London) based in London United Kingdom, and ULB (Université Libre de Bruxelles) based in Brussels Belgium. A list of the international experts who will be involved in the survey is provided in Annexe 6, together with the list of African country representatives who attended the workshop on “Identification of Highly Pathogenic Avian Influenza’s risk factors for disease introduction, spread and persistence in Africa” held in Cairo Egypt on 3-5 April 2007.

Although design of the study and data analysis will involve several persons in each institute, two international experts will be more specifically in charge of scientific and technical coordination for each country. They will be the survey resource persons for this specific country among the international experts just like the national survey consultant will be the survey resource person for his/her country among the national experts. Whenever possible, the binomial of international experts for each country will be composed of representatives of two distinct institutes. As of 14 December 2007, the assumed binomials of experts for each country will be as follows:

- Burkina Faso: Julien Cappelle (CIRAD) and Anja Globig (FLI)
- Côte d'Ivoire: Sophie Molia (CIRAD) and Raffaella Nisi (IZS)
- Niger: Eric Etter (CIRAD) and Barbara Haesler (RVC)
- Nigeria: Gillian Diesel (RVC) and Detlef Hoereth-Boentgen (FLI)
- Cameroon: Wolfgang Böhle (FLI) and Agnès Waret (RVC)
- Egypt: Alessandro Cristalli (IZS) and Guillaume Fournié (RVC)
- Sudan: Filippo Cilloni (IZS) and Manfred Tanner (FLI)

6. Activities

Activities which will be implemented for descriptive, analytic and predictive studies can also be classified by general type of activities: preparation work, information collection at the local level (field work), laboratory analyses, information collection at the national level, data management, data analyses, and report writing. A description of activities is provided hereafter and the task distribution and putative timeline are provided respectively in Annexe 7 and Annexe 8.

6.1 Scientific and technical preparation work

International experts have already fine-tuned the list of risk factors for which information will be collected at the national (Annexe 4) and at the local (Annexe 2) level. The questionnaire (Annexe 1) that will be used to collect information at the local level has also been designed. This questionnaire will be tested in January and eventually modified before the actual implementation of field missions.

A ftp has been created on the server of the CIRAD website to host all documentation relevant to the survey. It contains a folder for each country involved in the survey. The aim is to facilitate the exchange of non-confidential information, including maps, reports, Promed bulletins, etc among partners of the survey. The connection information of the ftp is as follows and the password will be made available to all persons involved in the survey:

Serveur address: 195.221.173.145
Login: ftp_epiaaf
Communication port: 21

A practical session has been organised by CIRAD in Montpellier in May 2007 for some of the international experts who will participate to field missions in order to ensure that sample collection and outbreak investigation procedures are well standardised among the different countries. Before field investigation missions are initiated, it will be indispensable to repeat this training session for participants who did not attend it in May 2007. This is especially true for national survey consultants.

Because of the importance of standardisation in the survey and the importance of the role of the NSCs in collecting information and facilitating field investigation missions, it has indeed been deemed necessary to organise a NSC training workshop as soon as possible after the NSCs have been hired in order to:

- Present the survey to the NSCs and answer any question they may have on the protocol
- Clearly explain to the NSCs what is expected from them (see terms of references in Annexe 5)
- Train them for sample collection
- Train them for interview and questionnaire fill-up

In that purpose, funds have been secured by FAO to organise this training workshop in Bamako. It is hoped that the NSCs will be hired no later than 15 January 2008, to allow this training workshop to take place during the second half of January.

6.2 Information collection at the local level (field investigation missions)

Because of the importance of the preparation and facilitation work needed for efficiency of field investigation missions, it is recommended that these missions start a minimum of one month after the NSCs have been hired. It is hoped that the NSCs will be hired no later than January 15 2008 so that field missions can start by 15 February 2008. This will enable field missions to take place within the assumed peak of circulation of avian influenza viruses and in a period when environmental conditions are still favourable for field work.

Field investigation sites will be selected by the national consultant and the binomial of international experts in collaboration with national veterinary authorities and other involved institutions. Field investigation sites selection will take into account both epidemiological and feasibility (good accessibility, good cooperation with farmers, reasonable travel distance) factors. The survey will allocate funds sufficient to cover all expenses for a three-week field work period.

The team for field missions will be composed of four persons on top of the driver: the national consultant, two international experts and one person (veterinarian, technician, paraveterinarian, or community animal health worker) from the local representation of the veterinary services of each investigation site. The latter will be identified by the NSC and should have a very good knowledge of the area because of the responsibilities he or she will have, including:

- Identifying the sites where field investigation missions will be conducted
- Explaining to villagers from the chosen site what is the aim of the survey and what kind of collaboration is expected from them
- Providing the villagers with the list of information that they will need to prepare before the actual field investigation
- Arranging a meeting with the major stakeholders of poultry production in the village on the date of the field investigation mission in order to fill in the questionnaire
- Arranging the collaboration of the major stakeholders of poultry production in the village on the date of the field investigation mission in order to collect samples from poultry

He/she will be hired for the duration of field work in his/her area, and will therefore be a different person in each investigation area.

All expenses for field missions will be covered by the survey. These include: 4x4 vehicle rental with driver, gas, personal protective equipment, sampling equipment, cold chain equipment rental and purchase, and per diem.

Activities implemented during field work will include:
- Outbreak investigation
- Investigation of “control” sites
- Sample collection

All unused personal protective equipment (masks, blouses, gloves, goggles) and sample collection equipment (syringes, needles, swabs, cryotubes), as well as other equipment (microcentrifugator, pipette, cool box, etc) will remain in the country and will be the property of the veterinary services.

All questionnaires will be scanned and saved as pdf to be put on the ftp of the survey and to be accessible from the survey database.

6.3 Laboratory analyses

Analyses at the national diagnostic laboratory

Analyses at the national diagnostic laboratory will be performed using techniques used in routine. A lump amount of money will be available from the survey to cover diagnostic expenses. It will be the responsibility of each national diagnostic laboratory to establish its needs with respect to reagent and basic supplies (taking into account supplies already provided by FAO under other surveys) and to communicate them to the national survey consultant and the local FAO representation in the country. Results of the national diagnostic tests will not be used for the survey as standardisation requires results from a reference laboratory. Results used for the survey will therefore be those provided by the FAO reference laboratory for avian influenza (IZS Padova). Nevertheless, national diagnostic laboratories will be encouraged to compare their results with the ones provided by IZS Padova as a mean to further strengthen their diagnostic capacity.

Analyses at the FAO reference laboratory for avian influenza (IZS Padova)

Standardised analyses will be performed by the FAO reference laboratory for avian influenza in Padova. RNA-extraction, reverse transcription and PCR for detection of avian influenza type A and Newcastle disease will be performed on tracheal samples pooled by five and on cloacal samples pooled by five. If one pool is PCR-positive, then samples will be analysed separately with subsequent isolation and typing for PCR positive individual samples. Additionally, serum samples will be tested by hemagglutination inhibition for the detection of antibodies against H5, H7 and H9 avian influenza viruses and against Newcastle disease viruses. Results will be communicated in a timely manner to FAO headquarters in Rome, to national veterinary services, to the national consultant and to the binomial of experts who participated to field work in the concerned country. Results will be provided under a format readily uploadable on the database of the survey (format to be defined in collaboration with

FLI experts in charge of databases build-up). If any notifiable avian influenza virus is detected, full confidentiality will be kept so that national veterinary authorities are solely responsible for notification to OIE.

