The Risk Pathways Leading to Transmission of Highly Pathogenic Avian Influenza Virus infection within and between Small Scale Broiler Farms and Village Chickens in the District and Municipality of Bogor, Indonesia

Under
The DFID-funded Pro-poor HPAI Risk Reduction Strategies Research Project

Phase 1
December 2008

Document prepared by: Syafrison Idris and Maria F Palupi
Contributions from Elly Sudiana, Solenne Costard and Fred Unger

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Annexes

1. Minutes of the workshop

The minutes of the workshop are presented in **Annexes 1 to 14**. The minutes provide information about the participants of the workshop, the programme followed and the presentations given. They also summarize the main points discussed during the workshop: other projects on AI or poultry industry, other risk assessments and value chain analyses previously conducted and potential risk questions to address under this DfID funded project. In addition, the minutes present the main outputs of the workshop.

2. Timeline for the Qualitative Risk Assessment

Phase 1: Risk Questions and risk pathways:

24 – 28 Nov 08	Risk Pathway Workshop Writing up of report (RAF/CC): Risk question and pathways Data needs and Sources
1 – 5 Dec 08	Circulation of Minutes of the Workshop Writing up of report (RAF/CC): Risk question and pathways Data needs and Sources
8 – 12 Dec 08	Review of reports on risk pathways *(AL & External reviewer)* Approach for Collation of Data (AL, RAF, CC)
15 – 19 Dec 08	Amendment of country reports *(RAF + support CC/AL)* Deadline for final risk pathways reports *(RAF / CC)* Circulation of report to stakeholders

Phase 2: Qualitative Risk Assessment:

Jan-09	Data Collation: Elicitation of Expert Opinion *(RAF)* *Value Chain Analysis: Rapid Appraisal (VCA Team)*
Feb-09	Risk Estimation & Risk Mitigation *(RAF with technical support AL/CC)*
Mar-09	Writing-up report *(RAF with support CC)*
	Deadline for country reports on Qual. RA *(RAF/CC)*
Apr-09	Review of reports on qual. RA *(External Reviewer)*
	Amendment of reports on Qualitative Risk Assessment *(RAF with support EC, review AL)*
May-09	
	Deadline for final country report Circulation to stakeholders *(RAF / CC)*

RAF: Risk Assessment Facilitators CC: Country Coordinator AL: Activity Leader

3. Risk Question

Avian influenza remains a large and complicated problem in Indonesia, influencing the overall poultry sectors[a]. The current hypothesis about maintained HPAI virus infection among poultry population is that sustained circulation of HPAI virus involves all poultry sectors and market chains as an "infection cycle". This hypothesis has been described by the Expert Team in the document for Refocusing National Strategic Work Plan 2009 – 2011[1] as described in figure 1.

1 DGLS – Directorate General of Livestock Services (2008). Refocusing National Strategic Work Plan 2009 - 2011.

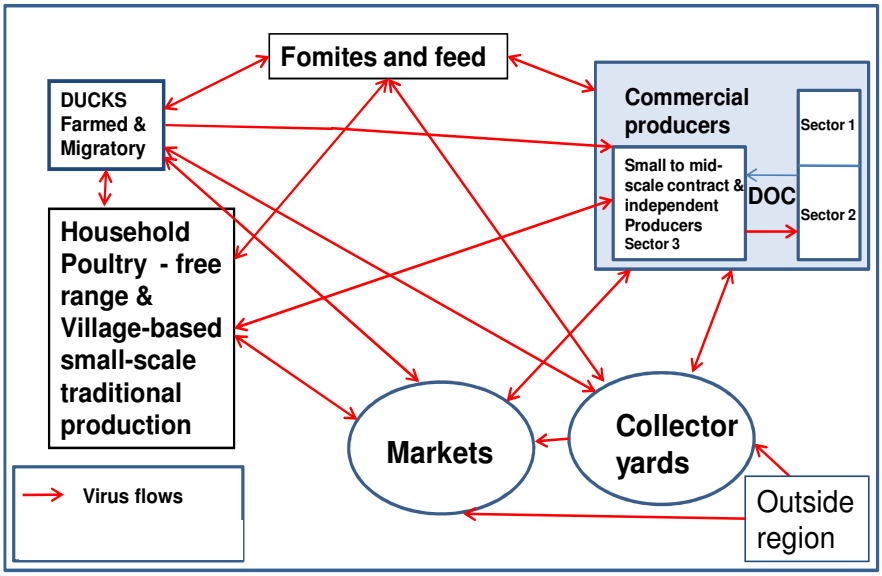

Figure 1: Sustained transmission network of HPAI virus described in Refocusing National Strategic Plan 2009 - 2011.

In a publication from the public health sector2, it is described that human cases of H5N1 in Indonesia reflect exposures to the ongoing H5N1 epizootic among backyard poultry in Indonesia (sector 4). The high density and close living arrangements of birds and humans in Indonesia increase the risk of transmission from poultry to human

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[a] The poultry industry in Indonesia has been categorized into four sectors according to FAO category reflecting enterprise size, commercial intensity and level of biosecurity.
Sector 1 is comprised of the industrial large-scale, vertically-integrated, commercial producers, some of whom own the grandparent and parent stock to sustain Sectors 2 and 3. High levels of biosecurity apply.
Sector 2 is comprised of large, independent commercial broiler and layer producers (numerous in West and East Java). Moderate to high levels of biosecurity apply.
Sector 3 are the small-scale independent operators. This sector accounts for the largest number of poultry and has variable, usually low to minimal levels of biosecurity with birds/products bought and sold through live bird markets.
Sector 4 includes the free-ranging village poultry producers/keepers and urban backyard poultry producers/keepers where biosecurity is minimal or absent and birds/products are consumed locally or traded through live bird markets to meet short term cash needs. Many poultry kept in sector 4 could be described as ornamental or recreational in that they are not kept for income generation.

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2 Sedyaningsih et al. Epidemiology of Cases of H5N1Virus Infection in Indonesia July 2005 – June 2006. JID 2007: 196

The role of sector 3 and 4 poultry farms is considered very important in maintaining the circulation of HPAI virus. Because of the absence or minimal biosecurity measures applied in these sectors, they are likely to be exposed to HPAI virus and to allow its spread. Therefore, constant re-infection in these sectors and spread to others most likely contribute to the "infection cycle" of HPAI in Indonesia. In addition, many sector 3 poultry farms are surrounded by sector 4 farms, consequently both sectors are influences each other in the spreading of diseases including HPAI.

There is a need for improving the current control measures in sector 3 and 4 poultry farms. In terms of feasibility and concentrating limited resources a more targeted approaches is currently discussed among stakeholders related to the importance of each of the sectors in the spread of HPAI. Therefore, a better understanding of the routes of virus introduction into farms and transmission of virus infection between sectors 3 and 4 poultry farms is urgently needed before valid recommendations can be provided. .Sector 3 farms are very varied in Indonesia and can house from 1,000 to 100,000 animals. Small scale and large scale farms are likely to have different structures and involve different marketing chains. Using information on profiles of farms[3], it was decided to restrict the risk assessment to the following farms: small-scale broiler farms with less than 5,000 animals and village chickens.

Based on priorities defined by the NSWP4, it was decided to restrict the activity to an area targeted by the NSWP: West Java. The study area chosen for the Risk Assessment Activity is the District of Bogor and the City of Bogor, as this area has advantages such as: 1) previous studies in this area provide relevant information for the risk analysis; 2) Risk Analysis Facilitator team and key informants represent small scale broiler and village poultry farmer located here.

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3 FAO – Food and Agriculture Organization (2008). Commercial Poultry Production Profiling Study in Western Java.

4 DGLS – Directorate General of Livestock Services (2008). Refocusing National Strategic Work Plan 2009 - 2011.

Following these discussions during the workshop held in Bogor from 24th to 26th November 2008, it was decided by stakeholders that the Risk assessment conducted under the DFID project should address the following important risk question*:*

In the District of Bogor and Municipality of Bogor, What is the risk of transmission of HPAI virus infection:

- *between small scale broiler farms,*
- *between village chickens,*
- *between small scale broiler farms and village chickens?*

4. Risk assessment framework

For the qualitative risk assessment, the method followed is the framework recommended by world organization for animal health (OIE) as described on the hand book for the import risk analysis.
Annex 15 provides the definition of terms (glossary) to be used, as adapted from the OIE handbook.(*OIE, 2004).*

5. Risk Pathways

The pathways of transmission between small scale broiler farms and village chickens, corresponding to the risk question defined for Indonesia, are described in figures 2 to 5.

