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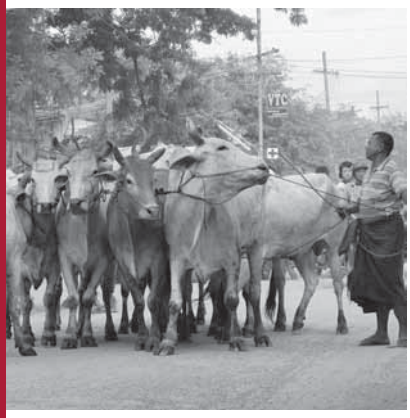
ISSN 1810-0708

FAO ANIMAL PRODUCTION AND HEALTH



guidelines

DESIGNING AND IMPLEMENTING LIVESTOCK VALUE CHAIN STUDIES

A practical aid for
Highly Pathogenic and Emerging Disease (HPED) control

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DESIGNING AND IMPLEMENTING LIVESTOCK VALUE CHAIN STUDIES

A practical aid for
Highly Pathogenic and Emerging Disease (HPED) control

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2012

Recommended citation

FAO. 2012. *Designing and implementing livestock value chain studies – A practical aid for Highly Pathogenic and Emerging Disease (HPED) control.* FAO Animal Production and Health Guidelines No. 10. Rome.

ISBN ISBN 978-92-5-107139-7

Contents

Acknowledgements

The main authors of this document are Nick Taylor[1] and Jan Hinrichs[2].

The authors would like to acknowledge the support of the FAO RAP staff in Bangkok who worked hard to successfully implement the workshop from which this document is a direct result. Most importantly the authors acknowledge the hard work of all the participants in the workshop. They all contributed their experience to this document and provided useful additional comments during the final drafting.

Likewise, the authors also acknowledge the European Union (EU) for providing full financial support to the development of this publication.

Several of the workshop participants made particular contributions in the chapter "Some examples of successful application of tools described in this document". These people are named within the headings of the sections they contributed.

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Purpose of the document

Several production system and market chain studies have been conducted to support disease control interventions in South East Asia. These value chain studies have been very useful to enhance understanding about the production system dynamics, product flows and the disease transmission impact of different actors' incentive structures and behaviours. However, it is felt that more explicit integration of the value chain approach into epidemiologic risk assessments would be beneficial to support animal health decision makers in identifying efficient and equitable disease control interventions.

Some of the early, exploratory field applications of value chain approaches to understanding disease epidemiology and risk assessment, with a focus on H5N1 HPAI, were used as a basis for the development of a FAO guidelines document (FAO, 2011[3] – hereafter referred to as "the FAO guidelines document"). The FAO guidelines document provides technical foundations of the value chain approach to management of disease risk and describes a practical approach for the incorporation of risk analysis with descriptive value chain mapping. Suggestions of field techniques are included.

This document is based on a consultative workshop on "The integration of livestock market chain analysis in the control of HPEDs in South and South East Asia", held from 26 to 27 April 2011 in Bangkok, Thailand (for convenience this will be referred to as "the Bangkok workshop"). Based on the collective experience of the participants in the workshop, this document sets out to prioritise the set of required data to be collected and to identify effective data collection and analysis techniques. After a brief overview to set the context of value chain studies in animal health decision support, the main body of the document consists of:

- A chapter covering the practical aspects of value chain study design, implementation and analysis. This chapter presents an overview of available data collection and analytical tools (a 'toolbox') with discussion of the appropriate use of the tools.
- A chapter describing some current regional experiences with value chain study approaches, containing brief examples of the successful application of different tools.

It is intended that as an adjunct to the FAO guidelines document this document will provide further practical advice that will encourage more effective use of value chain studies in South and South East Asia as part of animal health decision support.

The target audience for this document includes:

- International and national organizations contracting national institutes to conduct value chain studies and/or organizing capacity building in this subject.
- Research institutes in ASEAN and SAARC countries conducting livestock sector value chain studies.

[3] FAO. 2011. A value chain approach to animal diseases risk management – Technical foundations and practical framework for field application. Animal Production and Health Guidelines. No. 4. Rome. ISBN 978-92-5-106861-8.

Wider audiences include:

- in Africa AU-IBAR is actively seeking support for Value Chain approaches that will allow design of better, more standardised surveillance systems;
- there is private sector interest in data and analysis that is whole-chain or Critical Control Point focussed in nature.

This document, along with the more extensive FAO guidelines document, should be helpful as a reference document in the process of commissioning value chain studies for the purpose of supporting design of animal health strategies.