6.4 Information collection at the national level

The national consultant will be in charge of collating all available information on:
- HPAI outbreaks and history of HPAI infection
- Variables corresponding to potential risk factors for HPAI outbreaks (see list in Annexe 4) and whenever available, geographic layers corresponding to these variables

For that purpose, the national survey consultant will have to liaise with various national and international bodies including FAO general headquarters in Rome, veterinary services, wildlife services, bureau of statistics, Ministries of health, HPAI inter-ministerial cells, poultry farmers' associations, local representations of IBAR, OIE, and FAO, non-governmental organizations, etc. In particular for information pertaining to wild birds, the NSC will have to liaise with the NGO Wetlands International which has already been involved in several FAO projects on avian influenza and which has wild birds observation sites in each of the seven countries included in the survey.

FAO will also have a crucial role to play in information collection at the national level because of the large amount of data that is has already generated through reports from previous and on-going TCP projects, from FAO staff or from external consultants. Multiple FAO databases and GIS layers contain information that is highly relevant to the survey. FAO will need to make this information accessible to partners of the project through the ftp created on the CIRAD server.

The national consultant will work in close collaboration with international experts specifically chosen for his/her country to clear up all data collected and arrange them so that they fit in the standardised database.

6.5 Data management

The conception and build-up of the database will be the responsibility of experts from FLI, with the assistance of experts from other institutes. The database will be readily usable and accessible to all collaborators (built with Access® and hosted on a website).

The database will have to encompass three types of information:
- information collected by the national survey coordinator on risk factors at the national level (see list in Annexe 4),
- information collected through field investigation missions (see list in Annexe 2),
- and information pertaining to diagnostic test results, provided by the FAO reference laboratory for avian influenza (IZS Padova).

The anticipated deadlines for the delivery of these three components are respectively February 2008, March 2008 and April 2008.

Database population will be the responsibility of the NSCs, the international experts who were involved in field epidemiological investigations, and the reference laboratory for avian influenza (IZS Padova).

6.6 Data analysis

Data analysis and spatial model build-up will be done by international experts, especially by CIRAD, RVC and ULB. Descriptive analysis will provide baseline information on epidemiological characteristics of outbreak foci in infected African countries and will enable to elaborate hypotheses on potential associations between some risk factors and HPAI infection status of administrative units (level 1, and level 2 if enough data are collected) or sites. These associations will be further investigated by analytical studies. At first, univariate analyses will be performed in order to test the relationship between the outcome variable (HPAI infection status) and each explanatory variable. The Chi Square test and Fisher's exact test will be used for categorical variables, and Student's T test or its non-parametric counterparts (Mann-Whitney rank test, Kruskall Wallis test) will be used for quantitative variables, with a level of statistical significance for the rejection of the null hypothesis set up at $p \leq 0.05$. Correlation between explanatory variables found significantly associated with HPAI infection status will be explored using correlation tests such as the Chi Square independence test and Spearman correlation test. Finally, multivariate logistic regression analyses will be performed using explanatory variables chosen based on univariate and correlation tests results.

Considering the high number of variables for which information is going to be collected, it is anticipated that analytical studies will not enable to compute statistically significant results in countries with a limited number of outbreak foci. For those countries, qualitative conclusions will be drawn. Besides, depending on results of variability analysis among countries for each variable tested, data will be aggregated to compare results at the continental level with a larger number of observations.

The power and extent of data analysis that will be possible at the national level will largely depend on the amount and quality of data collected by the NSCs. It is therefore highly recommended to organise a survey midterm meeting in the second half of April or first half of May once all field investigation missions have been conducted and once most of the national level information has been collected. The purpose of this midterm meeting will be to review information collected so far and to adapt accordingly the strategy for data analysis. This meeting will have to be held before the end of the NSCs' contract so that these latter have time to collect any potential extra information that may be deemed useful. Funds have been secured by FAO to organise this midterm meeting.

Results and recommendations based on data analysis results will be discussed with national veterinary services before they are synthesized in the final report.

6.7 Report writing

Country-specific reports shall be written by the binomial of international experts specifically assigned to each country, in collaboration with the NSC and the national veterinary services. They will summarize activities performed during field investigation

missions and synthesize information collected at the national and local level. These reports will have to be produced within two weeks upon the end of the field investigation missions.

A survey midterm report is scheduled to be delivered on May 15 according to the reporting obligations of the LoA PR 37212. This report would ideally be delivered after the organisation of the midterm meeting.

A general report encompassing results from all countries included in the survey will be written by the international experts. All results will be presented during the survey restitution workshop before representatives of each participating country and institute. This restitution workshop is scheduled to take place in August 2008 (see survey timeline in Annexe 8)

7. Constraints identified and proposed solutions

The proposed methodology for this survey was discussed during several meetings including the workshop on "Identification of Highly Pathogenic Avian Influenza's risk factors for disease introduction, spread and persistence in Africa" held in Cairo Egypt on April 3-5 2007 and the EPIAAF inception meeting held in London on December 10-11 2007. During these meetings, constraints were identified and recommendations were made. These constraints and recommendations were taken into account for the writing of the present document. However some of them need to be emphasized and are listed hereafter.

In most of the infected countries in Africa, activities including active surveillance, laboratory capacities strengthening, or veterinary services staff training have already been or are currently being implemented by national authorities and through FAO. Questions were raised about the possible duplication of activities with the proposed survey. It was reminded that the current survey has two major specificities compared to previous or on-going surveys: its scientific objective and its regional scope. The major objective of the survey is to fill in gaps in the epidemiological knowledge of HPAI infection in Africa. Capacity-building and enhanced surveillance will therefore more be consequences than actual aims of the survey. Additionally, recommendations drawn from the survey have a vocation to be applied to the whole continent. Specific standardised protocols applicable to all countries will therefore be used which will be different from country-specific protocols. These specificities make the current survey very complementary to existing national surveys and all possible links will be made to exchange information between them for their mutual benefit.

The feasibility of field missions also raised a number of questions:

- One of them dealt with equipment that would have to be provided by the veterinary services. It was explained that the survey would cater for all expenses related to field missions, including personal protective equipment, sampling equipment, vehicle rental and per diem. Nevertheless, assistance will be needed from the veterinary services and the national consultant to facilitate airport pick-up and custom clearance of the equipment (which will be air cargo shipped from France) and to identify companies where to rent 4x4 vehicles or buy dry ice, liquid nitrogen and small equipment (shovels, spades, buckets, etc);
- The problem of farmers getting tired of veterinary services coming back to outbreak sites was also evoked. This is why preparation work before

implementation of field mission is indispensable and where the role of the NSCs and the veterinary services is crucial. It will be very important to sensitize farmers about the nature and objective of the survey in order to obtain their cooperation and this will have to be done *before* field missions are actually implemented;

There are major within-country and among-country variations with regards to geography (climate, ecotype, human density, etc), poultry production systems (type of production, density, trade), and HPAI situation (outbreak number and pattern, control measures undertaken, etc). Likewise, the quality, quantity, and format of information available will be extremely variable depending on the type of data. These variations may draw limits to the conclusions that can be drawn from the study and this is especially true for spatial predictive models which strongly depend on the resolution of the information that is fed into them. All possible efforts will therefore be made to collect as much data as possible and in the most standardised way as possible within the imparted time frame and resources.