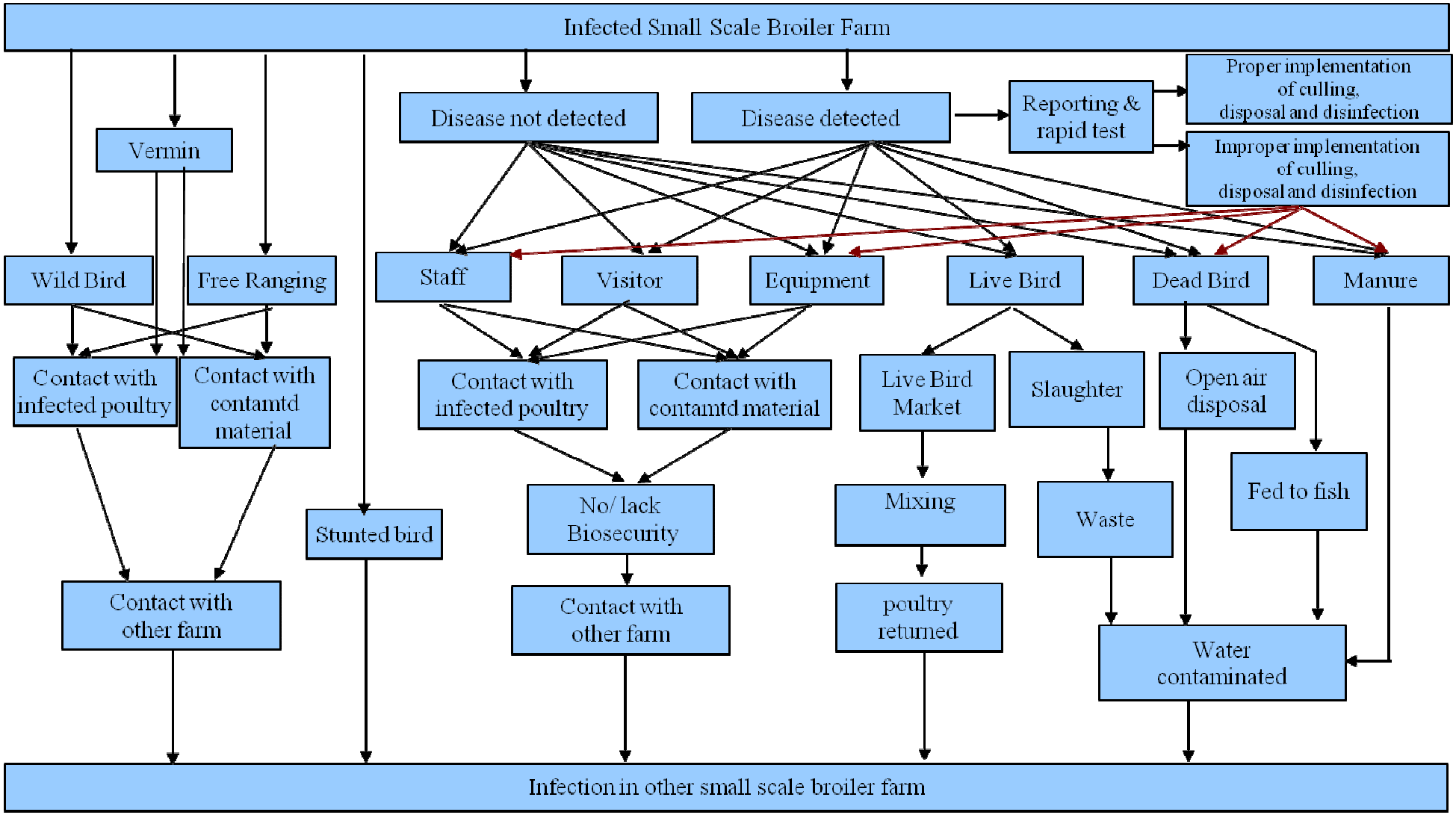


Figure 2: The risk pathways between small scale broiler farm

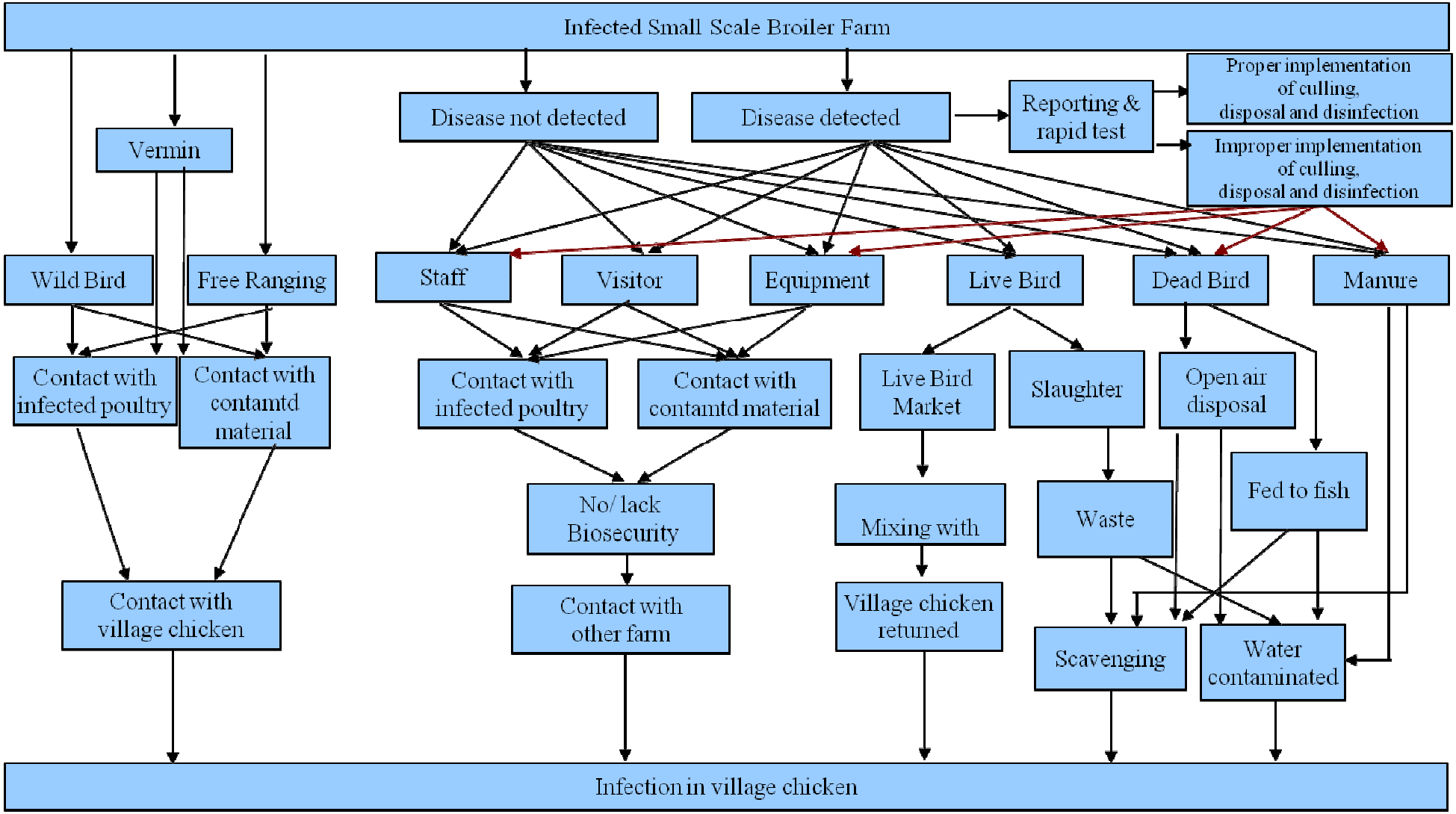


Figure 3: The risk pathways from small scale broiler farm to village chickens

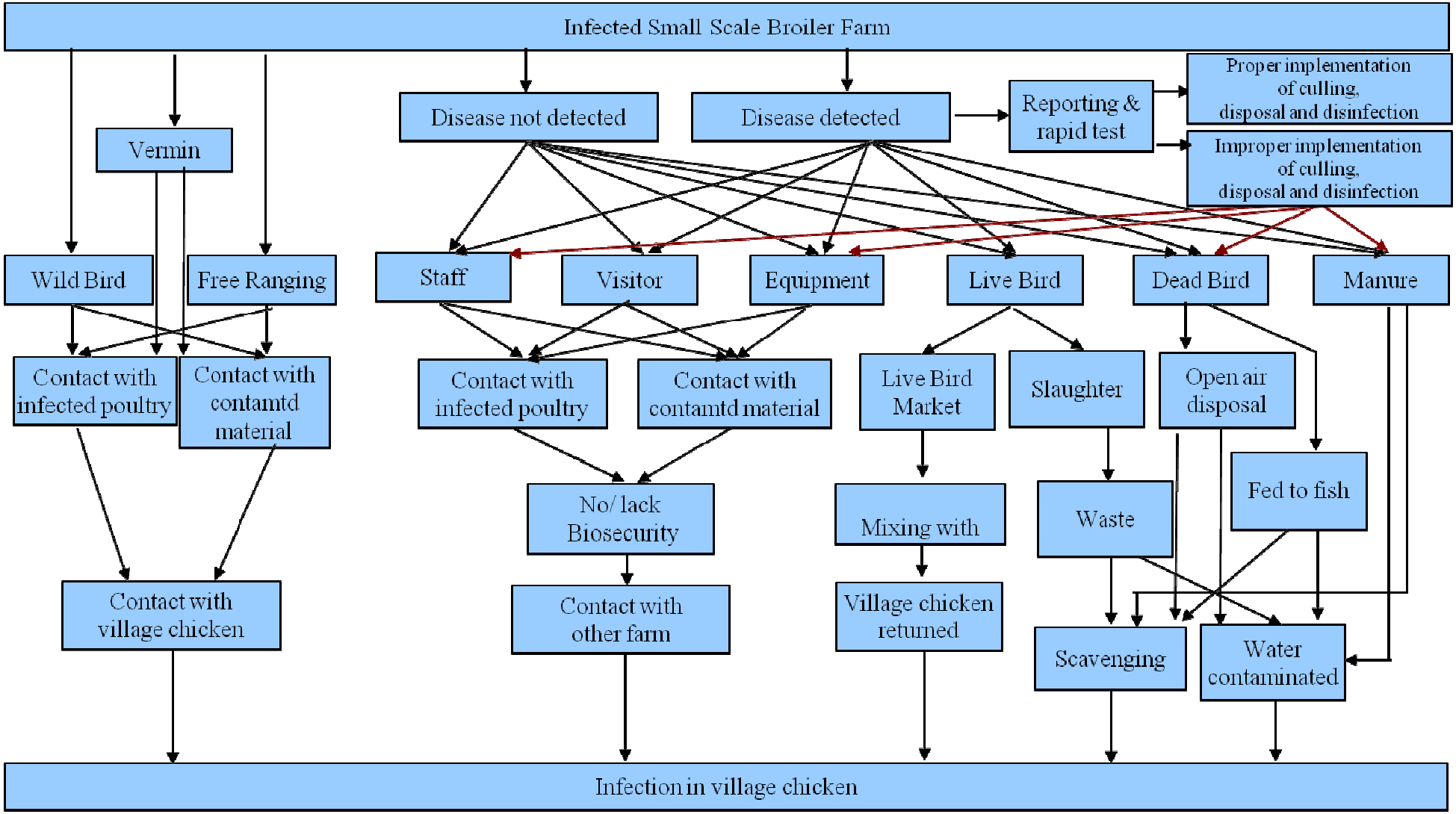


Figure 4: The risk pathways between chickens from different villages

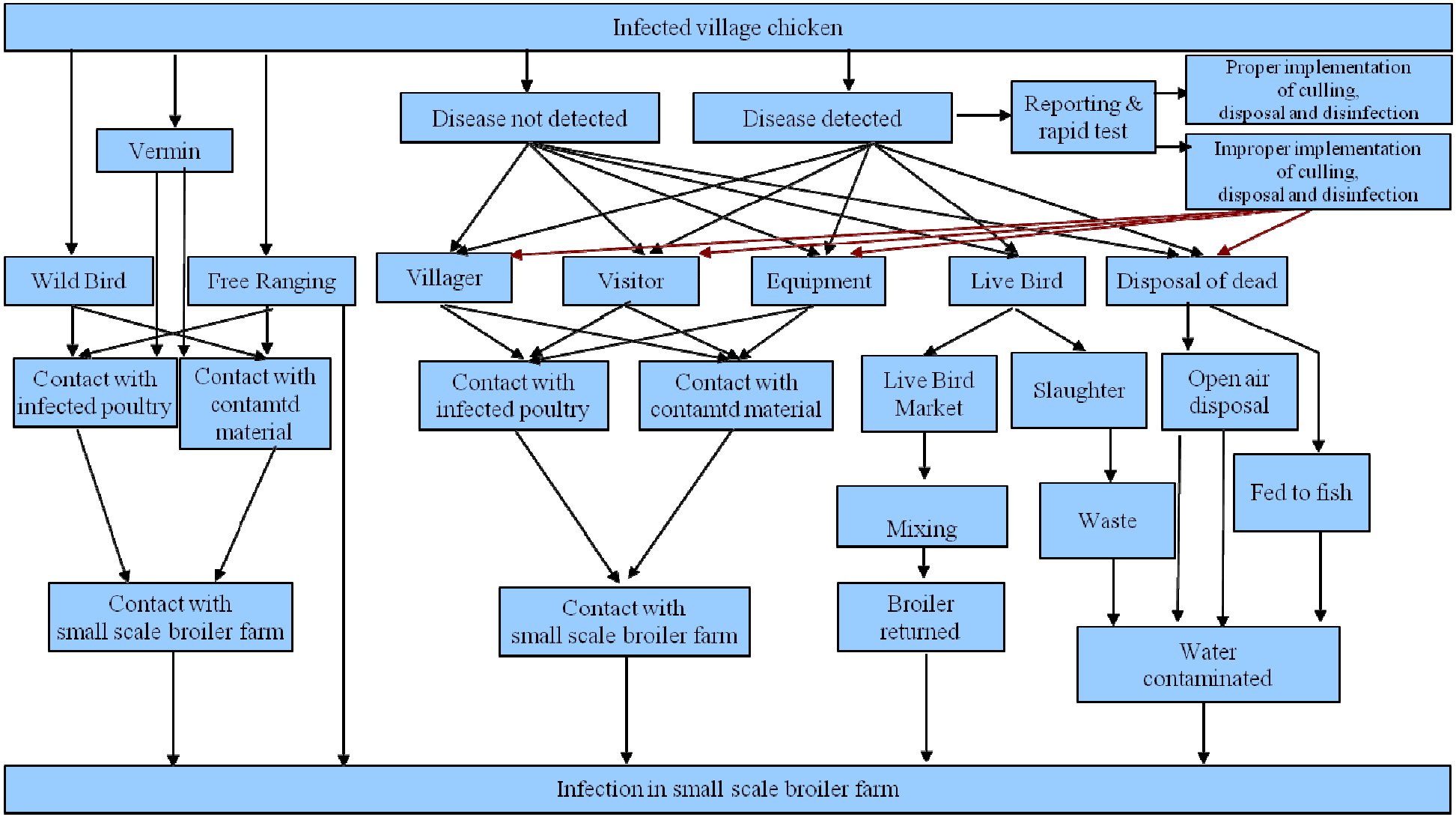


Figure 5: The risk pathways from village chicken to small scale broiler farm

6. Data needs and sources of information

Data required for the Risk Assessment were presented and discussed during the workshop held on 24th-26th November 2008. Sources of information and key informants were also identified during these discussions. Table 1 summarizes the main data needs and sources of information for the Risk Assessment to be conducted in Indonesia under the DfID Pro-poor HPAI risk reduction strategies project.

Table 1: Data needs and Sources of information identified during the workshop for the Qualitative Risk Assessment in Indonesia

	Sources of Information											
Data Needs	FAO Profiling Study	FAO Movement & Markets studies	FAO VCA Greater Jakarta	FAO PDSR	IDP	ILRI Operational Research	GOPAN	CP	Sierad	HIMPULI	PINSAR	DINAS
Farms (broilers <5,000 and village chicken): housing, demographics, biosecurity, etc.	■			■		■	■	■	■	■	■	■
Dead birds selling points						■	■	■	■		■	■
Collecting yards		■			■	■	■	■	■		■	■
Village chicken: Outputs			■	■		■				■		■
Broiler farms: Outputs	■		■				■	■	■		■	■
Live Bird Markets		■	■		■	■	■	■	■	■	■	■
Slaughterhouses /slaughter places			■			■	■	■	■	■	■	■
Feed Mills								■	■			■

It was agreed that elicitation of expert opinion would be used to collate data for the qualitative risk assessment, due to time and resources constraints. Sources of data for a subsequent quantitative risk assessment will be identified in the process. In addition, results of the VCA activity of the DfID Pro-poor HPAI risk reduction strategies project will be used to update the qualitative risk assessment when they become available.

7. Definition of terms

7. 1. Risk categories:

Once all information available for each of the parameter described above is reviewed, its probability of occurrence is assessed for classification by means of the descriptive scale shown in Table 2.

Table 2: Risk categories (EFSA, 2006)

Probability category	Interpretation
Negligible	Event is so rare that does not merit to be considered
Very low	Event is very rare but cannot be excluded
Low	Event is rare but does occur
Medium	Event occurs regularly
High	Event occurs very often
Very high	Even occurs almost at certainly

Adapted from: The EFSA journal. 2006. Migratory birds and their possible role in the spread of highly pathogenic avian influenza. 155p.

7. 2. Combination Matrix:

In order to assess the likelihood of occurrence of each of the pathways, the risk estimates of the parameters characterizing these pathways will then be combined.

In order to assess each of the probability of release, exposure and consequence (or transmission), risk estimates of parameters will be combined. For each biological pathway, a risk estimate will be obtained by combining parameters' risk categories according to the combination matrix presented in Table 6.

For combination of release risk estimate and exposure risk estimate, the combination matrix shown in Table 3 will be applied.

Table 3: Risk categories combination matrix

		Parameter 2 /Exposure ris k category					
Parameter 1 / Release risk category		Negligible	Very Low	Low	Medium	High	Very High
	Very High	N	VL	L	M	H	VH
	High	N	VL	L	M	H	H
	Medium	N	VL	VL	L	M	M
	Low	N	N	VL	VL	L	L
	Very Low	N	N	VL	VL	VL	VL
	Negligible	N	N	N	N	N	N

Adapted from: Cristobal Zepeda (Centers for Epidemiology and Animal Health USDA-APHIS /Animal Population Health Institute, Colorado State University), with slight modifications.

For combination of the combined release and exposure risk estimate with the consequence risk estimate, we will be using the combination matrix shown in Table 4.

Table 4: Risk categories combination matrix

		Consequence risk category					
Combined release and exposure risk category		Negligible	Very Low	Low	Medium	High	Very High
	Very High	N	VL	L	M	H	VH
	High	N	VL	L	M	H	VH
	Medium	N	VL	L	M	H	VH
	Low	N	VL	VL	L	M	H
	Very Low	N	N	VL	VL	L	M
	Negligible	N	N	N	N	N	N

Adapted from: Cristobal Zepeda (Centers for Epidemiology and Animal Health USDA-APHIS /Animal Population Health Institute, Colorado State University), with slight modifications.

7. 3. Uncertainty:

The level of uncertainty associated with each parameter of the risk pathways will be specified and considered for interpretation of data and results. The uncertainty associated to data will be categorised as presented in Table 5.

Table 5: Uncertainty categories (EFSA, 2006):

Uncertainty category	Interpretation
Low	There are solid and complete data available; strong evidence is provided in multiple references; authors report similar conclusions
Medium	There are some but no complete data available; evidence is provided in small number of references; authors report conclusions that vary from one another
High	There are scare or no data available; evidence is not provided in references but rather in unpublished reports or based observations, or personal communication; authors report conclusions that vary considerably between them

Adapted from: The EFSA Journal. 2006. Migratory birds and their possible role in the spread of highly pathogenic avian influenza. 155p.

8. Reporting format for qualitative risk assessment

In a first step, release, exposure and consequence assessments will be conducted separately.

Supporting evidence for assessing the likelihood of occurrence of each parameter of the pathways will be discussed in the text and will include references. At the end of the each of the risk assessment section, a table summarizing the following information will be included (Table 6)

Table 6: summary table

Parameter of pathway	Data Need	Source of information	Risk Category	Uncertainty

Then, the release, exposure or consequence risk estimate will be derived from the combination matrix. It will be presented together with its associated level of uncertainty.

The risk estimation will finally be conducted and provide an overall risk estimate for each risk question, together with an indication of the final level of uncertainty.

A list of references will be added at the end of the report.

List of Annexes:

1. List of participants
2. Presentation of the programme and objectives of the workshop
3. Overview of the DfID-funded Pro-Poor Risk Reduction Strategies Project
4. Summary of the project's achievements in Indonesia
5. Presentation of HPAI related activities in Indonesia
6. Presentation of the Risk Assessment Activity
7. Introduction to Risk Assessment
8. Integrating CBA with Risk Assessment for the Synthesis Analysis.
9. Definition of risk question and risk pathways
10. Presentation of the Spatial Modelling Activity
11. Presentation of Poultry Market Chains conducted in Indonesia
12. Presentation of the VCA Activity
13. Conclusions of the Workshop
14. Minutes of the workshop
15. Glossary

Annex 1:
List of Participants

IFPRI

1. Marites M Tiongco
2. Clare Narrod

ILRI

3. Dr. Fred Unger
4. Shinta Ismail

RVC

5. Dr. Solenne Costard
6. Prof. Dirk Pfeiffer

FAO

7. Dr. Pablo Romero Barios
8. Dr. Ron Thornton

MOA

9. Dr. Elly Siregar
10. Dr. Boethdy Angkasa

ICASEP

11. Edi Basuno

District Livestock Services of Bogor

12. Dr. Soetrisno
13. Dr. Titik Herawati

Association of Commercial Poultry Producers (FMPI)

14. Don P Utoyo

Sierad Produce

15. Dr. Randy L Payawal

Charoon Phokpand Indonesia

16. Dr. Singgih Hujianto
17. Dr. Agus Mardianto

Federation of Non Industrial Commercial Poultry Producer Organization (GOPAN)

18. Sugeng Wahyudi
19. Setya Winarno
20. Tri Kisowo

Native Poultry Farmer Association (HIMPULI)

21. Ade M Zulkarnain

Centre for Poultry Market Analysis (PINSAR)

22. Dr. C Baso Darmawan

Risk Analysis Facilitator

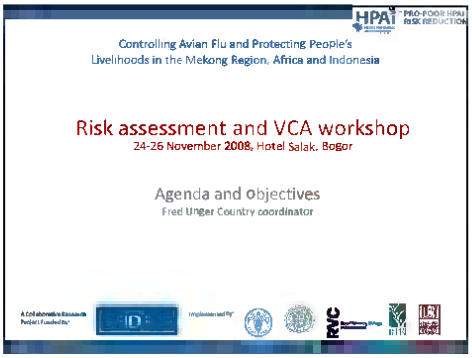
23. Dr. Syafrison Idris
24. Dr. Maria F Palupi

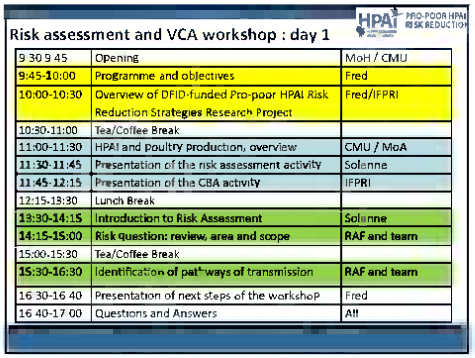
Veterinary Consultant

25. Dr. Iwan Wiliyanto

Annex 2:
Presentation of the programme and objectives of the workshop

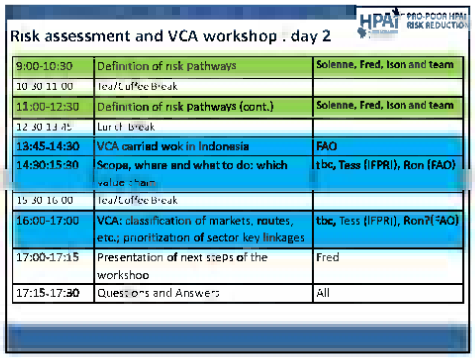
12/3/2008





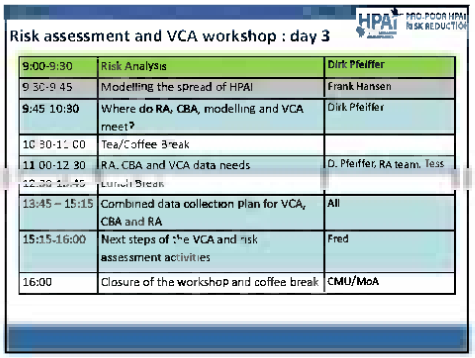
Risk assessment and VCA workshop : day 1