Overview: context of value chain studies

HOW VALUE CHAIN STUDIES FIT WITHIN THE WIDER CONTEXT OF DESIGNING DISEASE SURVEILLANCE AND CONTROL STRATEGIES

Disease prevention, surveillance and control, whether at national or farm level, state or private resourced, must be planned and implemented in proportion to the risk associated with animal disease. It is unrealistic to implement a very costly programme against a disease hazard that has low risk. In current parlance, planning for disease prevention and control should be *'risk-based'* and prevention and control measures should be *'proportionate to the risk assessed'*. Furthermore, it is recognised that in livestock production and marketing systems there are many stakeholders (people, groups and organisations) with different perceptions of the same risk, that may affect, and be affected by, disease hazards in different ways, and may face and accept different levels of risk. Different stakeholders may also be affected by prevention and control measures in different ways. Ideally, prevention and control measures should be *'proportionate to the risk'* faced (and perceived) by each stakeholder, otherwise compensatory mechanisms may be needed to assure compliance and equity.

To achieve this goal requires that two technical issues are addressed together.

1. Understanding the livestock production systems (including marketing and input supply) and the decisions stakeholders make within the livestock production systems in question.
2. Evaluation of disease risks within the livestock production systems in question and of measures to reduce risk.

The first issue falls within what in economics is called 'value chain analysis'; the second falls within what in veterinary epidemiology is called 'risk analysis'.

Value chain analysis provides a practical framework for disease risk assessment and animal disease management. It is a tool that can be used to identify key constraints and opportunities within a livestock production system, including possible risk for disease transmission within a value chain and the people involved along the value chain. In turn where the risks are deemed to be high enough and the reduction of these risks is thought to create large impacts on society in general (externalities) public interventions may be appropriate.

Value chain analysis can be a useful tool in such planning insofar as it directs and identifies people and organizations who need to be involved in order for an intervention to succeed. Used in a participatory way, for example, as part of a stakeholder consultation, value chain mapping acts as a focus for communicating knowledge, and can play a very important role in risk communication, thus leading to more transparent decision-making on animal disease management.

It is important to remember that value chain analysis complements other tools and information:

- Epidemiological information is essential – key activities in generating good epidemiological information are surveillance and outbreak investigation;
- Characterisation of pathogens and analysis of distribution – sample collection from outbreaks and as part of designed surveys with diagnostic testing and detailed characterisation of pathogens (e.g. molecular epidemiology) are important in this respect;
- Known risk factors should form part of the 'knowledge base' informing risk analysis in value chains – e.g. it is known that RNA viruses are more likely to emerge as new threats.

DEFINITION OF VALUE CHAIN AND VALUE CHAIN STUDY

For brief definitions of technical terms related to value chains and risk analysis, see Annex 1.

Value chains

Value chains are the linked groups of people and processes by which a specific commodity is supplied to the final consumer. These chains have inputs that are used to produce and transport a commodity towards a consumer; this is the supply chain. The value chain encompasses more than the production process; value chain as a term implies a flow of information and incentives between the people involved. Money is sent from the consumer to the different people in the chains to complete the value chain. Understanding the flow of materials through a value chain is important in understanding how risk of disease spread may be engendered in the chain, while understanding the flow and distribution of incentives is key to understanding how to manage those risks.

It is important to note that value chains may involve several products, including waste and by-products.

Value chain studies

Description

Value chain studies should firstly describe the processes through which livestock and other inputs pass during the production process[4] together with the resulting variety of products at the end of the chain. The results often include a ***flow chart*** or ***process map*** for ***specific products***. Value chain studies must also describe the places where each process occurs and the people involved, and therefore often include ***annotated maps***.

Value chain descriptions provide a good starting point for risk analysis and can be used as part of a stakeholder consultation process to create useful discussions about risk issues and therefore promote good risk communication.

The first output of a value chain study is usually one or several diagrammatic value chain "maps" consisting of boxes representing different people, groups or organizations and/or production/marketing sites in the chain with lines or arrows between these boxes indicating flows of livestock and animal products. Information on seasonal patterns and longer-term

[4] See *A value chain approach to animal diseases risk management* (FAO Animal Production and Health Guidelines 4) pages 25 to 30.

trends, product volumes and values, as well as numbers of enterprises or livelihoods supported at each point in the chain, can be presented as ***seasonal calendars***, linked to the charts and maps.

Analysis

Value chain analysis adds to the value chain description by analysing the internal and external environment of the chain or chains.