Another issue that was raised was the way to find a right balance between the need for standardization, which is indispensable to be able to compare data from different countries and to generate conclusions for the African continent, and the need to account for the specificities of the situations of the various countries involved in the survey (large number of outbreaks in Egypt and Nigeria, very limited number of outbreaks in other countries). A compromise was adopted by choosing to use the same tools (list of information to collect at the national level, questionnaire, sample collection and analysis procedures) in all the countries and by keeping some flexibility with regards to the number and location of sites to be investigated and the number of samples to collect in each site.

This was also relevant to the choice of the epidemiological unit to be considered for data collected at the field level: the village and its close surroundings was chosen as the epidemiological unit because it was the only epidemiological unit that was systematically involved in outbreaks in all countries (as opposed to commercial farms, markets, households, etc). However, shall some commercial farms, markets or households be considered as very important for the understanding of the epidemiology of HPAI in some countries (particularly in Nigeria and Egypt), they should be included in the sites visited during the field investigation missions.

A final issue that was addressed was the time component of information to be collected, especially at the local level. Indeed in some countries, more than one year has passed since the last outbreak occurred. Because our aim is to identify risk factors associated with infection, it would be logical to collect information pertaining to the time period when the outbreak occurred, not the time period when field investigation missions are conducted. There may indeed have been some changes (for example of poultry production systems, of trade practices, of vaccination practices, etc) in the time elapsed between now and when the outbreak occurred, whether these changes are related to HPAI outbreaks or not.

Because we chose the village as our epidemiological unit and because backyard poultry production practices are less susceptible to have evolved in time as compared to commercial poultry production practices, it was decided to collect risk factor information pertaining to the time period when the field investigations are conducted. Nevertheless, when interviewing villagers and filling-in the questionnaire, questions will systematically be asked to verify that the recorded patterns of poultry production, poultry health maintenance, poultry trade have not evolved with time.

8. Expected outputs

The main outputs of the survey will include:

- Standardized reports with good baseline epidemiological information on general HPAI situation, outbreak patterns, and outbreak investigation results for the seven infected African countries included in the survey;
- A standardised database with all the risk factors data collected at the national and local level. This database will be built using Access® and will therefore be readily usable by all collaborators. Besides, much of the information will be generic to poultry production and will therefore be useful to study other diseases of poultry;
- This standardised database will also include all the results of the serological and virological tests conducted on samples collected for the project. These results will provide an estimate of the level of circulation of avian influenza and Newcastle disease viruses and will contribute to test the hypothesis that HPAI viruses might be circulating undetected in previously or currently infected countries;
- Maps encompassing all layers of information collected;
- A spatial model of HPAI occurrence with an accuracy dependent on the quantity and quality as well as the spatial resolution of risk factor data gathered in the countries;
- A general report including the overview of HPAI situation in Africa since January 2006, a qualitative and quantitative identification of risk factors responsible for the introduction, spread and persistence of the disease in the infected countries with extrapolation to the whole African continent, recommendations for improved surveillance, risk management, and disease control, and recommendations on the need for future research based on key epidemiological hypotheses apprehended in the current survey;
- Pending permission from FAO and the national authorities of the countries participating to the survey, scientific publications summarising conclusions reached by the survey and acknowledging the technical input of all contributing collaborators.

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Gaidet N, Dodman T, et al. 2007. Avian influenza viruses in water birds, Africa. Emerging Infectious Diseases 13(4) 626-629.

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Annexe 1: Questionnaire for field investigations

Date	Questionnaire ID	Interviewers' names

Province or region	District or commune	Village

- **Shape of village: _____** (square, round, rectangle, diamond, etc)
- **GPS positions of village outline**

	Longitude	Latitude
	N __ __ . __ __ __ __ __ °	__ __ . __ __ __ __ __ °
	N __ __ . __ __ __ __ __ °	__ __ . __ __ __ __ __ °
	N __ __ . __ __ __ __ __ °	__ __ . __ __ __ __ __ °
	N __ __ . __ __ __ __ __ °	__ __ . __ __ __ __ __ °
	N __ __ . __ __ __ __ __ °	__ __ . __ __ __ __ __ °

1. POULTRY

1.1 Poultry numbers

		Number of poultry currently in the village	
Species	**Breeds** §	**Young**	**Adult**
Chicken			
Ducks			
Guinea fowls			
Geese			
Turkeys			
Pigeons			
Other _____			

§ Codes for breed: native = 1 foreign = 2 hybrid = 3

- Did the number of poultry in the village change because of HPAI ? Yes ☐ No ☐

If yes, when? _____

why? ☐ Government decision ☐ Personal decision ☐ Commercial impact

☐ Other _____

how many poultry were there before HPAI-related changes?

Chicken	
Ducks	
Guinea fowls	
Geese	
Turkeys	
Pigeons	
Other _____	

1.2 Poultry housing

- Is there any species kept permanently separate? Yes ☐ No ☐

- Type of housing:

Housing	**% of total number of animals**	**Comments**
Closed building		
Half-open building		
Fenced perimeter		
Free-ranging (day only)		
Free-ranging (day & night)		
Other_____		

If free-ranging, is it seasonal? **Yes** ☐ **No** ☐

If yes, during which period are they free-ranging ?_____

If free-ranging, please precise by ticking all appropriate answers:

☐ **Only within the village** ☐ **Within and out of the village (within a range of _____ meters)**

☐ **Access to any water body** ☐ **Contact with wild birds observed**

1.3 Poultry health aspects

- **Baseline morbidity**

- How many sick birds did you have last month ? _____

- Describe the usual morbidity pattern:

Clinical signs	Disease	Period of the year	#	Age-group mostly affected	Species mostly affected

- **Baseline mortality**

- How many dead birds did you have last month ? _____

- Describe the usual mortality pattern:

Clinical signs	Disease	Period of the year	#	Age-group mostly affected	Species mostly affected

- Which diseases/clinical signs are considered the most important? _____

_____

- **Sick and dead poultry handling and disposal**

- What is done with sick birds?

☐ **Nothing** ☐ **Sold** ☐ **Eaten**

☐ **Killed** ☐ **Isolated from healthy birds** ☐ **Other** _____

- Are precautionary measures taken when handling and killing sick poultry? Yes ☐ No ☐

If yes, which measures_____

_____

- What is done with dead birds?

☐ **Sold** ☐ **Buried** ☐ **Burnt** ☐ **Thrown to garbage**

☐ **Fed to dogs/ cats/ fishes** ☐ **Eaten** ☐ **Other** _____

- **Vaccination**

- Which vaccines are used routinely?