9 30 9 45	Opening	MoH / CMU
9:45-10:00	Programme and objectives	Fred
10:00-10:30	Overview of DFID-funded Pro-poor HPAI Risk Reduction Strategies Research Project	Fred/IFPRI
10:30-11:00	Tea/Coffee Break	
11:00-11:30	HPAI and poultry production, overview	CMU / MoA
11:30-11:45	Presentation of the risk assessment activity	Solenne
11:45-12:15	Presentation of the CBA activity	IFPRI
12:15-13:30	Lunch Break	
13:30-14:15	Introduction to Risk Assessment	Solenne
14:15-15:00	Risk question: review, area and scope	RAF and team
15:00-15:30	Tea/Coffee Break	
15:30-16:30	Identification of pathways of transmission	RAF and team
16 30-16 40	Presentation of next steps of the workshop	Fred
16 40-17 00	Questions and Answers	All



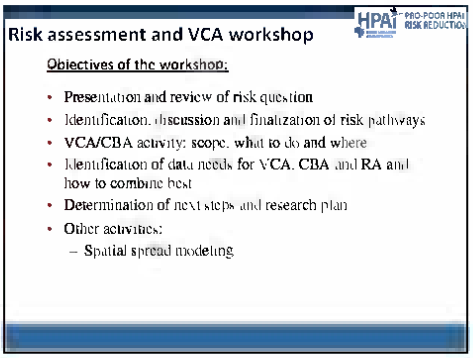
Risk assessment and VCA workshop : day 2

9:00-10:30	Definition of risk pathways	Solenne, Fred, Ison and team
10 30 11 00	Tea/Coffee Break	
11:00-12:30	Definition of risk pathways (cont.)	Solenne, Fred, Ison and team
12 30 13 45	Lunch break	
13:45-14:30	VCA carried wok in Indonesia	FAO
14:30-15:30	Scope, where and what to do: which value chain	tbc, Tess (IFPRI), Ron (FAO)
15 30 16 00	Tea/Coffee Break	
16:00-17:00	VCA: classification of markets, routes, etc.; prioritization of sector key linkages	tbc, Tess (IFPRI), Ron?(FAO)
17:00-17:15	Presentation of next steps of the workshop	Fred
17:15-17:30	Questions and Answers	All



Risk assessment and VCA workshop : day 3

9:00-9:30	Risk Analysis	Dirk Pfeiffer
9 30-9 45	Modelling the spread of HPAI	Frank Hansen
9:45 10:30	Where do RA, CBA, modelling and VCA meet?	Dirk Pfeiffer
10 30-11 00	Tea/Coffee Break	
11 00-12 30	RA, CBA and VCA data needs	D. Pfeiffer, RA team, Tess
12 30-13 45	Lunch Break	
13:45 – 15:15	Combined data collection plan for VCA, CBA and RA	All
15:15-16:00	Next steps of the VCA and risk assessment activities	Fred
16:00	Closure of the workshop and coffee break	CMU/MoA



Risk assessment and VCA workshop

Objectives of the workshop:

- Presentation and review of risk question
- Identification, discussion and finalization of risk pathways
- VCA/CBA activity: scope, what to do and where
- Identification of data needs for VCA, CBA and RA and how to combine best
- Determination of next steps and research plan
- Other activities:
  - Spatial spread modeling

Annex 3:
Overview of the DfID-funded Pro-Poor Risk Reduction Strategies Project

12/3/2008

Controlling Avian Flu and Protecting People's Livelihoods in the Mekong Region, Africa and Indonesia

DFID-Funded Collaborative HPAI Research Project for Asia and Africa

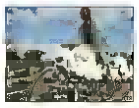
Clare Narrod
On behalf of the IFPRI/ILRI FAO/RVC/Berkeley team

Overview

- Background & Motivation
- Project Goal & Objectives
- Research themes
- Oversight & Management
- Principles & Next Steps

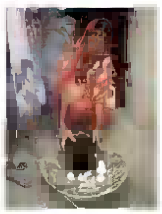
Motivation

- Considerable uncertainty about the timing, extent, and severity of a potential animal disease outbreak, yet developing countries must make critical decisions about ways to defend against a potential outbreak of diseases, such as Highly Pathogenic Avian Influenza



HPAI Threats

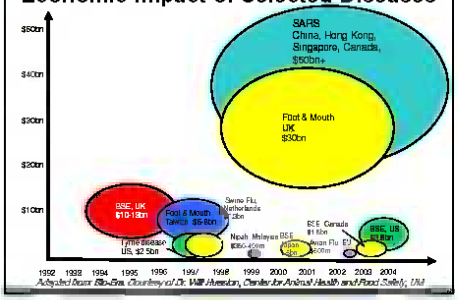
- Poor peoples' livelihoods
  - disease itself
  - control measures
- Poultry industry
  - in affected countries
  - in non-affected countries
- Global public health
  - rural populations
  - urban populations



Disease and control measures

- There are likely to be differential economic impacts on different income groups and sectors of the economy
- The rural poor, whose livelihoods depend in large part from poultry and who consume their own poultry, may disproportionately feel these costs.

Economic Impact of Selected Diseases



Adapted from Bio-Era. Courtesy of Dr. Will Hueston, Center for Animal Health and Food Safety, UM

HPAI Research & Research Gaps

Research

- Viral genomics – virus evolution
- Pathogenesis – in humans and poultry
- Immunology – vaccine development
- Disease ecology – wild bird & domestic reservoirs
- Disease epidemiology – e.g. spread mechanisms (some)

Research Gaps

- 'Stratum-specific' impacts of disease and disease control
- Cost-effectiveness / cost-benefit of control (acute, endemic)
- Institutional angles of HPAI control
- Externalities / 'global public goods' aspects of HPAI control

Project Goal

To help national governments and international organizations to be prepared to make informed decisions should need arise and to limit the spread of HPAI, while minimizing the impact on different socio-economic groups, particularly the poor.

Project Purpose

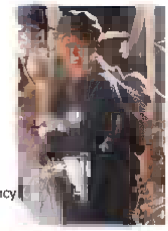
To aid decision makers in developing evidence-based pro-poor HPAI control measures at national and international levels.

Project Objectives

1. Provide scientific basis for
   - cost-effective, and
   - 'equitable'

   HPAI control strategies,
2. 'Inject' insights into
   - national,
   - regional and global

   policy processes, and
3. Build capacity for evidence-based formulation of disease control policy



Regional / Country 'Responsibility'

IFPRI
ILRI

Ethiopia, Kenya, Nigeria, Ghana, and Indonesia,
Project Lead- Clare Narrod

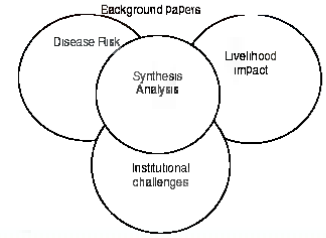
RVC

The Mekong Region: Thailand, Cambodia, Vietnam (Lao PDR)
Project Lead – Joachim Otte

Our Strategy

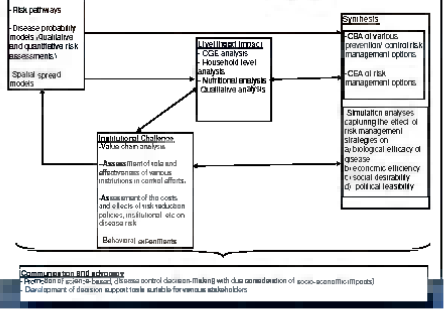
- DfID funded HPAI project is using a modified risk analysis approach, (risk analysis plus a number of other outputs) to inform decision makers of the potential impact of control measures on the poor
- A 6 thematic approach will be used to capture the complex interactions of the spread of AI and its impact on the economy as a whole
  - Attention paid to: 1) smallholders and the poor, 2) to acute vs endemic situations, and 3) long vs short distance spread
- Self-contained, but interlinked themes
  - Linked by baseline values, assumptions and policy options

Research work streams:



Risk communication and decision support tools

Methodological Framework



Background papers

Aim

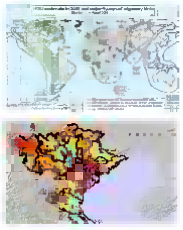
- Document ALL the available existing information pertaining to HPAI and poultry sector in the study countries
- Identify knowledge gaps to focus research in study countries

Research project

- Country baseline information, shocks (disease, policy response) and simulation assumptions agreed upon

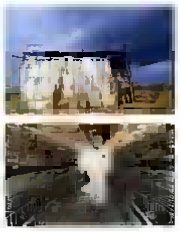
Disease Risk

- Base line risk maps
- Risk pathways
- Disease probability models (qualitative and Quantitative)
  - Likelihood of entry of HPAI virus and exposure of domestic poultry? Or likelihood of spread to different regions
- Spatial spread models
  - Potential pathways of HPAI spread to poultry and the likelihood that this will happen?



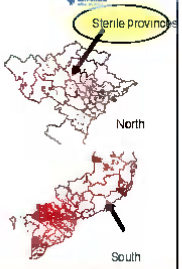
Livelihood impacts

- Economic: poultry sector and beyond
  - CGE analysis and multi-market analysis
- Livelihoods impact
  - Household level analysis (quantitative)
  - Nutritional analysis (quantitative)
  - Focus group surveys (qualitative)



Institutional mechanisms

- Assessment of role and effectiveness of various institutions in control efforts
  - Institutions (eg animal health services, MARDs, regional organizations)
  - 'Top-down' surveillance vs 'bottom-up' disease reporting
  - Public vs private sector engagement
  - Farm- vs value-chain focused approaches for disease control
  - National vs international responsibilities and cost sharing
- Assessment of the costs and risk reduction effects of various policies, reforms and institutional changes on disease risk to date
- Behavioral experiments to see what works under specific situations



Source: Pfeiffer *et al.*, 2005

Synthesis Analysis

- Cost/benefit analysis of various prevention/ control risk management options
- Cost/effective analysis of risk management options

- Risk analysis paradigm
- Simulation analyses capturing the effect of various risk management strategies on
  1. biological efficacy of disease
  2. economic efficiency
  3. social desirability
  4. political feasibility

Risk Communication

- Assessment of information needs / gaps of different stakeholders
- Identification of appropriate communication channels for different target audiences (e.g. women & children)
- Development of simple decision support tools as an interface for stakeholders to use information
  - network maps

Project Oversight / Management

Internal. Thematic responsibilities (IFPRI/ILRI)

- Background papers: National partners
  - Clare Narrod (IFPRI)
- Technical areas
  - Disease risk: Dirk Pfeiffer (RVC)
  - Livelihood impacts: Xinshen Diao (IFPRI)
  - Institutional mechanisms: Jeff Mariner (ILRI)
  - Synthesis analysis: Clare Narrod (IFPRI)
- Translation of research into policy action:
  - Klaus von Grebmer (IFPRI)

Country Coordinators

- Nigeria
  - Iheanacho Okike
- Ethiopia
  - Shahidur Rashid/Devesh Roy
- Ghana
  - Shashidhara Kolavalli, /Ekin Birol
- Kenya
  - Amos Omore
- Indonesia
  - Fred Unger

National collaborators (so far)

- Nigeria
  - University Ibadan-FAO
    - Dr. Timothy Obi
  - Cambridge University
    - Dr. Adewale Oparinde
  - FAO/CIRAD – Dr. Garba Maina
- Indonesia
  - CMU, MoA Universitas (Fred presentation)
- Kenya
  - Kenya Institute for Policy Research on Agriculture (KIPPRA)
    - Dr John Omiti
  - FAO
    - Dr. Samuel Okuthe
- Ghana
  - University of Ghana
    - Dr. George Anning
    - Dr. Sam Asuming-Brempong
  - University of Cape Coast
    - Dr. PK Turkson
- Ethiopia
  - Ethiopian Institute for Agricultural Research (EIAR)
    - Dr. Dawit Alemu
    - Dr. Setotaw Ferede
    - Dr. Tamirat Degefo

Country Champions – linking to policy making

- Nigeria
  - Dr Joseph Ayagar; HPAI country coordinator
- Ethiopia
  - Dr Amsalu Demisse, Deputy CVO
- Ghana
  - Dr. E B M Koney, CVO
- Kenya
- Indonesia
  - Dr Elly Sawitri; HPAI country coordinator

Principles

- open for others to join, avoid duplication
- transparent, disclosure of interim findings
- collaborative & trans-disciplinary
- iterative, ongoing adjustments
- constructive peer review
- end-user focused

Project Oversight / Management

External: Steering Committee

- Experts in different research domains, individuals tasked with disease control in affected countries and representatives of international organisations
- Charged with providing guidance to the project to ensure that the research conducted
  - addresses issues relevant to decision-makers;
  - is scientifically sound,
  - is practical and transparent, and
  - expediantly finds its way into national, regional and global decision making processes

Steps so far

- December – January: 'recruit' national partners and agree on ways and areas of collaboration
- December: Inception workshop in Chiang Mai
- January: 'Issues Paper' on main issues addressed by project
- Spring: 'Background Papers' prepared for each project country
- Summer: Country kick-off meetings to introduce project to stakeholders and agree on major gaps project will address

Next steps (cont.)

- At inception workshops (Summer)
  - Net mapping exercise (to look at communication strategy amongst stakeholders, institutions, during inception workshop
  - Agree-upon country baseline information, shocks (disease, policy response) and simulation assumptions agreed upon – stakeholders would find useful
- Define type of research approach and data needs (August-October)
  - Chose specific methodologies
  - Design survey instruments
  - Link outputs
- Fall 2008 – Risk maps

Next steps (cont.)

- Fall 2008 – Disease risk workshops, risk pathways and qualitative risk assessments
- Fall 2008- Spring 2009 – Value chain analysis
- Aug 2008-April 2009 – Economic and livelihood impact analysis
- Spring 2009 – begin survey's on CBA in countries
- Spring 2009 – Quantitative RA and spatial spread model work
- Spring 2009 -begin institutional mechanisms analysis in study countries
- Spring 2010 – draft synthesis analysis completed (risk analysis +)

Annex 4:
Summary of the project's achievements in Indonesia Fred Unger

12/3/2008

Controlling Avian Flu and Protecting People's Livelihoods in the Mekong Region, Africa and Indonesia

Risk assessment and VCA workshop

24-26 November 2008, Hotel Salak, Bogor

Achievements Indonesia

Fred Unger Country coordinator

Steps so far: Indonesia

- **Jan-Mar:** Identification of collaborating institutions and partners
- Apr: Contracting of consultants for the Background
  - Dr Bustanul Arifin (UoB), Bogor
  - Dr Bambang Sumiarto (GMU), Yogya
- **Jun:** Inception workshop at UGM Yogyakarta
  - Discuss background paper draft
  - Baseline information
  - Net mapping exercise
  - Next steps
- **Jul:** Meeting of stakeholders at Jakarta by ILRI/IFPRI economist
- **Aug:** final background paper

Steps so far: Indonesia (continued)

- **Aug-Oct**
  - Define type of research approach
  - Identification of potential partners
    - Consultant for RA (IRA) identified
      - Dr. Idris Syafrison (supported by Maria Fatima)
- **Oct-Nov**
  - Defining of risk pathways (draft report)
  - Consultants for Mitigation activity identified
    - Dr Bustanul Arifin and Dr Iwan Wiliyanto
    - Short country report on mitigations and institutions
  - Consultant for VCA (to be identified)
  - RA and VCA workshop
  - Finalization of Risk Pathways

Next steps

- Fall **2008 -Spring 2009**
  - **Risk maps**, risk pathways **and** risk assessments
  - **Risk maps**
  - **Value chain** analysis
  - Mitigations
  - **Economic** and livelihood impact analysis
- **Spring 2009**
  - begin survey's on **CBA in countries**
  - Quantitative **RA** and spatial spread model work
  - begin institutional mechanisms **analysis in study countries**
- **Spring 2010** – draft synthesis analysis **completed** (risk analysis +)

Annex 5:
Presentation of HPAI related activities in Indonesia Elly Sawitri Siregar

Background Information on Indonesia: HPAI, Poultry Production and Plan of Progressive Control 2009-2011

Elly Sawitri Siregar
HPAI-Campaign Management Unit/CMU
Directorate of Animal Health
DGLS-MoA

Risk Pathway Workshop
DFID-funded Pro-poor HPAI Risk Reduction Strategies
Salak Hotel, Bogor, 24-26 November 2008

Poultry Numbers

- Annual population 1.5 billion
- Standing population:
  - Village Chicken 300m (~600m annually)
  - Layer 100m
  - Broiler 175m (~1b annually)
  - Duck 35m
  - Total >600m
    (plus others – quail, pigeon, goose. .)