A complete value chain analysis would include information on the following:

- Identification of the products/by-products of interest;
  - Note that commercial interests focus on one or two products, while for animal and public health purposes it is necessary to look at the full spectrum of products, including low-value ones such as waste products, cull animals, etc.;
- who is involved in the value chain;
- physical location of activities and of the people in the chain;
- seasonality of supply and demand;
- appropriate analysis of profitability[5] for different people at different points, including transaction costs between people and points;
  - It is important to have the units correct: per ton, per animal, etc. This in turn requires that costs and revenues are, in fact, (i) able to be attributed and, (ii) able to be disaggregated into variable and fixed costs. The same goes for animal health costs and benefits.
  - Note that public goods and dynamics are important: costs of disease prevention and control have long term benefits and these may be public in nature. Costs incurred in the value chain are private and pay short term dividends.
- who sets regulations or conditions (pressures) for participation in the chain, who applies the rules and ensures compliance with them and/or provides assistance in meeting the conditions, i.e. who governs these chains;
  - public legislation that impacts on the functioning of the chain; this could include regulations not directly related to animal health, such as tax regulations favouring different scales of operation;
  - contractual arrangements (formal or informal);
  - private sector regulations;
- who and what factors are driving developments or changes in a value chain; this implies a temporal factor for the analysis;
- a complete value chain analysis will allow an assessment of the equity (e.g. market power) across the chain and its efficiency to convert inputs into products demanded by consumers;
  - equity can be skewed by governance and poor distribution of information across chains; for example, traders may have and retain better knowledge of consumer demands than producers so that traders can take advantage of premium markets without passing on benefits to producers;
  - presence of disease in the chains will reduce efficiency of the chain.

[5] i.e. gross margin analysis or enterprise budget.

In the practical application there need to be trade-offs between precise detail and requirements of the users of the study for timely decision making. For the specific purposes of animal disease management and health planning it is important to focus on identifying how people influence risk and react to it in the chain. It is particularly important to describe how chains actually work, not how they ideally work; for example, it is common to find abuse of procedures both by people directly involved in market chains and by those in authority, and this leads to enterprises operating outside regulations. These defects in market chains can often cause serious animal and public health risks. In such cases it is useful to ask: "Where is the leverage to deliver compliance with measures necessary to reduce risk?"

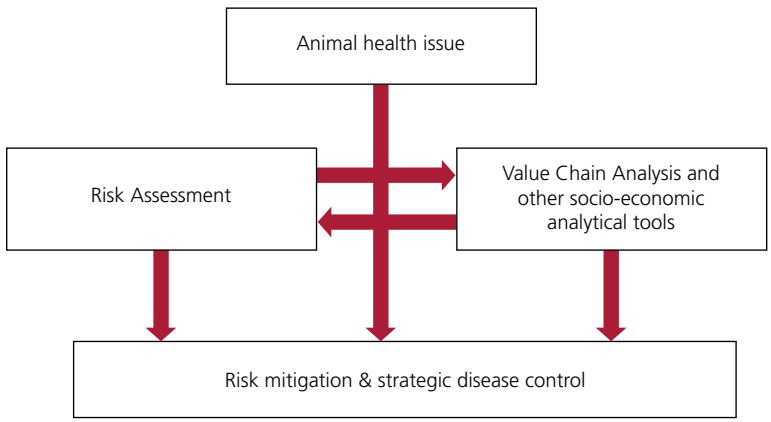
AN OVERVIEW OF THE PRACTICAL APPROACH

During the Bangkok workshop it was recognised that value chain analysis and other forms of socio-economic analysis are tools which can be used to support and inform disease control and risk analysis. The different components are linked as shown in Figure 1 below.

A critical issue is to determine where the entry points lie[6]. Establishing a clear disease control problem or question is an essential starting point and then value chain studies, analysis and other approaches can be selected and re-selected based on an ongoing analysis and prioritisation of requirements.

The FAO guidelines document describes a suggested stepwise approach to applying the combination of value chain and risk analysis to an animal health issue. Three steps are summarised as:

FIGURE 1
Inter-linkage of disease control, risk assessment, value-chain and socio-economic analysis



[6] This has been approached by ICRISAT, ILRI and others by "Innovation Platforms" which are 'talking shops' for people involved in value chains who engage in a cycle of communication using value chain analysis as a framework to refine problem and opportunity definitions, and help identify the entry points.