Disease	Name of vaccine	Type of vaccine §	Vaccinator §§	Frequency of vaccination

§ Codes for type of vaccine: drinking water = 1 intra-ocular = 2 injection = 3 spray = 4
§§ Codes for vaccinator: veterinarian = 1 technician = 2 CAHW = 3 farmer = 4

- Was avian influenza vaccine ever used in the village? Yes ☐ No ☐

If yes, when _____

- Which type of avian influenza vaccine? _____

- Where did you get the avian influenza vaccine from?_____

- **Routine treatments**

- Do you use any routine treatment? Yes ☐ No ☐

If yes, which one(s)? _____

- **Additional comments on health aspects**

1.4 Drinking water and food sources for poultry

- **Drinking water sources**

- Which water sources are used for poultry?

	Tick all answers that apply	Also used by wild birds (answer yes/no. If yes, indicate species)	Also used by poultry from other villages/farms (answer yes/no. If yes, indicate which villages/farms)
River			
Permanent pond or lake			
Temporary pond			
Well			
Collected rain water			
Municipal supply			

- Additional comments on water sources

- **Food sources**

- Which food sources are used for poultry? *(Tick all answers that apply)*

☐ **Scavenging** ☐ **Garbage/ Kitchen waste**

☐ **Leftover grains from harvest in village** ☐ **Free grazing on harvested fields**

☐ **Commercial premix or concentrate (explain origin: _____)**

☐ **Other _____**

- Where and how often are birds fed? _____

_____

- Do wild birds have access to food given to poultry? Yes ☐ No ☐

- Additional comments on food sources

2. BIOSECURITY

- **Presence of domestic animals other than poultry**

Species	Present in the village? *(yes/no)*	In contact with poultry? *(yes/no)*	Comments (number, etc)
Cat			
Dog			
Pig			
Goat			
Sheep			
Cattle			
Donkey			
Horse			
Other _____			

- **Biosecurity measures**

- Are newly introduced birds quarantined? Yes ☐ No ☐

If yes, for how long and what type of quarantine?_____

_____

- **What is done with poultry manure?**

☐ **Sold** ☐ **Put on the field** ☐ **Put in the pond** ☐ **Thrown to garbage**

☐ **Nothing** ☐ **Other _____**

- **What is done with poultry offals?**

☐ **Sold** ☐ **Burnt** ☐ **Thrown to garbage**

☐ **Fed to dogs/cats/fishes** ☐ **Nothing** ☐ **Other _____**

- Are you doing any rodent control in the village? ☐ No control ☐ Poisoning ☐ Trap

☐ Other _____

- Additional comments or observations on biosecurity

3. VETERINARY FOLLOW-UP

- Which type of animal health worker do you have access to and where?

☐ Veterinarian _____ ☐ Technician _____

☐ CAHW _____ ☐ Other _____

☐ None

- Are morbidity and mortality reported? Yes ☐ No ☐

- Additional comments or observations on veterinary services

4. CONTACT NETWORK AND TRADE

- **Origin of poultry**
  - **Where does your poultry come from ?**

Home bred (out of 10)	**Purchase (out of 10)**	**Gift (out of 10)**	**Loan (out of 10)** (explain where/who from)

- **If purchase:**
- **From within the village?** Yes ☐ No ☐
- **From outside the village?** Yes ☐ No ☐

Type of purchase*, place(s) of origin, & price	**Quantity /year**	**Period/frequency ****

* Code for type of purchase: Fertilised egg = 1; Day-old chick = 2; Young bird = 3; Adult bird = 4

** Code for period/frequency: Regularly throughout the year = 1; Throughout the year with peaks = 2 (specify peak period); At some specific periods = 3 (specify which periods)

- **For markets of origin, please explain:**

Location	**Distance (km)**	**# birds in market**	**# sellers in market**	**Frequency[§] & day of the week**

§ Code for frequency: Every day = 1; 3-6 times per week = 2; twice per week = 3; once per week = 4; less than once per week = 5

- **How are poultry and poultry products transported into the village?**

☐ **By foot** ☐ **By bike** ☐ **By motorbike** ☐ **By cart** ☐ **By car** ☐ **By truck**

- **Who is transporting poultry and poultry products into the village?**

☐ **Villagers** ☐ **Middlemen** ☐ **Company** ☐ **Other** _____

- **Self consumption**

- Out of 10 eggs, how many do you eat per week ? _____

- Is there a period of the year when you eat more eggs? _____

- Out of 10 chicken, how many do you eat per month? _____

- Is there a period of the year when you eat more chicken? _____

- How many inhabitants are there in the village? _____

- Are precautionary measures taken when handling and killing poultry? Yes ☐ No ☐

If yes, which measures_____

- **Sales**

- **Percentage of poultry sold inside the village?** _____
- **Percentage of poultry sold outside the village?** _____

- Is there a period of the year when you sell more eggs? _____

- Is there a period of the year when you sell more meat? _____

- What is the evolution of the price of eggs during the year?

- What is the evolution of the price of meat during the year?

- How is your production evolving during the year?

- For poultry sold outside the village, please explain:

Type of product ♪, place(s) of destination ♪♪, and price	Quantity /year	Period/frequency ♪♪♪

♪ Code for type of product: Live bird = 1 Slaughtered bird = 2 Egg = 3

♪♪ Code for place of destination: Market = 1 Road side = 2 Other (please precise) = 3

♪♪♪ Code for period/frequency: Regularly throughout the year = 1; Throughout the year with peaks = 2 (specify peak period); At some specific periods = 3 (specify which periods)

- For sale markets, please explain:

Location	Distance (km)	# birds in the market	# sellers in the market	Frequency§ & day of the week

§ Code for frequency: Every day = 1; 3-6 times per week = 2; twice per week = 3; once per week = 4; less than once per week = 5

- **How are poultry and poultry products transported out of the village?**

  ☐ **By foot** ☐ **By bike** ☐ **By motorbike** ☐ **By cart** ☐ **By car** ☐ **By truck**

- **Who is transporting poultry and poultry products out of the village?**

  ☐ **Villagers** ☐ **Middlemen** ☐ **Company** ☐ **Other** _____

• Other poultry exits

- **Do you offer or exchange poultry or poultry products?** Yes ☐ No ☐

  If yes, precise to whom and where_____

  _____

  _____

• Poultry movements key points

- Are there any hatcheries in the vicinity? Yes ☐ No ☐

If so, names, locations and distances in km _____

_____

_____

- Are there any markets in the vicinity? Yes ☐ No ☐

If yes

Location	**Distance (km)**	**# birds**	**# sellers**	**Frequency[§] & day of the week**

§ Code for frequency: Every day = 1; 3-6 times per week = 2; twice per week = 3; once per week = 4; less than once per week = 5

- Are there any middlemen collecting birds in the vicinity? Yes ☐ No ☐

If so, names, addresses and work range _____

_____

_____

_____

- Are there any slaughterhouses in the vicinity? Yes ☐ No ☐

If so, names, locations and distances in km _____

_____

_____

Automatic, half automatic, manual

Slaughter capacity / hour

- Are there any big industrial holding in the vicinity? Yes ☐ No ☐

If so, names, locations and distances in km _____

_____

_____

- Additional comments on animal movements

6. WILD BIRDS

- **Presence of wild birds**

Wild bird type	**Frequency of observation within 3km (0 + ++ +++)**
African Ducks	
Eurasian Ducks	
Gulls	
Terns	
Eurasian waders	
Rails	
Cormorants	