Source: Statistik Peternakan 2005

The Poultry Industry

Total investment	US$ 35b
Turnover	US$ 30b pa
People employed	>10m
Feed production	7.5m MT pa
DOC broiler	>1b pa
DOC layer	>100m pa
Markets daily	13,000 markets
Abattoir processing	~20%

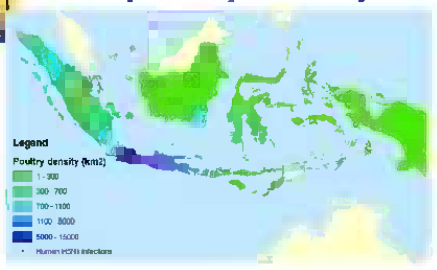
(Estimated 60% of households have poultry i.e. ~30m)

Source: Association of Poultry Industries (2004)

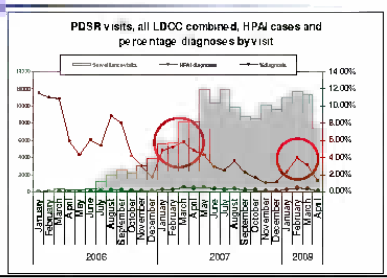
HPAI Situation in Poultry in Indonesia

- From 2003 - 2008 . Infected area 31/33 prov, 294/498 districts, poultry death 13 million.
- Based on level of cases, 3 area :
  1. Free (2 prov) . North Maluku, Gorontalo
  2. Endemic (18 prov): Jawa, Sumatra, South and Southeast Sulawesi
  3. Low Incidence (13 prov):Nusatenggara (east,west), Bali ,Kalimantan (South,central,west,east), Maluku, Papua, West Papua, Sulawesi (north,central,west)
- No report of AI cases during last 6 months . Bali, NusaTenggara, Kalimantan, Maluku, West Papua, Papua, North Sulawesi, Bangka Belitung

Total poultry density

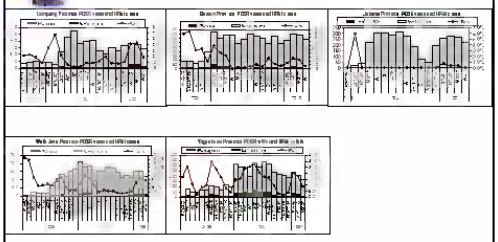


Surveillance, old PDSR database: Jan 2006 – April 2008

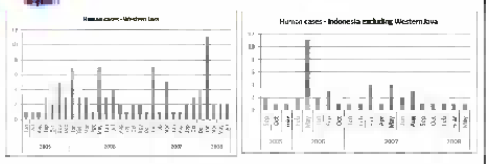


Cases present with yearly pattern:

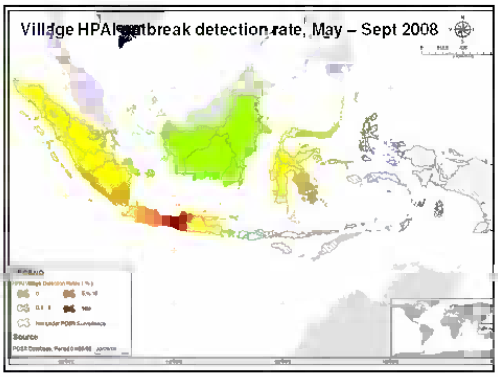
Lampung, Banten, DKI, West Java, Central Java and Yogyakarta



Human H5N1 cases



Village HPAI outbreak detection rate, May – Sept 2008



Example of village-level mapping capability of new PDSR database

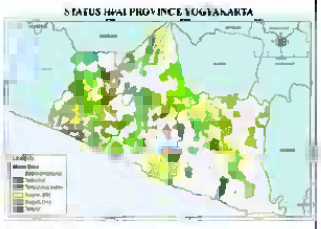
Red: INFECTED

Blue: CONTROLLED

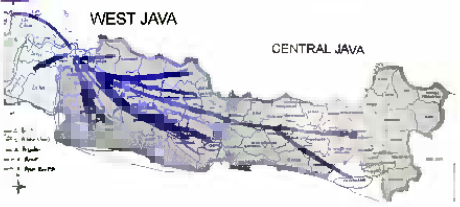
Yellow: SUSPECT 60 (lower risk, conduct follow-up investigation in 60 days)

Orange: SUSPECT 14 (high risk, conduct follow-up investigation in 14 days)

White: not yet visited by PDSR

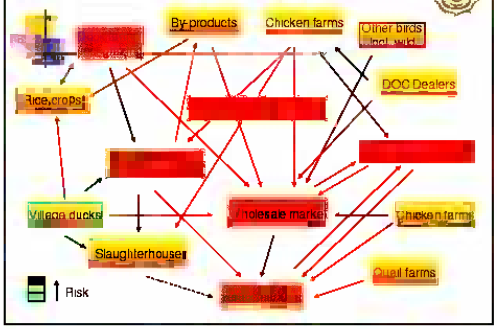


Poultry Movements

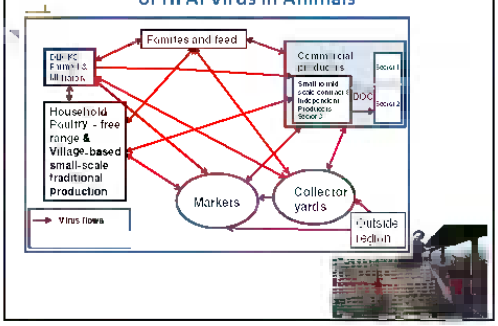


Virus afflicting both humans and local poultry may not be locally produced, but instead introduced from outside sources

2007 Indonesia (after Sims)



Sustainable Transmission of HPAI Virus in Animals



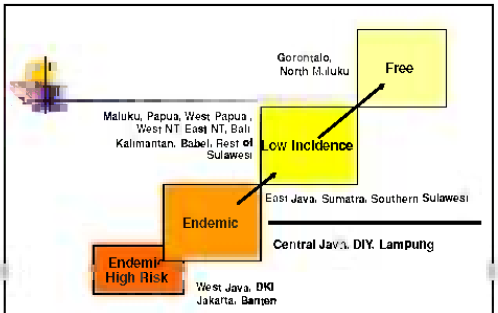
Overall goals
NSWP 2009 – 2011 *(draft)*

- Refocusing on progressive control and prevention of HPAI in poultry commercial industry and market chains
- Reduce impact on poultry production and community livelihoods
- Maintain and expand free status area of HPAI by control and prevention
- Reduce risk of transmission to human

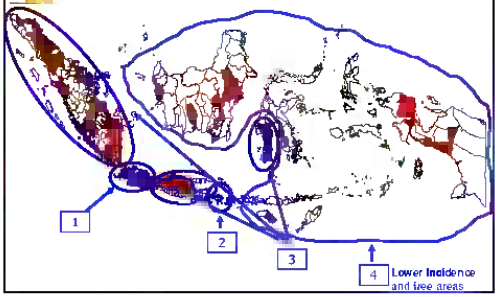
Regional Prioritization

- 4 Regions
  - Western Java (West Java, Banten, DKI Jakarta)
  - Bali
  - Rest of Java (East Java, Central Java, Jogyakarta), Sumatera and Southern Sulawesi
  - Low Incidence (West Nusa Tenggara, Kalimantan, Rest of Sulawesi, Maluku, Papua, West Papua) and Free area (Gorontalo, North Maluku)

→ Considering AI cases in poultry, cases in human and poultry density.



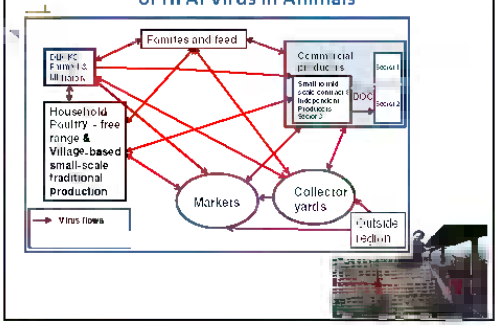
4 Priority regions



Plan of progressive control HPAI in Western Java, 2009

Goals and Purpose indicators:
Reduction of
- human cases in JABODETABEK
- Poultry and human cases in rest of western Java

Sustainable Transmission of HPAI Virus in Animals



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NSWP 2009 – 2011 *(draft)*

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- Reduce impact on poultry production and community livelihoods
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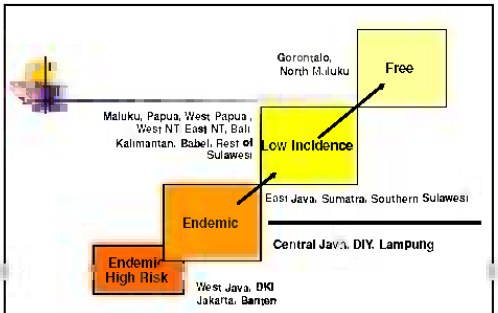
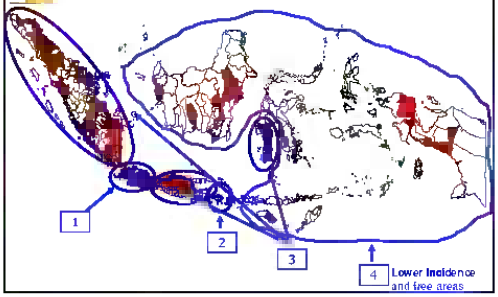
  - Bali
  - Rest of Java (East Java, Central Java, Jogyakarta), Sumatera and Southern Sulawesi
  - Low Incidence (West Nusa Tenggara, Kalimantan, Rest of Sulawesi, Maluku, Papua, West Papua) and Free area (Gorontalo, North Maluku)

→ Considering AI cases in poultry, cases in human and poultry density.



4 Priority regions



Plan of progressive control HPAI in Western Java, 2009

Goals and Purpose indicators:
Reduction of
- human cases in JABODETABEK
- Poultry and human cases in rest of western Java

Strategies Objective for Southern Sulawesi

- Establish a comprehensive and collaborative prevention and control programme managed by local government
- Animal disease surveillance & control systems
- Village level biosecurity and communication
- Commercial industry biosecurity and risk reduction
- Movement management (control) along market chain
- Baseline and ongoing data collection, surveillance and monitoring

Sumatera

- Goals and Purposes
  1. Reduce number poultry outbreaks per province
  2. Test integrated animal disease control program
- Strategies
  1. Enhance government disease surveillance and control capacity across all poultry sectors and marketing systems
  2. Improve poultry movement control in both northern and southern Sumatra

Plan of Control HPAI in Low Incidence Area

(West Nusa Tenggara, Kalimantan, Rest of Sulawesi, Maluku, Papua, West Papua) and Free area (Gorontalo, North Maluku)

Low Incidence and Free Areas

- Goal and Purpose :
  1. Ascertain freedom from disease in very low incidence and free provinces
  2. No HPAI cases in low incidence provinces
- Strategies :
  1. Establish sensitive surveillance and rapid response system
  2. Implement clear policy for establishing and maintaining free provinces
  3. Promote local poultry production and inter provincial cooperation

Programme Management

- Goal and Purpose :

  Improve quality of animal health services and control program management for successful completion of activities within the MoA 2009 National Work Plan for HPAI Control in Animals

Strategies of Programme Mangement

- Increase expertise and human capacity for campaign management
- Integrate management of the nationwide animal control programme under supervision of Directorate of Animal Health
- Improve government support funding and sustainability of HPAI control programme
- Strengthen laboratory support system
- Coordinate targeted research for HPAI control

Annex 6:
Presentation of the Risk Assessment Activity

HPAI PRO-POOR HPAI RISK REDUCTION

Controlling Avian Flu and Protecting People's Livelihoods in the Mekong Region, Africa and Indonesia

Risk Assessment Activity
Phase 1: risk question and risk pathways

Solenne Costard, RVC

Risk Assessment Workshop

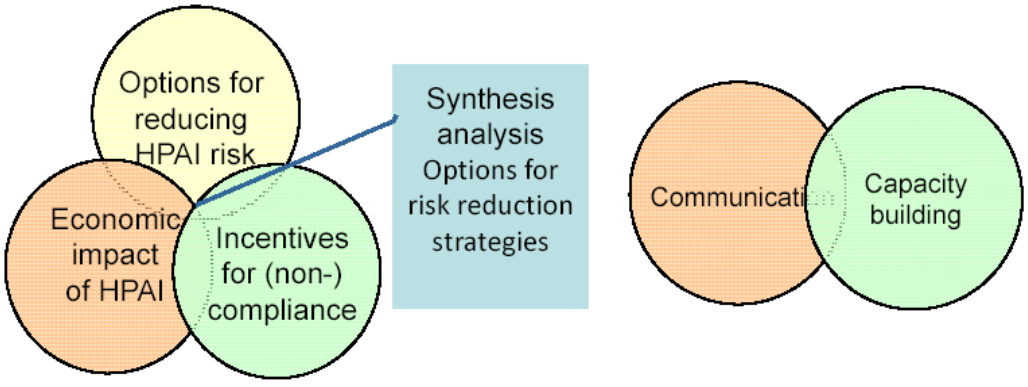
Bogor, 24th – 26th November 2008

A Collaborative Research Project Funded by: DFID Department for International Development

Implemented by: FAO, OIE, RVC, IFPRI, ILRI

HPAI PRO-POOR HPAI RISK REDUCTION

Where does the Risk Assessment Activity fit?



Where does the Risk Assessment Activity fit?

- Disease Risk Theme Activities:
  - systematic literature review of risk factors re HPAI entry and spread
  - risk maps (knowledge-driven approach)
  - risk assessment models for risk question specified with stakeholders, incl. simulation of impact of possible control measures from a disease risk standpoint

    (1st qualitative risk assessment, 2nd quantitative risk assessment if warranted)

Where does the Risk Assessment Activity fit?

- Research domain

  For specific risk questions relating to transmission of HPAI:
  - Description and ranking of mechanisms and steps leading to transmission of HPAI between sectors
  - Identification of "weak points" (step with high risk or influence on overall risk) for control measures
  - Outputs used in economic , institutional, and synthesis analyses to define disease control policy

Controlling Avian Flu and Protecting People's Livelihoods | Africa, Indonesia, Mekong Region.

Where does the Risk Assessment Activity fit?