Step 1. Situation analysis and preliminary risk analysis

- descriptive epidemiology of the situation regarding the disease(s) of concern
- description of livestock value chains and identification of people and organizations involved in those chains
- identification and characterization of the risk issues[7] and risk hotspots in value chains

Step 2. Detailed risk and value chain analysis leading to planning of risk management options

- development of risk pathways and identification of potential risk mitigation measures
- development of options for inclusion in a risk management strategy

Step 3. Option appraisal and decision-making

- analysis of impacts on different stakeholders

Livestock value chain studies and the information they generate are needed at all three steps. Different specifications of study may be needed at different stages in the process – 'quick and dirty' at step (1) and more detailed, rigorous studies in the following steps.

The overall approach merges classical veterinary disease investigation and control measures with a range of socio-economic tools and includes participatory approaches to epidemiological analysis.

Particularly in the second and third steps, the different components of the approach are linked through a dynamic and iterative process, in that value chain analysis will identify priority areas for deeper risk analysis and risk analysis will in turn identify priority questions to be answered by value chain studies.

It was recognised that through the iterative approach some tools could be applied rapidly and give urgent information back to decision makers (e.g. focus group discussions). That information would be of variable quality but would permit timely feedback. Where initial data quality was of concern and/or the significance of the decision being based on the data was high then several tools could be utilized or implemented in greater detail (e.g. value chain analysis could be conducted rapidly to map and identify key stakeholders or could be done in great detail to provide more depth and higher quality of analysis).

[7] Here it is only animal disease risk that is referred to. It is of interest to note that the concept of risk in value chains may also be applied to risks of other kinds of hazard faced by people in value chains. Some are related to disease risk (the weather) some are not (non-payment) and some have complex feedbacks (efficacy of surveillance systems and the associated information transfer, and the responses of people to it). Essentially, this issue places a probability on the profitability assessed.

Designing and implementing value chain studies

DECIDE OBJECTIVE AND OUTPUTS

During the Bangkok workshop it was recognised that the first requirement in setting up a successful value chain study is to establish a clear understanding of the ***questions to be addressed by the study***. Clearly stated questions in turn allow the expected value chain study results to be anticipated and specified.

In general, the combination of value chain mapping and economic analysis with epidemiological risk analysis is useful in Animal Health Planning to:

1. assess the epidemiological and socio-economic justification for different disease control strategies;
2. inform the stakeholders involved in the different disease control strategies;
3. evaluate the socio-economic impact of contagious diseases and the socio-economic sustainability of different control strategies on the different stakeholders affected;
4. plan adjustments to control strategies based on both the epidemiological and socio-economic assessments.

In support of animal health planning, some of the key questions that may be addressed using these techniques include:

- **Which processes within different production and marketing systems carry risk for disease spread, and what are their relative contributions to overall risk?**
  - Understanding role of movements of animals (+ products + inputs) in spread of disease - implications for disease control?
  - In case of outbreaks... which markets should be closed etc.?
- **What are the structural, institutional and governance issues which underlie higher risk situations?**
  - Infrastructure constraints and limitations on value chain operation (e.g. availability of specialised transport, existence of slaughter facilities... etc. etc. ...).
  - Distribution of incentives in the chains.
  - Rules and agreements (state and local / written and unwritten) that dictate behaviour of people in the chains.
- **Overall, which production systems carry more risk and therefore justify more regulation/intervention?** [risk assessment in value chains]
  - For example, with respect to H5N1 HPAI, should the priority be to deal with backyard poultry or do some other commercial systems require urgent attention?
  - And, how do people within these systems influence the level of risk through their behaviour? – which people have more influence than others?

- **Who are affected by risky processes/points, and how much?**
  - Who could be affected by any disease hazards (and how)... [impact assessment and risk assessment in value chains]?
- **Who has most to gain or lose through risk mitigation interventions?**
  - Who could be affected by any proposed control measures (and how)... and what are the alternatives [impact assessment and risk assessment in value chains]?
- **How can the state and/or other stakeholders including the private sector, agribusiness and civil society, act to promote less risky operating environments for livestock production?**
  - What are the possible impacts / consequences of major re-structuring plans [disease risk changes; stakeholder socio-economic impacts]?
  - How can (disease free / controlled) compartments be defined / established?
  - What are the options for controlling / managing cross-border disease risk?
- **Where in a country are the 'risk hotspots' (for example, locations where there is higher risk of disease emergence and/or spread)?**
- **When in the year are the high risk times?**
- **Where and when should control measures be targeted (in other words, identification of critical control points)?**
- **Where and when should surveillance be targeted?**

Outputs required from value chain studies

When commissioning or designing value chain studies to support animal health planning it must be remembered that, whereas the original focus of value chain analysis is on improving market efficiency, the focus for this purpose needs to be on risks of disease transmission in the production and market chain. Value chain studies can yield a mixture of quantitative and qualitative data:

- Quantitative data on: animal origin areas, location and volume of movement corridors, congregation points, processing points and consumption areas; price differentials and margins.
- Qualitative data on: practices of actors in the chain; governance, regulation and control of the chains; regulation, linkages and trust; knowledge, skills, technology and support service options for risk reduction.