- **Do you have foreign hunters coming to hunt with falcons?** Yes ☐ No ☐

- **Do you hunt or trap wild birds?** Yes ☐ No ☐

- **Do you keep wild birds in the village?** Yes ☐ No ☐

- **Which use do you have of wild birds?**

Use	*Tick all appropriate*	**Frequency/period**
None		
Hunting		
Egg collection		
Breeding for self-consumption		
Sale		
Pet		
Other _____		

- **Where do you keep wild birds in your village? _____**

- **Have you observed any unusual wild bird mortality in or around the village?** Yes ☐ No ☐

7. ENVIRONMENT

7.1 Land

- **Land use in a 3 km radius** (in %)

Cropland	Pasture	Savannah	Shrubland	Woodland	Forest	Wetland	Desert)

- **Are there any water bodies in a 3 km radius?** Yes ☐ No ☐

  If yes, which one(s)? ☐ **river** ☐ **temporary pond** ☐ **permanent pond**

7.2 Crop agriculture

Crop	% of cultivated area	Main planting season	Main harvest season

7.3 Draw a map of the surroundings of the village within a 3 km radius

8. OUTBREAK INFORMATION

8.1 Outbreak signs

- When were the first cases or signs of disease detected? _____

- When were the cases/signs of disease reported? _____

- Who reported the signs ? _____

- To who were the signs reported? _____

- Which species were affected?

Species	% sick	% dead	Number in the village	Age-group mostly affected	Vaccinated against Newcastle (Yes/ No)	Vaccinated against AI (Yes/ No)
Chicken						
Ducks						
Guinea fowls						
Geese						
Turkeys						
Pigeons						
Other _____						

- Which signs were observed?

Chicken	Ducks	Guinea fowls	Geese	Other

(Reduced food/water intake, Depression, Drop in egg laying,Egg shell deformations, Oedema/cyanosis/cutaneous haemorrhages, Diarrhoea, Nervous symptoms, Somnolence, Respiratory symptoms, Lacrimation, Sudden death)

- Was there concurrent mortality in wild birds? Yes ☐ No ☐

If yes, which species? _____

If yes, date of first mortality observed? _____

- Additional comments on outbreak signs

8.2 Outbreak investigation

- What was the date of the first visit to investigate the disease? _____

- Who came to investigate the disease? _____

- When were samples collected to investigate the disease? _____

- Additional comments on outbreak investigation

8.3 Outbreak mitigation

- Before governmental implemented control measures

- What was done with sick birds?

☐ **Nothing** ☐ **Sold** ☐ **Eaten**

☐ **Killed** ☐ **Isolated from healthy birds** ☐ **Other _____**

- Were precautionary measures taken when handling and killing sick poultry? Yes ☐ No ☐

If yes, which measures_____

_____

- What was done with dead birds?

☐ **Buried** ☐ **Burnt** ☐ **Thrown to garbage**

☐ **Fed to dogs or cats** ☐ **Nothing** ☐ **Other _____**

- Control measures implemented by the government

Measures	Yes/no	Starting date	Number of birds involved	Finishing date	Comment (method, etc)
Quarantine					
Control of movement					
Stamping out					
Vaccination					
Disinfection					
Other _____					

- Were any compensations paid for? Yes ☐ No ☐ Partially ☐

If yes, how much per head and per species?

_____

_____

If yes, when were compensations paid for?

- Additional comments on outbreak mitigation

Additional comments

Name of interviewee(s) & contact information

Thank you!

Information to be collected prior to field investigation

Presence of wild birds

Wild bird type	Frequency of observation within 3km (0 + ++ +++)
African Ducks	
Eurasian Ducks	
Gulls	
Terns	
Eurasian waders	
Rails	
Cormorants	

Climate

- Rainfall

Minimum: _____ mm/year **Average: _____ mm/year** **Maximum: _____ mm/year**

- Temperature

Minimum: _____ mm/year **Average: _____ mm/year** **Maximum: _____ mm/year**

Land

- **Elevation: _____** meters
- **Land use in a 3 km radius** (in %)

Cropland	Pasture	Savannah	Shrubland	Woodland	Forest	Wetland	Desert)

Outbreak investigation

- Which samples were collected?

Species	State	Type
Chicken	☐ sick ☐ dead	☐ Cloacal swab ☐ Tracheal swab ☐ Blood ☐ Feces ☐ Organ ☐ Other _____
Ducks	☐ sick ☐ dead	☐ Cloacal swab ☐ Tracheal swab ☐ Blood ☐ Feces ☐ Organ ☐ Other _____
Guinea fowls	☐ sick ☐ dead	☐ Cloacal swab ☐ Tracheal swab ☐ Blood ☐ Feces ☐ Organ ☐ Other _____
Geese	☐ sick ☐ dead	☐ Cloacal swab ☐ Tracheal swab ☐ Blood ☐ Feces ☐ Organ ☐ Other _____
Turkeys	☐ sick ☐ dead	☐ Cloacal swab ☐ Tracheal swab ☐ Blood ☐ Feces ☐ Organ ☐ Other _____
Pigeons	☐ sick ☐ dead	☐ Cloacal swab ☐ Tracheal swab ☐ Blood ☐ Feces ☐ Organ ☐ Other _____
Other _____	☐ sick ☐ dead	☐ Cloacal swab ☐ Tracheal swab ☐ Blood ☐ Feces ☐ Organ ☐ Other _____

- Was any type of rapid test used on site? Yes ☐ No ☐

If yes, which test? _____

- To which laboratory were the samples sent? _____

- When were the samples sent to the laboratory? _____

- When were the samples received by the laboratory? _____

- Which analysis techniques were used by the laboratory?

☐ RT-PCR ☐ Inoculation of embryonated egs ☐ Haemmaglutination test

☐ AGID ☐ HI ☐ ELISA ☐ Other _____

- What were the results given by the laboratory?

☐ Positive AI ☐ Doubtful AI ☐ Negative AI

- When were the results sent by the laboratory? _____

- To which reference laboratory were the samples sent for confirmation?_____

- When were the samples sent to the reference laboratory? _____

- When were the samples received by the reference laboratory? _____

- Which analysis techniques were used by the reference laboratory?

☐ RT-PCR ☐ Inoculation of embryonated egs ☐ Haemmaglutination test

☐ AGID ☐ HI ☐ ELISA ☐ Other _____

- What were the results given by the reference laboratory?

☐ Positive AI ☐ Doubtful AI ☐ Negative AI

- Was any tracing backward performed during outbreak investigation? Yes ☐ No ☐

If yes, which sources of infection were identified?

Source	Involved	Assumed place of origin	Comment
Legal movement of animals	☐ Yes ☐ No ☐ Possible ☐ ND		
Legal movement of animal products	☐ Yes ☐ No ☐ Possible ☐ ND		
Illegal movement of animals	☐ Yes ☐ No ☐ Possible ☐ ND		
Illegal movement of animal products	☐ Yes ☐ No ☐ Possible ☐ ND		
Wild birds	☐ Yes ☐ No ☐ Possible ☐ ND		
People	☐ Yes ☐ No ☐ Possible ☐ ND		
Fomites	☐ Yes ☐ No ☐ Possible ☐ ND		

- Was any tracing forward performed during outbreak investigation? Yes ☐ No ☐

If yes, which places were identified as possibly contaminated to this outbreak?