- "Non-Research Domains"
  - Communication: risk question and risk pathways, discussion of outputs
  - Capacity-building: risk assessment methodology and applications

Aim of the Risk Assessment Activity

- Provide support to HPAI-related risk assessment and management in Indonesia
- Successive phases:
  - Phase 1: define risk question and risk pathways
  - Phase 2: develop qualitative risk assessment model for HPAI in Indonesia
  - End of qualitative risk assessment, discuss if quantitative approach if warranted (then 3rd phase)

Ownership

- Indonesian risk assessors and stakeholders
- Technical support from RVC and ILRI

Interests and Applications

- For the risk question and pathways considered:
  - ranking => high risk pathways/processes
  - weak links identified for control measures
- Outputs provide basis for development of HPAI control strategies:
  - Inputs from economic, institutional, and synthesis analysis
  - Testing of different control methods and combinations and how they reduce risk

Interests and Applications *(cont.)*

- Capacity building: ability to conduct a risk assessment to inform the development of surveillance / control strategies
  - Other risk questions
  - Other diseases

Risk Assessment Team

- Risk Assessment Facilitators
- Country coordinator
- Activity Leader

+ Stakeholders
+ Other actors of the project:
  VCA Team (Data Collection)
  People working on synthesis analysis

Stakeholders

- Involvement of stakeholders:
  - Defining risk question
  - Outlining risk pathways & data needs
  - Providing data
  - Discussing outputs and implications

- Technical support from ILRI/RVC:
  - Facilitating definition of risk question and risk pathways
  - Providing methodological support for qualitative risk assessment (data collection and data analysis)

Timeline (1/2)

- Risk Pathways and Data Needs:

<table>
<tr><td>24 – 28 Nov 08</td><td>Risk Pathway Workshop
Writing up of report:
Risk question and pathways
Data needs and Sources</td><td rowspan="2"></td></tr>
<tr><td>1 – 5 Dec 08</td><td>Review of reports on risk pathways (AL & External reviewer)</td></tr>
<tr><td>8 – 12 Dec 08</td><td>Amendment of country reports (RAF + support EC + follow-up AL)</td><td rowspan="2">Value Chain Analysis:
Qualitative Data Collection and Analysis
Dec - January 2009</td></tr>
<tr><td>15 – 19 Dec 08</td><td>Deadline for final risk pathways reports (RAF / EC)
Circulation to stakeholders</td></tr>
</table>

Timeline (2/2)

- Qualitative Risk Assessment:

Jan-09	Data Collection *(RAF - VCA)*	Value Chain Analysis: Qualitative Data Collection End January 2009
Feb-09	Risk Estimation & Risk Mitigation *(RAF with technical support AL/EC)* Writing-up report *(RAF with support EC)*	
Mar-09	Deadline for country reports on Qual. RA *(RAF/EC)*	
Apr-09	Review of reports on qual. RA *(External Reviewer)*	
	Amendment of reports on Qualitative Risk Assessment *(RAF with support EC, review AL)*	
May-09	Deadline for final country report Circulation to stakeholders *(RAF / EC)*	

Annex 7:
Introduction to Risk Assessment

12/3/2008

Controlling Avian Flu and Protecting People's Livelihoods in the Mekong Region, Africa and Indonesia

Introduction to Risk Assessment

Solenne Costard, RVC
Bogor, 24th November 2008

Overview

- Concepts:
  - Risk
  - Hazard
  - Risk Analysis and Risk Assessment
- Approaches to Risk Assessment:
  - OIE vs Codex Alimentarius Framework
  - Qualitative vs Quantitative
- Risk Assessment Methodology
  - Requirements
  - Main steps

Concepts

- Risk:
  - a situation involving exposure to danger
  - the possibility that something unpleasant will happen

Compact Oxford English Dictionary of Current English

Concepts *(cont.)*

- Hazard:
  - A biological, chemical or physical agent in, or condition of, food with the potential to cause an adverse health effect (Codex Alimentarius Commission)
  - A condition or physical situation with a potential for an undesirable consequence (Society for Risk Analysis)

Concepts *(cont.)*

- Risk vs Hazard:
  - Hazard: something with the potential to cause harm.
  - Risk: the likelihood of occurrence and the magnitude of consequences of a specified hazard being realized.

Concepts *(cont.)*

- Risk Analysis:
  - analytical process to provide information regarding undesirable events;
  - process of estimating probabilities and expected consequences for identified risks.
  - detailed examination including risk assessment, risk evaluation and risk management alternatives, performed to understand the nature of unwanted outcome;

Society for Risk Analysis
http://www.sra.org/resources_glossary

Concepts *(cont.)*

- Risk Analysis.

  A process undertaken to deal with matters which pose a potential danger, managed according to certain standard procedure and that involves:

  - Hazard Identification
  - Risk Assessment
  - Risk Management
  - Risk Communication

Concepts *(cont.)*

- Hazard Identification.

  Identification of the hazard(s) (something potentially harmful) in the given context

  - List of pathogens / adverse agents associated with the product(s) of interest
  - List of disease(s) in the species / exporting areas

Concepts *(cont.)*

- Risk Assessment.

  The process of evaluating the risk resulting from a hazard (probability of occurrence and magnitude of consequences).

Concepts *(cont.)*

- Risk Management

  - Based on the results of the risk assessment and the judgement of the 'risk managers', decisions are taken and policy is formulated.
  - Risk management is the process of weighting policy alternatives in consultation with all interested parties considering risk assessment and other factors (institutional context, economic analysis, etc.).

Concepts *(cont.)*

- Risk Communication

  Information exchange between risk assessors, risk managers and those affected by both the risk and the decisions taken before the final policy decisions are taken.

Concepts *(cont.)*

- Risk Assessment is only one part of the Risk Analysis process:

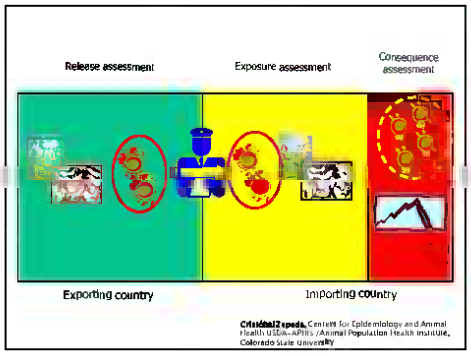
Approaches to Risk Assessment

- Main systems used in animal health, food safety, veterinary public health:
  - OIE International Animal Health Code
  - Codex Alimentarius Commission
- Different systems, developed to answer different types of risk questions:
  - OIE: Versatile, used to address risk questions of different types
  - Codex: Designed to answer questions in relation to maximum levels of substances or pathogens; main focus: microbiological food safety assessment

Approaches to Risk Assessment

- **OIE** International Animal Health Code

  The risk assessment includes the following steps:
  - **Release assessment**: description of biological pathways for release of hazard and estimation of its probability.
  - **Exposure assessment**: description of biological pathways necessary for exposure of humans / animals to the hazards released and estimation of its probability.
  - **Consequence assessment**: description of relationships between exposures to hazards and consequences of those exposures (biological, economic, etc.).
  - **Risk estimation**: Integration of results from previous 3 steps to produce overall measures of risk associated with the hazards



Risk Analysis Components (after OIE Animal Health Code)

Approaches to Risk Assessment

- Qualitative vs Quantitative Approach

  The risk estimate can be presented either:
  - Qualitatively: the evaluated risk is described in words. The estimate of risk is ranked or separated into descriptive categories.
  - Quantitatively: the evaluated risk is estimate numerically; numerical expressions of risk are provided.

Qualitative Risk Assessment

When:

- As a 1st step, before quantitative approach.

  Results -> rule out some pathways, identify non-negligible risk requiring quantification, or gaps in knowledge, etc
- When numerical data is not available
- When risks perceived do not justify time and effort required with the quantitative approach...

What:

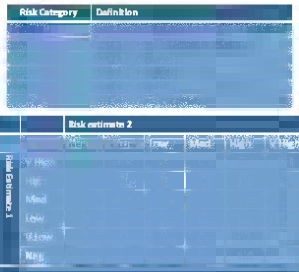
- Import policies,
- Surveillance activities,
- Etc.

⇒ Common approach to support routine decision-making

Requirements for Risk Assessment

- Clear definition of terms:
  - Risk question
  - Hazard identification
  - Qualitative risk assessment: risk categories and combination matrix
- Transparency:
  A risk assessment must be clearly set out, transparent and fully referenced in the resulting report

Requirements for Risk Assessment



Main steps of Risk Assessment

- Framing the risk question
- Identifying the hazard(s)
- Outlining the risk pathways
- Identifying data needs
- Collecting data
- Assessing the risk

Main steps of Risk Assessment

- Framing the risk question.
  The risk to be assessed should be clearly defined
- Points to consider.
  - What is the specific hazard of concern?
  - What specific risk do we want to assess?
  - What particular time frame are we interested in?

- If not specific enough, a risk question can be interpreted in different ways:
- Ex. What is the risk for the introduction of HPAI H5N1 (through migratory birds / poultry trade / wild bird trade ?) into (wild bird / domestic / human population?) in (Indonesia / Greater Jakarta/?)

Main steps of Risk Assessment

- Identifying the hazard(s):

Hazard may be explicit in risk question
  - Ex. What is the risk of importing Pathogen X in this group of animals?

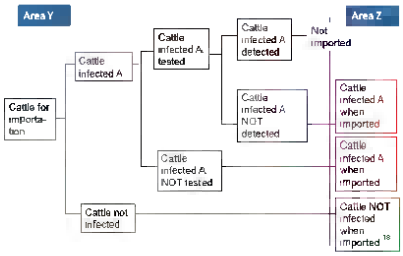
Otherwise full hazard identification must be undertaken

Main steps of Risk Assessment

- Outlining the risk pathways:

  A Risk pathway is the framework on which to base the risk assessment, describing all stages in the biological process that lead to the outcome of interest

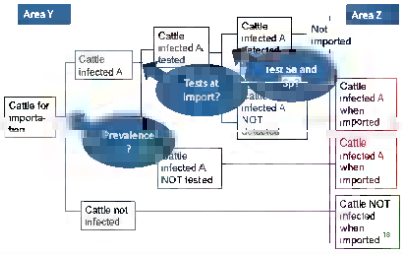
  - list all steps required for the risk to occur, differentiating release, exposure and consequence
  - report your underlying assumptions



Main steps of Risk Assessment

- Identification of data needs.

  The data required to assess the likelihood of occurrence of each step of the pathway must be identified.



Main steps of Risk Assessment

- Data collection:
  - Different sources of information.

    literature, experimental, expert opinion. .
  - Consider validity.

    Most up-to-date

    Estimates of prevalence from surveillance systems,

    Expert opinion

    => Best available data should be used
  - Fully referenced (transparency)
  - For Qualitative approach, no new data collected; rather identification gaps in knowledge

Main steps the Risk Assessment

- Assess the risk.

  Once the relevant information for the different steps is collected the overall risk is assessed
  - For qualitative risk assessments a logical overall conclusion will be reached based on the probability of occurrence of each of the individual steps. The final risk estimate would be expressed in words
  - For quantitative risk assessments. An overall probability of the unwanted outcome will be given in mathematical terms

Main steps of Risk Assessment

- Qualitative risk assessment:
  1. Describe data
     - In concise and objective manner
     - Avoid opinion or interpretation
  2. Interpret data
     - Analyse information for each step
     - Estimate risk category
  3. Organise information

Risk pathway step	Data Need	Source of Information	Risk Category
Risk of cattle from Area Y being infected	Prevalence data in Area Y	Surveillance data (Year [2006])	Moderate
Risk of [illegible] not being tested at importation	Frequency of correct importation	Expert Opinion	[illegible]
Risk of an infected cattle not being detected	Test characteristics (se and Sp)	Literature: Xavier et al., 2007	Very Low

Main steps of Risk Assessment

- Qualitative Risk Assessment *(cont.)*.
  4. Estimate risk for Release, Exposure and Consequence Assessment

     Combine parameter estimates using pre-defined matrix
  5. Combine risks from Release, Exposure and Consequence Assessment

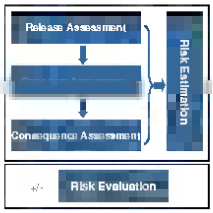
     ⇒ Deduct Overall Probability of Occurrence of the risk considered and of unwanted consequences
  6. Formulate conclusion

Main steps of Risk Assessment

- Qualitative RA:
- Review information available and estimate risk for each step
- Combine risk estimates using pre-defined combination matrix
- Deduct the overall probability of occurrence of the risk of interest and of unwanted consequences
- +/- decide whether this risk is acceptable or not

NB. "low" or "negligible" risk does not imply "acceptable risk" (e.g. when severe consequences for human population)

- OIE Framework (Import Risk Analysis)

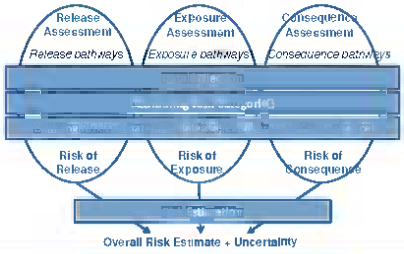


Main steps of Risk Assessment

- Dealing with Uncertainty

Uncertainty category	Interpretation
Low	Valid and complete data available; strong evidence provided in multiple references, authors report similar conclusions
Medium	Some but no complete data available; evidence provided in a small number of references, authors report conclusions that vary
High	Scientific data available; evidence not provided in references but rather in unpublished reports or based observations, or personal communication, authors report conclusions that vary considerably between them

Qualitative Risk Assessment



Additional remarks

- Communication between experts and stakeholders is crucial.
  - Agreement on specific risk question(s)
  - Team effort
- Risk pathways are essential (meaningful diagrams)
- Consider conditionality of risk pathway components
- In order to limit the subjectivity of the assessment, it needs to be transparent and fully referenced

Additional remarks

In our context:

- Qualitative risk assessment ⇒ Estimation of the overall likelihood of occurrence of the adverse event considered and its biological consequences
- Identification of the pathways and steps of the pathways having high risk of occurrence / high impact on overall risk estimate
- From an epidemiological standpoint, where (on what steps/processes) to focus control efforts

Examples of risk pathways

- What is the risk for human health from the handling/consumption of wild games?

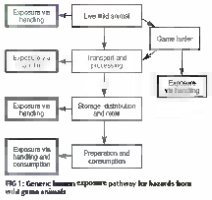
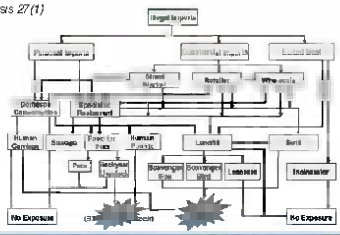


FIG 1: Generic human exposure pathway for hazards from wild game animals

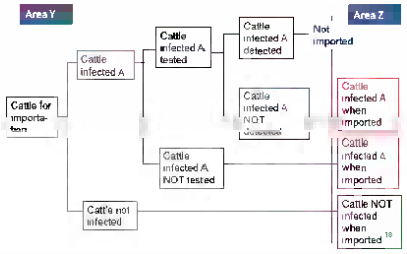
Coburn, H L Snary E L *et al.* (2005) Qualitative risk assessment of the hazards and risks from wild games. Vet recoid 157(11) 321-322

Examples of risk pathways

Hartnett E., Adkins A *et al (2007) A quantitative assessment of the risks from illegally imported meat contaminated with Foot and Mouth Disease Virus to Great Britain. Risk Analysis 27(1)*



Example: how to combine risk estimates



Example: how to combine risk estimates

Risk pathway step	Data Need	Source of Information	Risk Category

	Risk estimate 2	
Risk Estimate 1		

Overall Release Estimate: Combination of Parameter 1 and 2, and then Parameter ½ and 3

Parameter 1/2 = M x H to VH => L

Release Estimate = L x VL => N

Acknowledgments

- Pr Dirk Pfeiffer
- Dr Javier Guitian
- Dr Barbara Wieland
- Dr Cristobal Zepeda
- Raphaelle Metras

Annex 8:
Integrating CBA with Risk Assessment for the Synthesis Analysis.