Step1. Outputs from situation analysis and preliminary risk analysis

The first step of a value chain study focused on disease risk must result in the following outputs:

- Identified people, groups and organizations in the livestock value chain from the input supplier to the producer, trader, processor, retailer and through to the final consumer.
- Mapped routes to markets for specified livestock and livestock products, which could be what currently exists and what potentially is available or could be developed.
- Identified opportunities for disease transmission (the big 'risk issues') and hotspots.

Step 2. Outputs from detailed risk and value chain analysis

As a second step a more detailed risk and value chain analysis should lead to the following outputs:

- Identified practices that tend to increase risk for disease transmission and the prevalence of these practices;
- Developed practices (regulated or not) aimed at risk reduction (good production practices including bio-security) and compliance with these;
- Assessed resources and capability of people in the chains to react to disease challenges.

Step 3. Outputs from option appraisal and decision-making

A risk mitigation strategy is the required output for the last step in the process of analysing value chains. Risk mitigation approaches should be consistent with economic incentives across the supply chain. This requires the value chain analysis to consider the multiple factors that affect economic behaviour and have implications for risk mitigation. These factors include basic market incentives, perception and beliefs about risk, institutions operating in the chain, and socio-economic factors affecting all the actors in the chain.

Consumer preferences for livestock products shape value chain structure and can either support or undermine efforts to control disease. Demand driven approaches[8] to risk mitigation require both a clear understanding of consumer preferences and the economic behaviour of all actors in livestock market supply chains. Effective and credible tracing and certification systems need to be developed to utilize consumer willingness to pay for safe livestock products.

RECOMMENDED DATA COLLECTION AND STORAGE METHODS

Here we summarise the prioritized information needed to answer questions such as those listed above and to produce the outputs as described above. The data collection process is following the suggested stepwise approach to value chain and risk analysis. Data collection tools are described that are among the most useful approaches to providing the required information.

Information to be collected

Step 1. Data for situation analysis and preliminary risk analysis:

Information needs to be collected on the key people involved, the segmented markets supplying segments of consumer needs, how chains may change over time (seasonal) or regional (spatial) differences.

Key items of data to be collected are described below.

[8] Demand driven approaches are approaches that rely on the consumer preferentially selecting products that derive from chains that carry less disease risk.

Description of the value chain

- What are the products?
- Who are the stakeholders?
  - How are they involved, what are their roles?
  - Connections/relationships between stakeholders
  - Level of influence of different stakeholders
- What does the institutional landscape look like?
  - Which institutions are present, how strong are they, what relationships exist?
  - What institutional gaps might exist, what is the likely consequence?
- Practices along the production and marketing chain (including payment methods)
  - Important in disease control as it means tracking when an animal changes hands and who is left with the loss if it suddenly becomes ill/valueless or dies.
- Consumption trends: quantity and quality of meat demanded
  - Profiling of stakeholders and classification of consumer groups
- Infrastructure in place

TIP 1

It is useful to begin with a less detailed overview approach and then target the 'hotspots' or 'risk issues' for more detailed data collection. The important thing is that at the initial rough overview stage ***all the areas of the value chain are covered***, and all potentially useful data items are at least briefly noted (perhaps just listing or cataloguing data items without collecting actual data). In general, the aim should be for a ***comprehensive***, if less detailed initial overview to be followed by detailed focus on the high risk issues. The overview should be constantly referred back to in order to ensure that in the detailed analysis stages, potentially important areas are not forgotten or otherwise overlooked.