Location	Source of infection	Had outbreak? (Yes/No)	Comment
Legal movement of animals	☐ Yes ☐ No ☐ Possible ☐ ND		

Legal movement of animal products	☐ Yes ☐ No ☐ Possible ☐ ND		
Illegal movement of animals	☐ Yes ☐ No ☐ Possible ☐ ND		
Illegal movement of animal products	☐ Yes ☐ No ☐ Possible ☐ ND		
Wild birds	☐ Yes ☐ No ☐ Possible ☐ ND		
People	☐ Yes ☐ No ☐ Possible ☐ ND		
Fomites	☐ Yes ☐ No ☐ Possible ☐ ND		

- Additional comments on outbreak investigation

Annexe 2: List of field risk factor data to be integrated in the survey database

Category	Variable	Type
Poultry	Number of poultry currently in the village	Quantitative
	Number of chicken currently in the village	Quantitative
	Number of ducks currently in the village	Quantitative
	Number of guinea fowls currently in the village	Quantitative
	Number of geese currently in the village	Quantitative
	Number of turkeys currently in the village	Quantitative
	Number of pigeons currently in the village	Quantitative
	Number of other species currently in the village	Quantitative
	Breeds	Multiple choice answer
	Number of poultry in the village before HPAI-related changes	Quantitative
	Number of chicken before HPAI-related changes	Quantitative
	Number of ducks before HPAI-related changes	Quantitative
	Number of guinea fowls before HPAI-related changes	Quantitative
	Number of geese before HPAI-related changes	Quantitative
	Number of turkeys before HPAI-related changes	Quantitative
	Number of pigeons before HPAI-related changes	Quantitative
	Number of other species before HPAI-related changes	Quantitative
	If free-ranging, is it seasonal?	Yes/No
	If yes, during which period are they free-ranging ?	Nominal
	If free-ranging, Only within the village?	Yes/No
	If free-ranging, Within and out of the village ?	Yes/No
	If free-ranging within and out of the village, within which range?	Quantitative
	If free-ranging, Access to any water body?	Yes/No
	If free-ranging, Contact with wild birds observed?	Yes/No
	How many sick birds did you have last month ?	Quantitative
	How many dead birds did you have last month ?	Quantitative
	What is done with sick birds?	Multiple choice answer
	What is done with dead birds?	Multiple choice answer
	Which vaccines are used routinely?	Nominal
	Was avian influenza vaccine ever used in the village?	Yes/No
	Which type of avian influenza vaccine?	Nominal
	Which water sources are used for poultry?	Multiple choice answer
	Is the water source also used by wild birds?	Yes/No
	Is the water source also used by poultry from other villages/farms?	Yes/No
	Do wild birds have access to food given to poultry?	Yes/No
Biosecurity	What is done with poultry manure?	Multiple choice answer
	What is done with poultry offals?	Multiple choice answer
Trade	Where does your poultry come from?	Multiple choice answer
	If purchase, purchase from within the village?	Yes/No
	If purchase, purchase from outside the village?	Yes/No
	Out of 10 eggs, how many do you eat per week ?	Quantitative
	Is there a period of the year when you eat more eggs?	Yes/No
	Out of 10 chicken, how many do you eat per month?	Quantitative
	Is there a period of the year when you eat more chicken?	Yes/No
	How many inhabitants are there in the village?	Quantitative
	Percentage of poultry sold inside the village?	Quantitative

	Percentage of poultry sold outside the village?	Quantitative
	Is there a period of the year when you sell more eggs?	Yes/No
	Is there a period of the year when you sell more meat?	Yes/No
	Are there any hatcheries in the vicinity?	Yes/No
	Are there any markets in the vicinity	Yes/No
	Are there any middlemen collecting birds in the vicinity?	Yes/No
	Are there any slaughterhouses in the vicinity?	Yes/No
	Are there any big industrial holding in the vicinity?	Yes/No
Wild birds	Do you have foreign hunters coming to hunt with falcons	Yes/No
	Do you hunt or trap wild birds?	Yes/No
	Do you keep wild birds in the village?	Yes/No
	Have you observed any unusual wild bird mortality in or around the village?	Yes/No
Environment	Are there any water bodies in a 3 km radius?	Yes/No
	If yes, which one(s)?	Nominal
Outbreak	When were the first cases or signs of disease detected?	Date
	When were the cases/signs of disease reported?	Date
	Which species were affected?	Multiple choice answer
	Was there concurrent mortality in wild birds?	Yes/No
	yes, date of first mortality observed?	Date
	What was the date of the first visit to investigate the disease?	Date
	When were samples collected to investigate the disease?	Date
	Average temperature	Quantitative
	Average minimum temperature	Quantitative
	Average maximum temperature	Quantitative
	Average precipitation	Quantitative
	Minimum precipitation	Quantitative
	Maximum precipitation	Quantitative
	Percentage of land with cropland (irrigated or not)	Quantitative
	Percentage of land with irrigated cropland	Quantitative
	Percentage of land with pasture	Quantitative
	Percentage of land with woodland	Quantitative
	Percentage of land with shrubland	Quantitative
	Percentage of land with savannah	Quantitative
	Percentage of land with forest	Quantitative
	Percentage of land with dryland	Quantitative

Annexe 3: Sample collection form

General data

		Province/ region		**Farmer/market**	
Team		**District/ commune**		**Latitude**	N __ __, __ __ __ __ __
Country		**Village**		**Longitude**	__ __ __, __ __ __ __ __

Individual data

	Sample ID	**Species**	**Breed**	**Sex**	**Age**	**Comments** (health status, vaccination status, problems with sampling, etc)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						

Code species: LC = local Chicken; BL = Broiler; LA = Layer; BR = Breeder; DU = Ducks; GF = Guinea fowls; TU = Turkeys; GO = Goose; OT = other
Code age: AD = adult; Y = young Code sex: F = female ND: not determined

Comments:

Annexe 4: List of risk factor data to be collected at the national level

Information for these risk factors will have to be collected at the lowest administrative unit possible (national, level 1 = region/governorate, level 2 = district/commune)

X : high priority information, absolutely needs to be collected
x : lower priority information