HPAI PRO-POOR HPAI RISK REDUCTION

Controlling Avian Flu and Protecting People's Livelihoods in the Mekong Region, Africa and Indonesia

Integrating CBA with Risk Assessment for the Synthesis Analysis

Marites Tiongco
Clare Narrod
November 24-27, 2008

A Collaborative Research Project Funded by: DFID Department for International Development
Implemented by: FAO, IFPRI, ILRI

HPAI PRO-POOR HPAI RISK REDUCTION

Facts versus fears: Understanding perceived risk

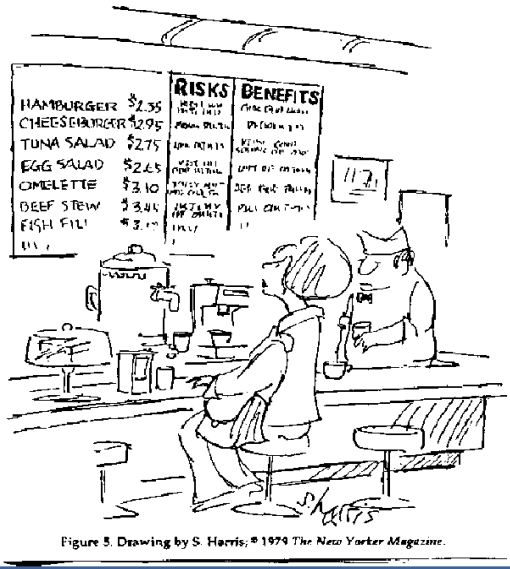
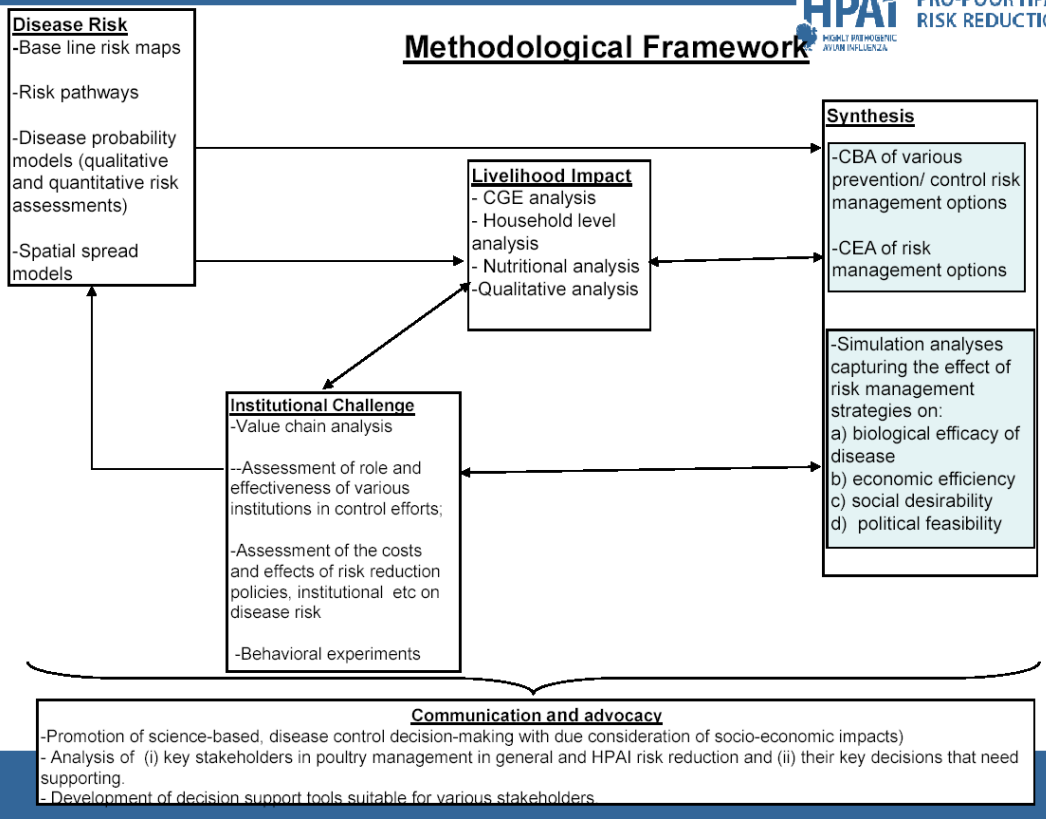


Figure 5. Drawing by S. Harris; © 1979 *The New Yorker Magazine*.

PRO-POOR HPAI RISK REDUCTION

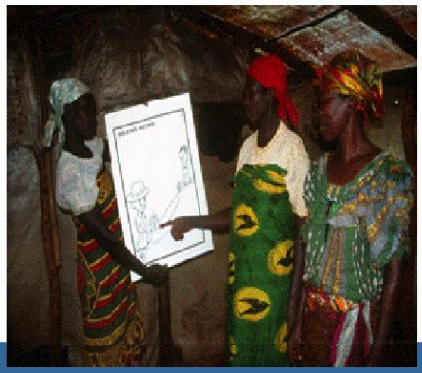
Methodological Framework



PRO-POOR HPAI RISK REDUCTION

Goal of the synthesis analysis

- To help governments to make informed decisions regarding HPAI control that minimize the impact on the poor.



Synthesis analysis work stream

- CBA/CEA associated with various prevention/ control measures (household, along value chain, institutional level).
- Simulation analyses capturing the effect of various risk management strategies on:
    - biological efficacy of disease
    - economic efficiency
    - social desirability
    - political feasibility
- Develop a decision tool utilizing all outputs to evaluate the spatial distribution of effects from HPAI and its control.

Cost benefit analysis

- Typically used by governments to evaluate the desirability of a given intervention in markets.
  – Understand the efficiency of the intervention relative to the status quo in an objective quantitative way of determining whether protections should be initiated, continued, or abandoned.

Economic efficiency

- Measured as the net contribution of an intervention to overall social welfare.

- For governments, acceptable (intervention) policies typically are when:

$$E(\text{Benefits}) \geq E(\text{Costs})$$

Optimal measure is:

$$E(MB) = E(MC)$$

Cost benefit analysis (CBA)

- Estimate the direct costs of control measures through data collection in study countries through household, value chain, and institutional surveys (analyzed synthesis analysis work stream)

Spread sheet model

$$C = L + R + P$$

Where:

C = direct cost per year

L = annual loss in expected outputs and wasted inputs due to disease

R = the increase in expenditures on non-veterinary recourses due to the disease

P = annual cost of disease prevention measures

Control methods in Indonesia

- Active and passive surveillance
- Ban on the movement of poultry and poultry products in and out of the infected area.
- Culling of affected and in-contact animals
- Paid compensation to layer farms with less than 10,000 hens and broiler farms with less than 15,000 bird per cycle
- Public awareness campaign
- Selective vaccination
- Closure of wet poultry markets in the area

Data needs for CBA

- Cost of improved biosecurity at household level (changes in housing structure, keeping wild birds from accessing feed and water supplies, thorough cleaning of all clothing, shoes, an equipment before coming into contact with birds); Costs for testing and diagnosis, and routine serology
- Vaccination costs and frequency, if done
- Education and technical assistance; public awareness campaign costs; training costs
- Surveillance costs to promote rapid disease reporting (farm level and value chain level) (public and private costs)
- Labor and distribution cost of control measures such as number of veterinary officers, assessors, cull teams, control strategy teams, travel requirements, disposal capacity (fed ministry)

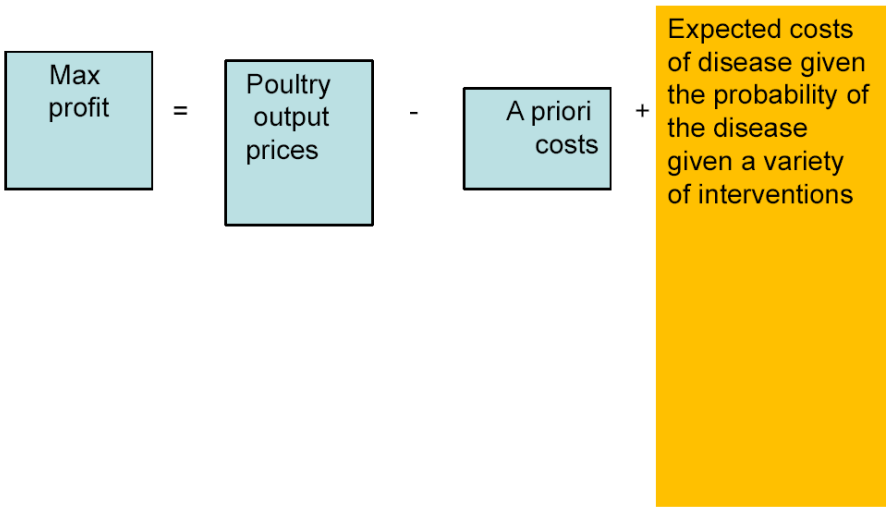
Data needs (cont)

- Laboratory costs – budgets of vet institutes or private labs
- Compensation costs and eradication estimates (could be based on compensation paid out)
- Cost of depopulation and appropriate disposal, and loss of market value in the event of an outbreak
- Decontamination costs/cleaning and disinfection of infected and culled premises
- Disposal costs and associated transportation costs (incinerations, on-farm disposal, or off farm disposal)
- Travel and subsistence of staff working in the field, and salary of culling teams

Bio-economic simulation modeling approach

- Using Breukers, et al.'s (2008) method to assess the changes in outcomes from alternative disease management options
  - Adapted to simulate the propagation of disease through the supply chain with an economic consequences model and a cost-benefit analysis to create a cost-effectiveness trade-off curve that can inform policy decisions

Bio-economic model



Outputs of CBA

- Distribution of benefits and costs of HPAI control measures among different groups
- Excel spreadsheet model that estimates costs and benefits of control measures for decision makers to use
- Bio-economic model
- Decision toolkit comprising a set of possible consequences of one course of one action versus another (CEA)

Simulations

- No intervention - baseline
- Improved surveillance and increased flock segregation (including improved biosecurity and changes in patterns of poultry/people movement)
- Stamping out strategy
- Modified stamping, only culling animals with clinical signs
- Vaccination (once, twice, targeted, ring vaccination)
- Movement restrictions (live market and poultry movement)
- Targeted pre-emptive depopulations
- Combination of strategies

Annex 9:
Risk Question

Second day summary

PRO-POOR HPAI RISK REDUCTION

Risk question: Risk of transmission of HPAI between/within small scale (independent/contracted) broiler farms and backyards.

TBD village vs .household level (backyards)

Study location RA, VCA, CBA: West Java, Bogor

- preferred by CMU, in accordance with current control priorities/programmes
- poultry density, previous studies (VCS Jakarta, commercial farms, Dutch study ect.)
- logistics, RAF team located here, CBA expert, VCA (hopefully recruited form Bogor, previously involved in Jakarta VCS)

Annex 10:
Presentation of the Spatial Modelling Activity

12/3/2008

Some thoughts on

Spatial modeling

Frank Hansen

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

What's a model?

- "useful representation" (Starfield 1997)
- whenever you represent a system in any way and learn something from it you got yourself a model

What can models do?

- help us understand a system
- describe a system
- predict long term dynamics from snap-shot data
- → predict systems reaction to interference
- → develop resource-efficient control measures

Ok, so modeling is good, bagus. But why spatial modeling? It's soo complicated!

What's epidemiology?

- spatial
- distribution of diseases in populations as well as factors influencing their occurrence

Thrusfield, M (1995) Veterinary Epidemiology Blackwell Science

- epidemiology is the ecology of diseases

„Unter Oecologie verstehen wir die gesamte Wissenschaft von den Beziehungen des Organismus zur umgebenden Außenwelt."

Ernst Haeckel 1866

"ecology is the science of the relationships of the organism to the surrounding world"

Some more points about space in epidemiology

- "spread" of disease
- host populations are distributed in space
- direct transmission:
  - =2 animals must be in the same point in space at the same time
- indirect transmission (e.g. via parasite eggs):
  - =2 animals must be in the same point in space at different times
- indirect transmission (e.g. vectors):
  - an infected host and a vector must be in the same point in space, same time
  - a susceptible host and a vector must be in the same point in space, same time

Disease dynamic is a spatial process!

and therefore should be modeled spatially

What kind of models are we talking about?

Agent-based, spatially-explicit dynamic system model

- Agent = things; entities that are individually represented in a model
- Agents have individual characteristics (age, infection history, position, ...)
- Spatially-explicit: things have a position in space
- The spatial position of agents influences what happens to them
- Dynamic system model
- Set of agents and a set of processes that change state of agents
- Processes are applied periodically (time discrete), state of agents updated

Highly flexible, widely used in ecology, no restrictions by math

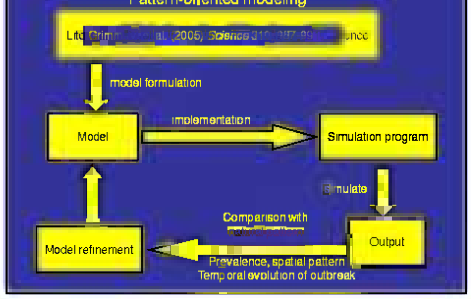
How do spatial models look like?

grid-based models, generalization of cellular automata

- landscape divided into uniform squares (grid cells)
- size of grid cell determined by ecological factors
- homogeneity within grid cells
- grid cells can be farms, areas, ...
- can have different characteristics (risk factor map)

- animals (as agents)
- live within grid cells
- travel between grid cells
- risk pathways modeled between grid cells

How are these models analyzed?
Pattern-oriented modeling



What do we need to make such a model for HPAI in Indonesia?

- spatial data on risk factors (Solenne)
- spatial data on poultry population, i.e. poultry production industry

A new idea on modeling spatial spread of disease
2 ways to model spatial spread of disease

Grid and Spatial spread kernel

Networks

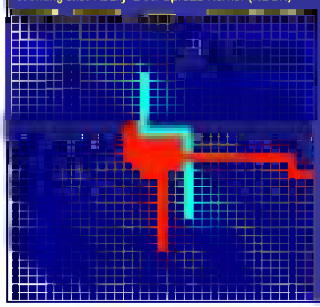
Nodes: farms, markets, villages ...
Connections: streets, airways, ...

ignores topology

ignores "matrix"

Combine these two ways: eccentric, individual spread kernels
Working title: Really Cool Spread Kernel (RCSK)

using transport resistance



- considers topology and matrix
- 2d map
- each grid cell includes 2d map
- → 4d map
- add temporal dynamic
- → 5d model
- huge computational effort
- huge amounts of data to be handled

Some RCSKs for Nigeria

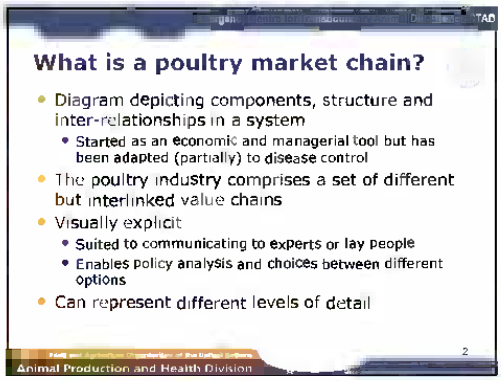
A Demonstration for Nigeria

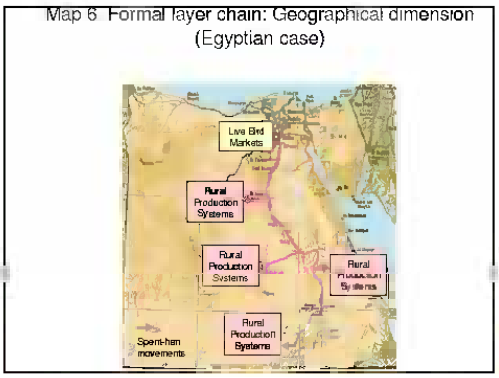
- no risk maps, just homogeneous landscape
- no risk pathways, just simple spatial spread kernel
- culling:
  - detection at 10% prevalence
  - 5 grid cells culling radius

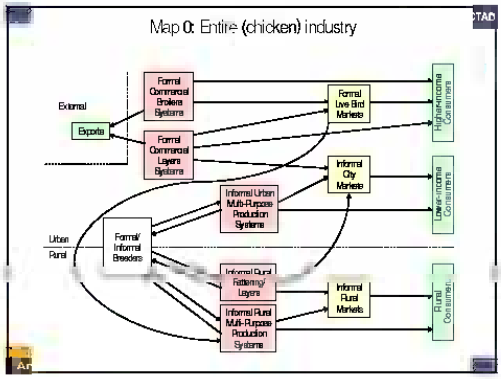
→ all very crude

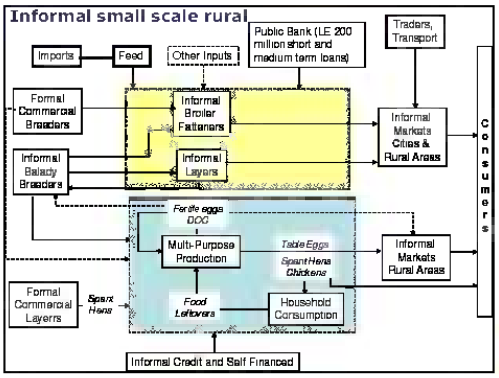
Not a simulation model, just a demonstration!