Details to be included

- Identify **all** products and characterise them.
- Identify **all** stakeholders (e.g. make sure those dealing with waste and by-products are included) – cover **all** branches of value chain
- Seasonal factors (production, demand, supply)
- Production, processing and distribution system analysis (characterisation of different systems)
  - Define production systems
  - Map production systems
  - Identify extant or possible collective action - this alters the cost landscape, particularly where there are variable and fixed cost dichotomies
- Perceptions of stakeholders (what is "acceptable" profit / risk (risk in both a disease and an economic sense), livelihoods / vulnerability, knowledge about disease)
- Movements of products - Patterns of trade
  - Geographic mapping of trade routes (local and international)
- Links/crossing between value chains

TIP 2

To fully cover all areas of possible disease risk it is important to include ***non-monetary value chains*** – one may need to include non-livestock chains if there are overlapping chains with disease risk implications (e.g. forestry products – forest margin development / encroachment alongside people with livestock).

Socio-economic value chain data

The collection of socio-economic data should provide understanding of the incentive structure for stakeholders, for example to comply with risk reduction measures. We also need to know existing institutional arrangements and how they may interact on value chains.

- Formal and informal contracts between stakeholders, including the credit and financing arrangements in exchange of products and services
- What are their motivations for behaviour change (especially what factors might influence behavioural changes and changes to practices)?
- Value, batch size and frequency of transactions
- Profit margin and sales volume at different points in the chain
- Contribution of the value chain related activity to the household income of the stakeholders
- Regulatory mechanisms (formal and informal) – Institutions (Including the potential geographical variation in the capacity and/or regulation of institutions, e.g. district veterinary offices)
- Certification / inspection / regulations – both the 'written' rules but also the practical credibility of certification

TIP 3

There are significant challenges to be faced with data collection:

- It is usually difficult to identify a sampling frame/sample for credible random sampling because:
  - categories of value chain actors are not always well-defined – individuals doing multiple functions or dealing with different products from day-to-day;
  - traders especially are highly mobile and difficult to 'catch'.
- The nature of supply flows in informal markets are especially non-linear and dynamic – changing from day-to-day, with many cases of non-repeated transactions/functions/activities.
- It is difficult to get 'representative' budget information – highly variable given the non-linearity of supply systems, lack of records to be able to evaluate variability over time.
- In addition to 'predictable' seasonal variations, it is important to recognise and record daily variability in quantities and values.

Step 2. Data for the development of risk management options

At the stage of **development of risk management options**, value chain studies should provide information about:

- Stakeholders' attitude to disease (including different groups of consumers)
  - Self-coping methods in contrast to imposed control measures
  - information on compliance of actors towards possible interventions
- What contributions do different groups make to the epidemiology of the disease (spread, maintenance, transmission) [value chain study combined with risk analysis]?.
- Information of particular stakeholders that can impact on control (e.g. remuneration).
- Temporary value changes when disease occurs
  - Stakeholders' reaction to disease and control measures (e.g. selling sick livestock, purposely infecting livestock or moving livestock to get compensation, smuggling to avoid quarantines)
- Are (how are) stakeholders organised? Are there groups that can be worked with?
- Existing disease control policies
  - commitment of government at all levels to control diseases (level of response)
  - capacities, resources, etc. of the veterinary services – cost structure (institutions and individuals)

Step 3. Data for option appraisal and decision making

The data collected during step 1 and 2 represents the base for this step very few additional data might be required. However, in order to analyse the impact and feasibility of developed risk management options further information from the affected stakeholders might be required. This would include:

- What is expected to comply with control measures – how does this interact with the interests of specific value chain actors (budgets and margins, cultural beliefs or behaviours)?
- What has a chance to be implemented (e.g. in terms of capacity of specific value chain actors; backyard farmers may have lower or no interest to comply)?

Potential data sources

Primary sources (the people involved in value chains themselves)

1. Individuals

- Individual livestock input suppliers (different types / levels)
- Individual livestock producers (different types / levels)
- Individual livestock traders (different types / levels)
- Individual livestock product processors (different types / levels)
- Individual livestock product consumers
- Individual livestock value chain infrastructure providers (e.g. market workers, transport drivers, veterinarians and animal health workers)

2. Groups and Representatives

- Input suppliers' trade associations
- Producers' associations
- Traders' associations
- Processing and marketing associations
- Individual slaughterhouses' and milk plants'
- Consumer groups
- Veterinary associations
- Government departments

Secondary sources

- Existing livestock sector reviews
- Census and other population statistics (human, livestock populations, income, consumption, productivity, market volumes)
- Market price monitoring databases
- Project documents and reports
- 'Experts'
- Baseline trade data
- Review of existing disease prevalence
- Outbreak investigations

TIP 4

Data about livestock movement can be obtained by following and directly observing:

- Traders
  - Traders will share price and trade volume data if trust is established and they are well informed about what the information is used for.
  - Traders & other market chain participants might not be willing to share their buying prices /margins but generally will share selling prices. If all participants are interviewed margins can accordingly be backed out from selling prices.
  - Focus group discussion with traders might only work if participating traders are not competitors.
- Livestock in transit / transport
  - The movement of livestock herds or trucks transporting livestock can be directly observed and give an indication of volumes and directions.