Category	Variable	Level of			Type	Unit	Information source
		National	Admin level 1	Admin level 2	Type	Unit	Information source
Country	List of administrative units		**X**	**X**	Nominal		
	Area	**X**	**X**	**X**	Quantitative	km²	
	Perimeter	**X**	**X**	**X**	Quantitative	km	
	Human population density	**X**	**X**	**X**	Quantitative	number of people /km²	
	% rural human population	**X**	**X**	x	Quantitative	%	
	% urban human population	**X**	**X**	x	Quantitative	%	
Poultry	Total number of chicken	**X**	**X**	x	Quantitative		
	Number of chicken in sector 1	**X**	**X**	x	Quantitative		
	Number of chicken in sector 1 layer	**X**	**X**	x	Quantitative		
	Number of chicken in sector 1 broiler	**X**	**X**	x	Quantitative		
	Number of chicken in sector 2	**X**	**X**	x	Quantitative		
	Number of chicken in sector 2 layer	**X**	**X**	x	Quantitative		
	Number of chicken in sector 2 broiler	**X**	**X**	x	Quantitative		
	Number of chicken in sector 3	**X**	**X**	x	Quantitative		
	Number of chicken in sector 3 layer	**X**	**X**	x	Quantitative		
	Number of chicken in sector 3 broiler	**X**	**X**	x	Quantitative		
	Number of chicken in sector 4	**X**	**X**	x	Quantitative		
	Total number of ducks and geese	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 1	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 1 egg	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 1 meat	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 2	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 2 egg	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 2 meat	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 3	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 3 egg	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 3 meat	**X**	**X**	x	Quantitative		
	Number of ducks and geese in sector 4	**X**	**X**	x	Quantitative		
	Number of other poultry in sector 1	x	x	x	Quantitative		
	Number of other poultry in sector 2	x	x	x	Quantitative		
	Number of other poultry in sector 3	x	x	x	Quantitative		
	Number of other poultry in sector 4	x	x	x	Quantitative		

Trade	Poultry meat consumption per year	**X**	**X**	x	Quantitative	kg/person/year	
	Poultry egg consumption per year	**X**	**X**	x	Quantitative	number/person/year	
	Poultry meat production per year	**X**	**X**	x	Quantitative	tons/year	
	Poultry egg production per year	**X**	**X**	x	Quantitative	number of thousands/ year	
	Poultry meat export per year	**X**	**X**	x	Quantitative	tons/year	
	Country(ies) of destination of poultry meat export	**X**	**X**	x	Nominal		
	Poultry egg export per year	**X**	**X**	x	Quantitative	number of thousands/ year	
	Country(ies) of destination of poultry egg export	**X**	**X**	x	Nominal		
	Poultry meat import per year	**X**	**X**	x	Quantitative	tons/year	
	Country(ies) of origin of poultry meat import	**X**	**X**	x	Nominal		
	Poultry egg import per year	**X**	**X**	x	Quantitative	number of thousands/ year	
	Country(ies) of origin of poultry egg import	**X**	**X**	x	Nominal		
	Day-old chicks import per year	**X**	**X**	x	Quantitative	number/year	
	Country(ies) of origin of day-od chicks	**X**	**X**	x	Nominal		
	Number of slaughterhouses	**X**	**X**	x	Quantitative		
	Number of slaughtered birds per year	**X**	**X**	x	Quantitative		
	Number of nurseries	**X**	**X**	x	Quantitative		
	Number of markets doing trade across administrative level 2	**X**	**X**	x	Quantitative		
	Location of markets doing trade across administrative level 2	**X**	**X**	x	Nominal		
Environment	Average temperature	**X**	**X**	**X**	Quantitative	° Celsius	
	Average minimum temperature	**X**	**X**	**X**	Quantitative	° Celsius	
	Average maximum temperature	**X**	**X**	**X**	Quantitative	° Celsius	
	Average precipitation	**X**	**X**	**X**	Quantitative	mm/year	
	Minimum precipitation	**X**	**X**	**X**	Quantitative	mm/year	
	Maximum precipitation	**X**	**X**	**X**	Quantitative	mm/year	
	Elevation	**X**	**X**	**X**	Quantitative	meters	
	Slope	**X**	**X**	**X**	Quantitative	degree	
	Landuse	**X**	**X**	**X**	Map		Africover
	Percentage of land with cropland (irrigated or not)	**X**	**X**	**X**	Quantitative	%	Africover
	Percentage of land with irrigated cropland	**X**	**X**	**X**	Quantitative	%	Africover
	Percentage of land with pasture	**X**	**X**	**X**	Quantitative	%	Africover
	Percentage of land with woodland	**X**	**X**	**X**	Quantitative	%	Africover
	Percentage of land with shrubland	**X**	**X**	**X**	Quantitative	%	Africover
	Percentage of land with savannah	**X**	**X**	**X**	Quantitative	%	Africover
	Percentage of land with forest	**X**	**X**	**X**	Quantitative	%	Africover
	Percentage of land with dryland	**X**	**X**	**X**	Quantitative	%	Africover
	Wetlands	**X**	**X**	**X**	Map		
	Water bodies: river, ponds (temporary and permanent).	**X**	**X**	**X**	Map		

Wild birds	Wintering count of wild ducks	**X**	x	x	Quantitative		Wetlands International, Wildlife Services
	Wintering count of shore birds	**X**	x	x	Quantitative		Wetlands International, Wildlife Services
	Wintering count of other water birds	**X**	x	x	Quantitative		Wetlands International, Wildlife Services
	Map with wetlands	**X**	x	x	Map		
Veterinary services	PVS evaluation	x			Report		OIE
	Number of border inspection posts	**X**	x	x	Quantitative		
	Number of official/state veterinarians	x	x	x	Quantitative		
	Number of official/state animal health workers	x	x	x	Quantitative		
	Number of NGOs working animal health	x	x	x	Quantitative		
	National outbreak investigation policy	**X**			Report		
	National diagnostic pathway	**X**			Report		
	National contingency/emergency plan (including involvement of other stakeholders: human health, police, customs, etc)	**X**			Report		
	National compensation strategy	**X**			Report		
	National surveillance and monitoring programme	**X**			Report		
	Government structure (including description of CVO's responsibility)	**X**			Report		
	Communication among veterinary services	**X**			Report		
	Vaccination	**X**			Report		
	Culling	**X**			Report		
HPAI outbreak	Number of diseased animals for each species and age group	**X**	**X**	**X**	Quantitative		
	Number of dead animals for each species and age group	**X**	**X**	**X**	Quantitative		
	Number of animals present for each species and age group	**X**	**X**	**X**	Quantitative		
	Date of detection of first signs of first outbreak	**X**	**X**	**X**	Date		
	Date of notification of first signs of first outbreak	**X**	**X**	**X**	Date		
	Date of investigation of first signs of first outbreak	**X**	**X**	**X**	Date		
	Date of detection of sample collection for first outbreak	**X**	**X**	**X**	Date		
	Date of detection of outbreak confirmation of first outbreak	**X**	**X**	**X**	Date		
	Date of first outbreak mitigation measures first outbreak	**X**	**X**	**X**	Date		
	Length of first outbreak	**X**	**X**	**X**	Quantitative	days	
	Interventions undertaken: date and type (stamping out, partial culling, movement controls, peri-focal vaccination, cleaning and disinfection)	**X**	**X**	**X**	Report		
	Backward and forward outbreak movements tracing	**X**	**X**	**X**	Report		
	Outbreak definition criteria	**X**	**X**	**X**	Report		
	List of dates and locations of all outbreaks	**X**	**X**	**X**	Report		

Annexe 5: Terms of Reference of the National Consultant

Within the framework of the FAO-EMPRES Emergency Centre for Transboundary Animal Diseases (ECTAD) directed by the FAO Chief Veterinary Officer, under the technical supervision of the Animal Health Service (AGAH), under the general supervision of the Chief of Emergency Operations Unit, under the supervision of the project manager from the Centre de coopération internationale en recherche agronomique pour le développement (CIRAD) and the direct supervision of the FAO Representative, the incumbent will work in close collaboration with the national Veterinary authorities and will be responsible for the following activities within the EPIAAF (Epidemiology of Avian Influenza in Africa) Survey:

1. Data collection at the national level

1.1 Collect all relevant data on HPAI outbreaks that occurred in the country and on surveillance and control measures implemented by the government. These data will be obtained from all possible sources (Government, UN agencies, NGOs, national research institutes, farmers' association, etc).