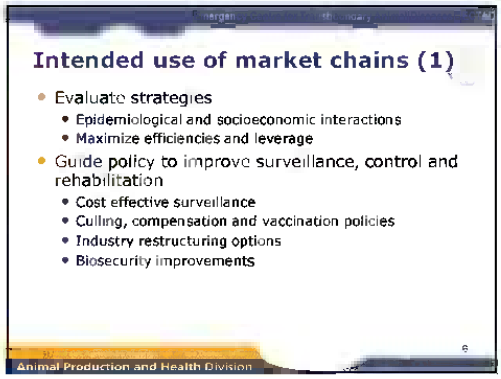
Annex 11
Presentation of Poultry Market Chains conducted in Indonesia











Intended use of market chains (2)

- Facilitate analysis
  - Where to outbreaks concentrate?
  - Where do risks concentrate?
- Effects of interventions
  - Impact on disease
  - Effects on industry
  - Effects on vulnerable groups
- Communication tool
  - Lay audience
  - Experts

7

Animal Production and Health Division

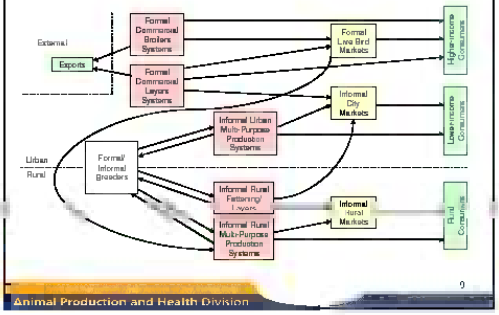
Market chain subsets

- Sector subsets eg
  - Commercial layer
  - Commercial broiler
  - Farmed ducks
  - Village chickens
  - Song birds
  - (fighting cockerels; wild birds)
- Information subsets
  - Overview
  - Volume
  - Value
  - Relationships
  - Current control
  - Risks

8

Animal Production and Health Division

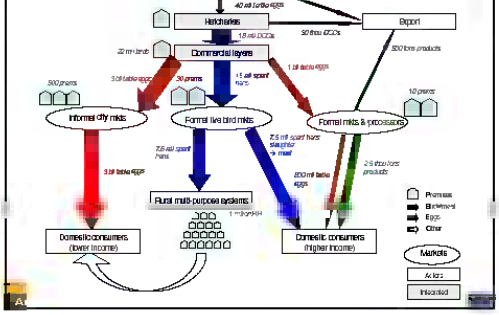
Map 0 Entire (chicken) industry



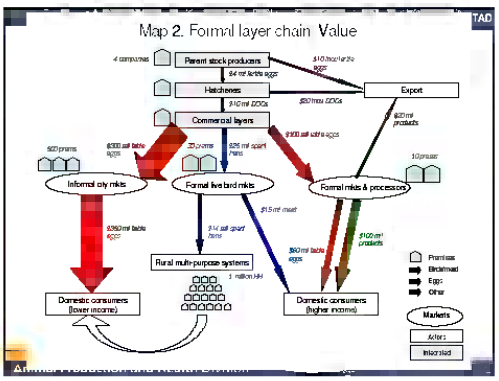
9

Animal Production and Health Division

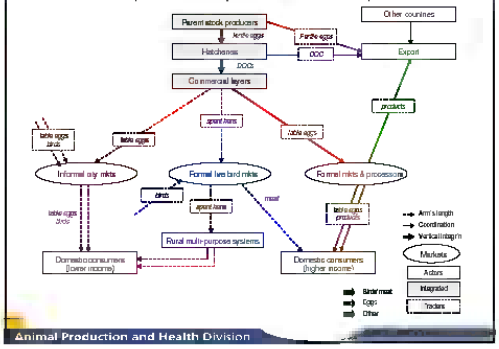
Map 1. Formal layer chain: Volume



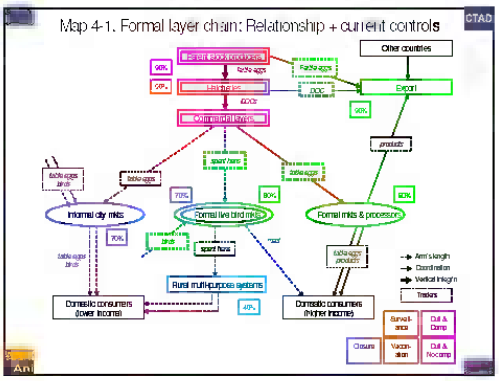
Map 2. Formal layer chain: Value

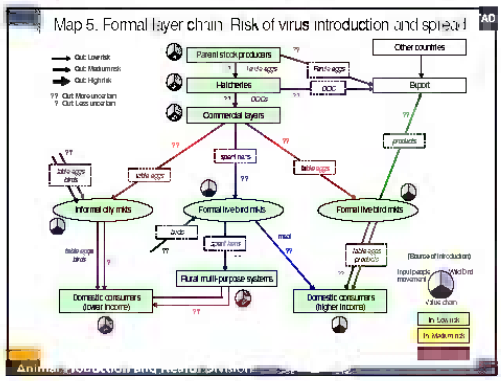


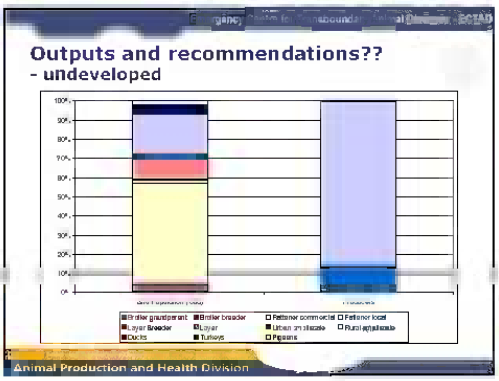
Map 3. Formal layer chain: Relationship

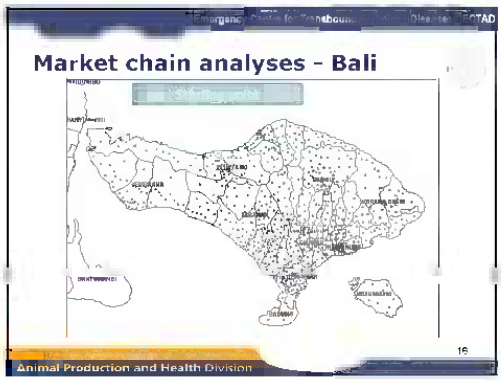


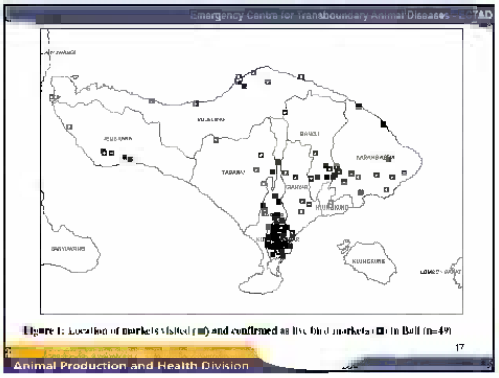
Animal Production and Health Division

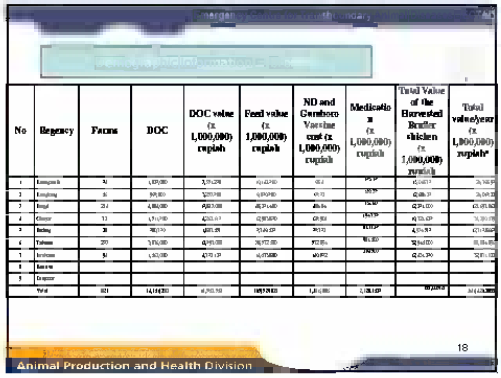

Map 4-1. Formal layer chain: Relationship + current controls
Other countries
Export
Hatcheries
DOC
Commercial layers
Informal city mkts
Formal live bird mkts
Formal mkts & processor
Rural multi-purpose systems
Domestic consumers (lower income)
Domestic consumers (higher incomes)
Arm's length
Coordination
Vertical integrn
Traders
Surveillance
Culling & Dump
Closure
Vaccination
Culling & Re-stock


Map 5. Formal layer chain: Risk of virus introduction and spread
Other countries
Export
Hatcheries
Commercial layers
Informal city mkts
Formal live bird mkts
Formal live bird mkts
Rural multi-purpose systems
Domestic consumers (lower income)
Domestic consumers (higher income)
In Low risk
In Medium risk


Outputs and recommendations??
- undeveloped
Animal Production and Health Division


Market chain analyses - Bali
16
Animal Production and Health Division


17
Animal Production and Health Division

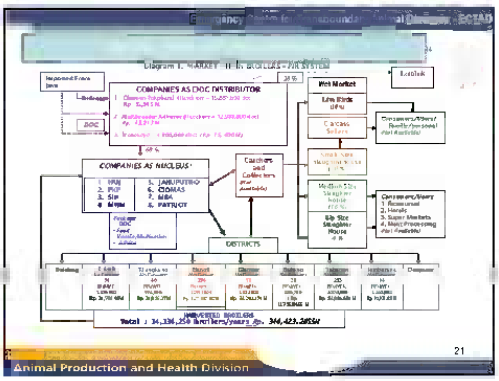

No
Regency
Farms
DOC
DOC value (x 1,000,000) rupiah
Feed value (x 1,000,000) rupiah
ND and Gumboro Vaccine cost (x 1,000,000) rupiah
Medicatio n (x 1,000,000) rupiah
Total Value of the Harvested Broiler chicken (x 1,000,000) rupiah
Total value/year (x 1,000,000) rupiah*
18
Animal Production and Health Division

No.	Regency	PIR (Nucleus and Plasma) System	Independent System
1	Denpasar	-	1
2	Badung	28	5
3	Tabanan	253	6
4	Gianyar	72	7
5	Klungkung	46	-
6	Bangli	274	-
7	Karangasem	54	17
8	Jembrana	94	4
9	Buleleng	-	6
Total		821 (94.4%)	46 (5.6 %)

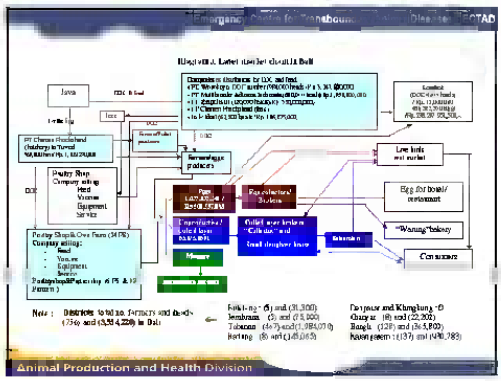
Animal Production and Health Division

Regency	Large (cap. 2000/day)	Medium (cap. 500/day)	Small (house hold)a (cap. < 100 /day)
Denpasar	-	8	36
Badung	-	1	150
Tabanan	1		15
Gianyar	-	-	2
Klungkung	-	-	2
Bangli	-	-	4
Karangasem	-	-	18
Jembrana	-	-	16
Buleleng	-	-	49
Total	1 (0.3%)	9 (3%)	292 (96.7%)

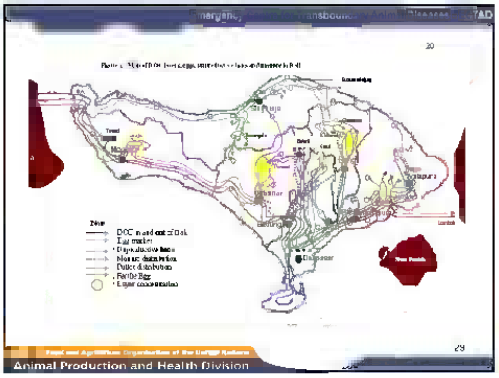
Animal Production and Health Division



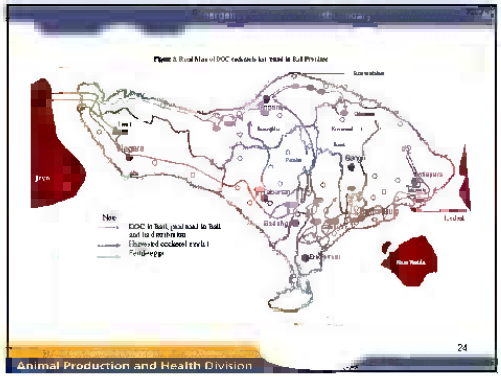
Animal Production and Health Division



Animal Production and Health Division



Animal Production and Health Division



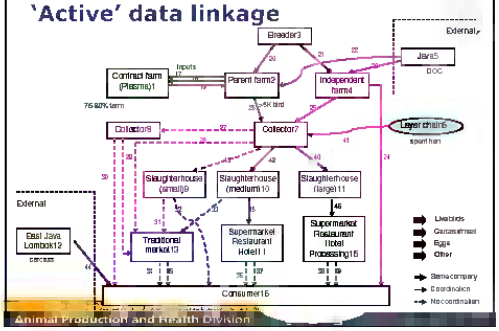
Animal Production and Health Division

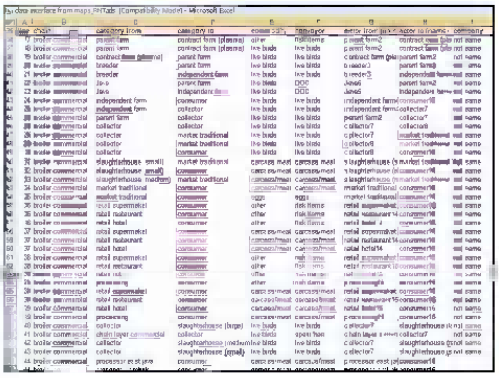
•Nice pictures
•Summary tables
•Explanatory text

BUT

'Frozen data' a major weakness
- Restricts analysis
- Limits conclusions/recommendations
- Restricts modeling options
- Poor interface for risk analysis

'Active' data linkage





Summary: Potential usage

Strengths
- Multidisciplinary
- Governance
- Inter-linkages
- Leverage
  - Trickle down effects
- All players represented
- Detail can vary
- Excellent communication tool
  - attractive

Weaknesses
- Can be 'busy'
- Lack detail
- Proliferation of maps (25+)
- Not all linkages are explicit, or easy
- Must still use other techniques (C-B etc)
- *Does not easily address risk

Where to now?

- Three market chain analyses in Indonesia
  - Bali (2007)
  - Medan (2007)
  - Jakarta (2008)
- Same basic model, but variable application
- How best to use the data?
  - Local usage for specific purposes
  - Mainly demographic usage
- Attempt 'higher usage', with 'active data'
  - Risk
  - Socioeconomic effects
  - Strategy and policy

Thank you

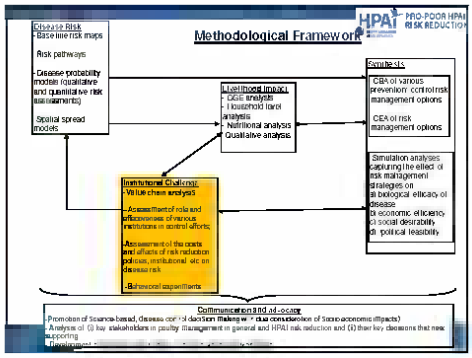
Annex 12:
Presented of the VCA Activity

12/3/2008

Controlling Avian Flu and Protecting People's Livelihoods in the Mekong Region, Africa and Indonesia

Value Chain Analysis: Key Concepts and Ideas

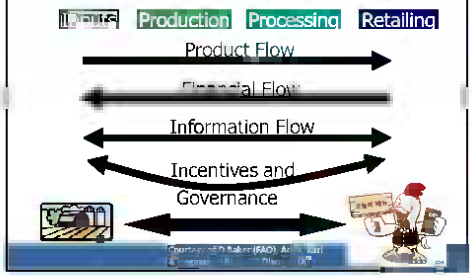
Presented by:
Marites Tiongco, IFPRI



Value chain analysis

- Value chain analysis is an analytical tool that helps to understand the way in which firms (large and small) are integrated and linked in the value chain. The value chain describes a full range of activities which are required to bring a product or service from the time the product is only an idea to the time when it is produced, processed, delivered to final consumers, and disposed of after use (Kaplinsky and Morris 2000).

Concepts – critical dimensions of a value chain



Key issues in value chain (concepts) analysis

- Issue 1. Mapping the value chain
- Issue 2: Governance in the value chain
- Issue 3. Identify opportunities for *upgrading* in the value chain
- Issue 4. Distributional issues

Issue1 : Mapping the value chain

- Idea: identify actors, assess the characteristics of actors, profit, and cost structures; flows of products throughout the chain, employment characteristics; and the destination and volumes of domestic and foreign sales
- Key constructs: barriers to entry in the chain, economic rents, typologies of chain actors based on income; multiplicity of different chains based on relationships, etc

Issue 2: Governance in the value chain

Idea: Identify the structure of relationships and coordination mechanisms that exist between actors in the value-chain.