Choosing the right data collection tool

During the Bangkok workshop the following data collection tools were identified and discussed (Table 1). This list is by no means exhaustive, and other tools may be useful in particular situations.

TABLE 1
DATA COLLECTION TOOLBOX - A selection of data collection tools of potential use in value chain studies

Data Collection Tool	Can be used for	Strengths	Weaknesses
DESK-BASED			
Literature review... (review of relevant existing literature - e.g. using 'secondary sources' noted above)	Scoping study. As a prelude to commissioning field work. To review and describe existing knowledge; can form the basis of a rapid preliminary risk analysis; should be used to identify knowledge gaps that may be prioritised to be filled by further (field) work.	Can be commissioned as a 'desk' study; Will avoid duplication of effort in field work; Relatively cheap.	Reliability of the information in existing reports may be difficult to verify – information may be poor quality, misleading and not updated.
Models... for example: Qualitative or quantitative population (individual and herd/flock) models	Quantifying relationships between different parts of the production sector (e.g. parent flocks : broiler flocks) and estimating product quantities and flows. Identify the dynamics of overall livestock populations and seasonal changes in susceptible or reservoir sub-categories of the population.	Effective capture of temporal population dynamics. Detection of important shifts in sub-populations Simple models can be ***very good*** tools to facilitate discussion and to identify key data to be collected.	Complex. Often requires reliance on other estimated data compounding any inaccuracies. Requires some understanding of the epidemiology of a pathogen and differential infection patterns to make most use of this technique.
EXPERT OPINION			
Informal: interviews with experts, invited expert papers	Scoping study. As a prelude to commissioning field work. To describe existing knowledge; to formulate hypotheses; preliminary risk analysis.	Informal expert consultation is quick and relatively cheap to do.	Highly dependent on choice of experts and experts' knowledge – risk of bias and/or misinformation.
Formal: DELPHI workshop (a structured communication technique with anonymous summary feedback rounds)	'Expert' assessment of risk, prioritisation, ranking, scoring, weighting (etc.) of risk factors.	Formal DELPHI workshop follows precise methodology that is designed to minimise bias.	Dependent on choice of experts and experts' knowledge.

(cont.)

TABLE 1 *(cont.)*

Data Collection Tool	Can be used for	Strengths	Weaknesses
FIELD-BASED WORK			
'LARGE SCALE' FIELD WORK Statistically designed surveys often using closed question questionnaire as the main instrument.	***In general***... to obtain quantitative estimate of... e.g. ... proportion of household owning livestock, proportion of produce sold (by different routes)... etc. Also qualitative data on different practices and preferences may be gathered.	Both ***quantitative*** and ***qualitative*** outputs more likely to be representative of the population if the surveyed sample is large and especially if randomised selection processes are used. ***Quantitative*** results can be produced with statistically calculated confidence and precision (ideally derived from random sample).	High requirement for resources. Difficult to incorporate flexibility. By necessity the issues investigated and parameters measured are narrow and therefore some important issues may be overlooked.
'SMALL SCALE' FIELD WORK Usually purposive sampling and smaller sample size surveys often using face to face interviewing with more open questions as the main instrument.	***In general***... to obtain qualitative, semi-quantitative and some quantitative data on a variety of issues. Emphasis is less on obtaining precise estimates of quantitative parameters and more on capturing the range and variability or similarity of parameters.	Being smaller scale the approach can be more flexible and responsive to themes that emerge in the course of the work. Can be cheaper and quicker but not necessarily if aiming for greater detail.	If sample size is too small and/or too narrow, information obtained my give false impression of the normal situation in reality (e.g. extreme cases may be over-represented).
DIFFERENT TYPES OF SURVEYS AND STUDIES			
Cross-sectional or longitudinal?	Cross-sectional to produce data on current situation. Longitudinal to monitor temporal patterns in 'real time'. [cross-sectional can include questions about past events to give retrospective temporal information]	Cross-sectional surveys are quicker and generally use less resources. Longitudinal studies can capture reliable data in real time across all seasons. Can be used to observe response to an intervention.	Cross-sectional may miss important seasonal variations. Longitudinal studies are expensive and can be complex to carry out.
Household survey – consumers	To gather data on consumption habits.	Information is provided by consumers themselves.	Without careful survey testing and appropriate methodologies, there is potential respondent bias/misinformation.
Household survey –producers	To gather data on production processes, productivity, and on animal health.	Information is provided by producers themselves.	Without careful survey testing and appropriate methodologies, there is potential respondent bias/misinformation.
Survey in markets – consumers and traders	To gather data on trading processes and patterns, and on prices and volumes.	Information is provided by traders themselves.	Without careful survey testing and appropriate methodologies, there is potential respondent bias/misinformation.