1.2 Collect data on potential HPAI risk factors (example: land use, poultry density, wild bird density, market proximity, etc). A detailed list of data to collect will be provided by CIRAD prior to data collection. These data will be obtained from all possible sources (Government, UN agencies, NGOs, national research institutes, farmers' association, etc). These data should be collected at the lowest possible administrative unit.

1.3 Refine data collected under article 1.2 through a questionnaire-based survey intended for head officers of the veterinary services in each region/governorate. The standardised questionnaire will be provided by CIRAD prior to data collection.

1.4 Meet with institutions, national authorities, NGOs, farmers' associations, etc, to collect all data described in articles 1.1, 1.2, and 1.3.

1.5 When relevant, carry out in-country missions to collect data only available at the local level.

1.6 Transmit, on a bi-weekly basis, all collected data to CIRAD and AGAH in a standardized form that will be provided by CIRAD.

1.7 Prepare monthly narrative reports as defined in the project document and submit through the FAO Representation to TCEO and AGAH.

2. Field epidemiological investigation missions

2.1 Liaise with CIRAD and the two international experts assigned to the country in order to prepare administrative, scientific and logistic aspects of the field epidemiological investigation missions.

2.2 Assist with administrative, scientific and logistic aspects of the organisation of the field epidemiological investigation missions. In particular:

- Provide assistance to choose infected and non-infected sites for field epidemiological investigation missions.
- Obtain all relevant authorisations from national authorities, to conduct field epidemiological investigation missions, including sample collection.

- Liaise with the head officers of the veterinary services for the regions/governorates where field missions will be conducted to 1) facilitate field missions, 2) identify precise villages/farms/markets where the investigations will be conducted, 3) identify a local technician/field assistant who will participate to field investigations.
- Obtain all relevant authorisations from national authorities, including customs, to be delivered the field mission equipment (personal protective equipment, sample collection equipment, etc) that will be sent from France by CIRAD.
- Ensure safe and proper storage of field mission equipment until the field missions begin.
- Identify possible sources where to rent/be loaned a 4X4 vehicle with driver for the field missions.
- Find means to ensure the cold chain for biological samples: freezer in the capital city, place where to buy/be loaned a liquid nitrogen container, place where to buy liquid nitrogen and dry ice, fridge in every location where field investigations will be conducted.

2.3 Participate to field epidemiological investigation missions in infected / previously infected or high-risk areas. In particular:
- Assist with sample collection, labelling and aliquoting.
- Assist with collection of risk factor data at the local level.

2.4 Assist with shipment of biological samples to the FAO Reference laboratory for avian influenza in Padova. In particular:
- Obtain all relevant authorisations from national authorities, including customs, to ship biological samples to the laboratory in Padova.
- Liaise with local office of the transporter and with the laboratory in Padova to arrange for shipment (date, flight, etc)

2.5 Liaise with the National diagnostic laboratory to identify equipment that will be needed to analyse biological samples.

3. Undertake any other avian influenza related tasks as required.

Reporting
The Consultant will prepare report on a monthly basis and when requested by AGAH, TCEO, CIRAD and the FAOR. At the end of his assignment the Consultant will submit a final report providing a complete review of activities undertaken, major obtained results, impact of activities, problems encountered, and progress. This report will contain a section on recommendations and lessons learned.

Duty Station: XXX, with in-country travels.

Duration: 4 months.

Qualifications: The Consultant will have good communication skills. He/she will be a veterinarian with at least 5 years of experience in epidemiology and animal disease control management and/or animal production. Knowledge and experience in data management and analysis is highly desirable. Proficiency Level C in French or English is required.

The report should encompass the following sections (6 pages maximum):

1- Summary of the report (15 lines)

2- Introduction (15 lines)
   - Brief overview of the HPAI situation in the country insisting on the epidemiological aspects
   - Latest development in terms of activities regarding HPAI in the country (training, new project ….)

3- Activities carried out (2 pages)
   - Meetings with authorities and institutions
   - In-country mission to collect data only available at the field level
   - Activities related to the CIRAD and international experts team venue
   - Investigations with CIRAD and international experts team
   - Other activities carried out

4- Results (1 table and 1 page)
   - To be summarized in an Excel spreadsheet:
     i. Name of the risk factors
     ii. Date of request to the national authorities or institutions after meetings)
     iii. Data of collection
     iv. Date of transmission to CIRAD
     v. If not obtained indication of the tentative date to be obtained at a short term period
     vi. If not collected, precise the reason
   - Comments on the results

5- Difficulty encountered and solutions proposed (15 lines)

6- Next activities foreseen (15 lines)

7- General recommendations and conclusions (15 lines)

Annexe 6: List of partners

Firstname LASTNAME	Country	Institution	Position	Email
Dr Estelle KANYALA	Burkina Faso	Ministère des Ressources Animales	Directrice de la Santé Animale	masibidou@hotmail.com
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Annexe 7: Task distribution

X = main responsibility
x = assistance

	General coordination	Scientific & technical preparation	Information collection at national level	Field investigations	Laboratory analyses	Database build-up	Data analysis	Model build-up	Country specific report writing	General report writing
National survey consultants		x	**X**	**X**					**X**	
National veterinary services		x	x	x					x	
National veterinary diagnostic laboratories		x			x				x	
CIRAD	**X**	**X**		**X**		x	**X**	x	**X**	**X**
FAO	x	x	x			x	x	x		
FLI		x		**X**		**X**	x	x	**X**	x
IZS		x		**X**	**X**	x	x	x	**X**	x
RVC		x		**X**		x	**X**	**X**	**X**	x
ULB		x				x	x	**X**		x

Annexe 8: Timeline

	Nov 07 16-30	Dec 07 1-15	Dec 07 16-31	Jan 08 1-15	Jan 08 16-31	Feb 08 1-15	Feb 08 16-28	Mar 08 1-15	Mar 08 16-31	Apr 08 1-15	Apr 08 16-30	May 08 1-15	May 08 15-31	Jun 08 1-15	Jun 08 16-30	Jul 08 1-15	Jul 08 16-31	Aug 08 1-15
Sub contracting between CIRAD and partner institutes																		
Preparation of questionnaire, risk factors list, data analysis protocol, &,database framework																		
Inception meeting																		
NSC recrutement																		
NSC workshop																		
Collection of epidemiological information by NSC																		
Data base build-up																		
Field missions																		
Samples analysis & results communication																		
Populating the database																		
Midterm meeting																		
Descriptive studies																		
Analytical studies																		
Spatial model build-up																		
Restitution workshop																		