- Key constructs:
  - Who decides what is produced (buyer vs. producer chains)
  - How the rules of trade are determined
  - The nature of relationships between the participants
  - Coordination mechanisms (contracts, market sales, etc)
  - The extent of chain "power," based on the relative size of a particular actor, share of chain profits, or control over a key technology

Issue 3: Identify opportunities for *upgrading* in the value chain

- Idea: What are the prospects for adding value for specific actors in the chain? (innovation and value creation)
- Key constructs:
  - Process upgrading: improving efficiency through new processes
  - Product upgrading: introducing higher-value products
  - Functional upgrading: changing the mix of products or activities within a firm to add value
  - Chain upgrading: moving into new chains altogether

Issue 4: Distributional issues

- Ideas: Who gains and who loses in value chains? How is value-added distributed among chain participants?
- Key constructs: Analysis of margins and value-added, identification of ways to improve shares
- What was the general perception of the impact on AI on different stakeholders in the poultry value chain, including the impact on prices, volumes sold, etc. of competing value chains (e.g., poultry), and on consumers?

How a value chain approach helps

- Effective in tracing product flows, showing the value adding stages, identifying key actors and the relationships with other actors in the chain
- Helps to identify all the enterprises that contribute to the production of a good or service and shows what institutions are needed to support the enterprises

How a value chain approach helps

- Helps to identify all the enterprises that contribute to the production of a good or service and shows what institutions are needed to support the enterprises
- Helps policymakers and entrepreneurs find out which parts of the chain are holding up progress – which bottlenecks deserve priority attention

How a value chain approach helps

- Identifies strategies to help local enterprises compete and to improve earning opportunities
- Helps to identify and select relevant stakeholders for programme planning and provides a framework for sector-specific action
- Helps develop and strengthen effective disease prevention and control policies and interventions

Five Typical Action Areas in a Value Chain

- Selection of sector and value chains
- Value chain mapping
- Consultation with lead firms and other chain participants
- Participatory value chain analysis
- Stakeholder validation and planning workshops

Mapping the Chain

- In most cases there are several maps
  - Initial map (straw dog map?)
  - Refining the map
  - Detailed maps
- Researchers need to make decisions on what to map in charting a path through complex value chains

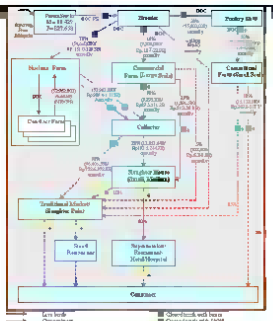
Mapping the Chain

- Drawing the first maps and identifying risk factors
  - In most cases there are several maps; Researchers need to make decisions on what to map in charting a path through complex value chains
- Collecting data
- Describing the industry structure, refining and completing the maps
- Conducting analyses (qualitative and quantitative)

Value of Mapping

- Gives a visual representation of the basic relationships between value chain actors, and the flow of goods from raw material supply to the end consumer market
- Helps to get a grasp of complicated realities
- Helps to identify bottlenecks and control points
- Helps to address disease (HPAI) policy issues

- Can start with a generic qualitative VC analysis
  - identify structure of flows, markets, networks, and relative importance/ interactions between sectors 1-4



VCA for broilers in North Sumatra

Major VCA activities linked to Risk Assessment and CBA

- Map the value chain for poultry and poultry products including their formal and informal trade routes
- Identify risk factors, potential transmission mechanisms and entry points for mitigating HPAI risk
- Assessment of the market interactions, linkages, and incentives in poultry markets with potential economic/public health effects
- Estimate the cost of control and prevention measures used by key actors to mitigate the risk of HPAI (for example, cost of biosecurity measures).

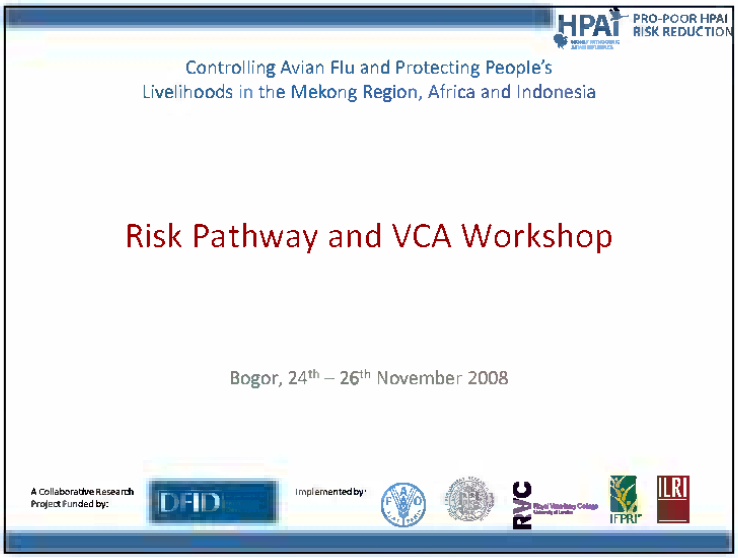
Expected outputs of VCA

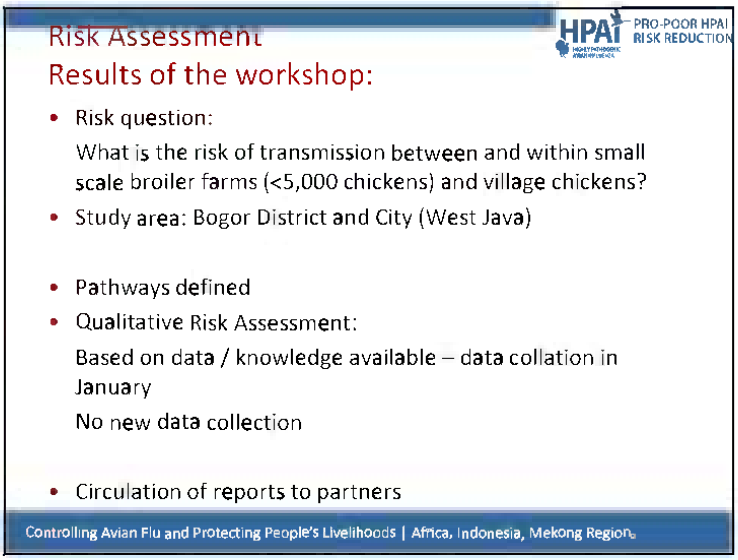
- Simple budgeting-type excel models of costs and margins at each stage of the chain
- VC map that characterizes the structure of the value chain
  - relative importance of specific flows (including trade flows), different actors, and linkages
  - Disease transmission mechanisms
  - Possible entry points for intervention in the value chain
- Final Report

Timelines?

- Identify/finalize teams
- Finalize TORs
- Refine instruments for data collection
- Qualitative data collection and analysis
- Report writing

Annex 13:
Conclusion of the workshop





Risk Assessment: Next Steps

- By 1st week of Dec Draft report on risk question, risk pathways, data needs and data sources (RAF)
- Dec: External Review of report
- By end Dec.
  - Final report on risk question, risk pathways and data (RAF)
  - Preparation of collation of data: preparation of elicitation of expert opinion / interviews, contact key informants to agree on meeting dates (RAF / AL/ CC)
- January: Collation of data available (RAF + follow-up AL/CC)
- February – March: Risk Assessment including recommendation for control measures (March: update using results of VCA), with draft report (RAF, support AL)
- April: External Review of draft report
- End May: final report on qualitative risk assessment including recommendations (RAF)

Risk Assessment: Timeline (1/2)

- Risk Pathways and Data Needs:

24 – 28 Nov 08	Risk Pathway Workshop Writing up of report. Risk question and pathways Data needs and Sources
1 – 5 Dec 08	Review of reports on risk pathways *(AL & External reviewer)*
8 – 12 Dec 08	Amendment of country reports *(RAF + support EC + follow up AL)* Approach for Collation of Data (AL, RAF, EC)
15 – 19 Dec 08	Deadline for final risk pathways reports *(RAF / EC)* Circulation to stakeholders

Risk Assessment: Timeline (2/2)

- Qualitative Risk Assessment:

Jan 09	Data Collation *(RAF VCA)*
Feb 09	Risk Estimation & Risk Mitigation *(RAF with technical support AL/EC)* Writing up report *(RAF with support EC)*
Mar 09	Deadline for country reports on Qual. RA *(RAF/EC)*
Apr-09	Review of reports on qual. RA *(External Reviewer)*
May-09	Amendment of reports on Qualitative Risk Assessment *(RAF with support EC, review AL)*
	Deadline for final country report Circulation to stakeholders *(RAF EC)*

Controlling Avian Flu and Protecting People's Livelihoods | Africa, Indonesia, Mekong Region

VCA next steps

- End Nov/begin Dec: Recruitment Consultant (CC)
- Dec: Questionnaires to be developed (CC, VCA expert, Jonathan)
- January: Rapid Appraisal on Value Chains, Bogor (VCA expert, 2 weeks)
- Draft report VCA available early of Mar 2009, providing of results to RAF
- Final report Apr 2009 (VCA expert, CC)

Controlling Avian Flu and Protecting People's Livelihoods | Africa, Indonesia, Mekong Region

CBA next steps

- End Nov/begin Dec: Recruitment Consultant (CC)
- Dec: Questionnaires to be developed (CC, CBA expert, IFPRI)
- January: Institutional level data collection
- Feb/Mar Farm level data collection (CBA expert, 3-4 weeks)
- Draft report CBA available early of May 2009
- Final report Jun 2009 (CBA
- expert, CC)

Modelling

- Models by October 2008

Minutes of the workshop

HPAI PRO-POOR HPAI RISK REDUCTION

- Presentations
- Main points of discussion
- Plan for next steps
- List of participants with contact details

- Need for a follow-up meeting (by End Of March 2009)
- Need to centralise requests for data (CC) and minimise the number of requests made; need to request data asap (Dec)

- Circulation of information to all participants / partners

Annex 14:
Minutes of the workshop

Risk Assessment and VCA workshop

Bogor, Indonesia, 24-26th November 2008

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1. List of participants (Annex 1)

Monday 24th November

2. Opening address: Elly Sawitri Siregar, HPAI-Campaign Management Unit/CMU, Directorate of Animal Health, DGLS-MoA

The participants were welcomed to the workshop and the overall aim of the DfID Pro-poor HPAI Risk Reduction Strategies Project was presented. It was highlighted that many activities and many projects on HPAI or the poultry sector have already been conducted or were currently on-going in Indonesia, therefore this project should complement rather than duplicate them. It was also stressed that it is important that this project is in line with the National Strategy Work Plan for 2009-2011, which was presented in more details later on the 1st day of the workshop.

3. Presentation of the programme and objectives of the workshop Fred Unger

(Annex 2)

The presentation stressed the efforts made to bring the different activities of the project together, and the necessity to build on the activities that have already been conducted in Indonesia.

4. Overview of the DfID-funded Pro-Poor Risk Reduction Strategies Project Clare Narrod

(Annex 3)

The different streams of activities and links between them were emphasized.

5. Summary of the project's achievements in Indonesia Fred Unger

(Annex 4)

6. Presentation of HPAI related activities in Indonesia Elly Sawitri Siregar

(Annex 5)

The National Strategy Work Plan (NSWP) for 2009 – 2011 was presented, and it was stressed that the project should not duplicate what has been done already, and should be in line with the NSWP.

7. Presentation of the Risk Assessment Activity Solenne Costard

(Annex 6)

The presentation stressed that the RAs are Indonesian decisions and inputs are Indonesian. The project will focus on capacity building so that the RAs can be updated and the technique can be used for other livestock diseases. IFPRI, ILRI and RCV will only facilitate the process and provide technical support.

8. **Introduction to Risk Assessment** Solenne Costard

   (Annex 7)

9. **Integrating Cost-Benefit Analysis with Risk Assessment for the Synthesis Analysis.** Marites Tiongco

   (Annex 8)

10. **Definition of risk question and risk pathways** Facilitation: Solenne Costard, Fred Unger

The participants were asked to determine the risk questions that would underpin the risk assessment for Indonesia.

A risk question had been proposed and was discussed: What is the risk of transmission of HPAI between sector 3 and sector 4 farms?

Points of discussion included the following:

- Sector 3 farms are very varied in Indonesia: from 1,000 to 100,000 animals. Small scale and large scale farms are likely to have different structures and involve different marketing chains. Using information on profiles of farms, it was decided to restrict the risk assessment to the following farms: small-scale broiler farms with less than 5,000 animals and village chickens.

- Based on priorities defined by the NSWP (National Strategic Work Plan), it was decided to restrict the activity to an area targeted by the NSWP: West Java.

- The participants discussed activities conducted in West Java, to make sure the project would not duplicate work conducted there. The study area chosen for the Risk Assessment Activity is the District of Bogor and the City of Bogor **(Annex 9)**

The final risk question participants agreed on is:

What is the risk of transmission within and between small-scale broiler farms of less than 5,000 animals and village chickens, in the District of Bogor and Bogor City?

The risk pathways for this risk question were defined in a participatory manner on day 1 in the afternoon and morning of day 2 (Annex 10 to 13).

Tuesday 25th November

11. **Presentation of the Spatial Modelling Activity** Franck Hansen

    (Annex 14)

12. **Presentation of Poultry Market Chains conducted in Indonesia** Ron Thornton (FAO)

    (Annex 15)

13. **Presentation of the VCA Activity** Marites Tiongco

    (Annex 16)

Wednesday 26th November

14. **Presentation of the Disease Risk Cluster of the DfID Project** Dirk Pfeiffer

15. **Data Needs and Sources of Data** Idris Syafrison and Marites Tiongco

Data required for the Risk Assessment and for the Cost Benefit Analysis were presented and discussed, and sources of information / key informants identified. **Table 1** summarises data needs and sources of information for the Risk Assessment Activity.

16. **Conclusions of the Workshop**

    (Annex 17)

A wrap-up session at the end of the workshop was used to present the main achievements of the workshop (risk question, risk pathways and data needs / sources) as well as the next steps for the Risk Assessment, Value Chain and CBA Activities. There was a consensus that these activities will be targeted on the District and City of Bogor.

Three points were highlighted during this final discussion:

- The minutes of the meetings and the reports should be circulated to all participants and partners;
- A meeting in March was recommended by stakeholders to allow a good follow-up of the different activities of the project;
- Requests for access to data from other studies / projects (RA, VCA, CBA) should be centralised by the country coordinator, and the request should be made as soon as possible.

The workshop was closed on Wednesday 26th November at 3pm.

Annex 15:
Glossary

Source: OIE, 2004: Handbook on Import Risk Analysis for Animals and Animal Products: Introduction and qualitative risk analysis, Vol.I. OIE Publications, Paris. 60p

Consequence assessment: The process of describing the relationship between specified exposures to a biological agent and the consequences of these exposures. A causal process must exist by which exposures produce adverse health or environmental consequences which may in turn lead to socio-economic consequences. The consequence assessment describes the consequences of a given exposure and estimates the probability of them occurring.

Commodity: Animals, products of animal origin intended for human consumption, for animal feeding, for pharmaceutical or surgical use or for agricultural or industrial use, semen, embryo/ova, biological products and pathological material.

Exposure assessment: The process of describing the biological pathway(s) necessary for exposure of animals and humans in the importing country to the hazard (in this case the pathogenic agent) released from a given risk source, and estimating the probability of the exposure(s) occurring, either qualitatively or quantitatively.

Hazard: Any pathogenic agent that could produce adverse consequences.

Hazard identification: The process of identifying the pathogenic agents. Qualitative risk assessment : An assessment where the outputs on the likelihood of the outcome or the magnitude of the consequences are expressed in qualitative terms such as high, medium, low or negligible.

Quantitative risk assessment: An assessment where the outputs of the risk assessments are expressed numerically.

Release assessment: The process of describing the biological pathway(s) necessary for an importation activity to “release” (that is, introduce) pathogenic agents into a particular environment, and estimating the probability either qualitatively or quantitatively, of that complete process occurring.

Risk: The likelihood of the occurrence and the likely magnitude of the consequences of an adverse event to animal or human health in the importing country during a specified time period.

Risk estimation: The process of integrating the results from the release assessment, exposure assessment, and consequence assessment to produce overall measures of risks associated with the hazards identified at the outset.

Risk assessment: The evaluation of the likelihood and the biological and economic consequences of entry, establishment, or spread of a pathogenic agent within the territory of an importing country.

Transparency: Comprehensive documentation of all data, information, assumptions, methods, results, discussion and conclusion used in the risk analysis. Conclusions should be supported by an objective and logical discussion and the documents should be fully referenced.

Uncertainty : The lack of precise knowledge of the input values which is due to measurement error or to lack of knowledge of the steps required, and the pathways from hazard to risk, when building the scenario being assessed.