(cont.)

TABLE 1 *(cont.)*

Data Collection Tool	Can be used for	Strengths	Weaknesses
KAP (Knowledge, Attitudes and Practices) study	A formal study designed to understand the link between what people know and how they actually behave. Useful for describing risky and risk avoidance (e.g. biosecurity) behaviour.	Formal design and method to produce a standardised output that may be comparable with other studies (across time and location).	Complex to implement and can be expensive. Potential for bias and misinformation.
Case study (usually a detailed observational study of a particular case or situation).	To gain detailed understanding of a particular case.	Very detailed information can be obtained.	Information may not be representative of the wider population.
INSTRUMENTS AND APPROACHES USED IN SURVEYS AND STUDIES			
Questionnaire – closed questions	To obtain data in response to a fixed set of questions.	Questions can be structured to provide easily analysable and / or quantifiable data (closed questions). Low level of skill/training required by administering staff. Easier to administer to a high number of respondents.	Questions must be fixed in advance. There is no opportunity to follow up themes that emerge in the course of questioning (especially if the questionnaire is administered 'remotely').
Questionnaire – semi-structured	To obtain data on a pre-arranged set of issues.	Can include some closed type questions to provide easily analysable and / or quantifiable data while at the same time including open questions. Interviewer is prompted to probe certain issues using a checklist, thus generating richer information.	High level of skill/training required by administering staff. Difficult to administer to a high number of respondents.
Direct observation 'free' (exploratory) or with checklists (analytical)	'Free' observation may be used at the start of, often before, a study, simply to explore a value chain and to identify issues for further study. 'Analytical' observation used, in particular, to record the way that certain procedures are carried out – to record actual behaviour.	Direct observation avoids respondent bias (where people say what they think they should say, rather than reporting accurately what they do).	Limited scope to apply on a large scale (mass observation). Usual compromise would be to ask the subjects of observation to self-record in a longitudinal study.

(cont.)

TABLE 1 *(cont.)*

Data Collection Tool	Can be used for	Strengths	Weaknesses
Key informant interview (using a semi-structured interview checklist)	To obtain data on a pre-arranged set of issues. Useful where it can be identified that most/all of the required data are known by a small number of 'key informants'. This would be mainly applicable to purely factual data rather than to information about practices and preferences etc. (where it is not realistic to expect a key informant to speak for other people).	If key informants are well chosen a lot of data can be obtained quickly.	Highly dependent on choice of informants and informants' knowledge – risk of bias and/or misinformation.
Snowball interviewing – where each interviewee is asked to identify other potential interviewees. e.g. following a marketing chain by following-up traders' contacts.	Snowballing technique to trace and identify all stakeholders involved along the value chain. This can be used to characterise a network.	Does not require knowledge of the chain in advance – reduces the chance that important stakeholders will be overlooked. Highly appropriate for where relational data is of interest and when the sampling frame is not available or unknown.	High level of skill/training required by administering staff. Can lead to highly biased sample if not handled with care. Difficult to budget in advance because number of interviews not known at start. Snowballing can rapidly lead to a high number of respondents and thus costs.
Focus group discussion	Similar to key informant interviews, but because a group is interviewed the tool is more applicable to issues of perceptions, practice and behaviour. Can also be used to obtain 'consensus estimates' of factual data.	Interaction with interest groups increases the likelihood of valid communicative exchange. Allows open discussion of issues and may lead to discovery of further research priorities.	High level of skill/training required by administering staff. Difficult to administer to a high number of respondents.
Participatory workshop	Similar to focus group discussion but workshop environment can allow several focus groups to work together (i.e. several interest groups may be represented and can interact). Workshop setting implies longer duration and inclusion of several related issues. 'Participatory' implies participants may be allowed some responsibility for directing the study and drawing conclusions.	Establishes valid communicative exchange (i.e. more likely to get more "truthful" responses to your questions). Establishes rapport and ability to empathise with stakeholders' various perspectives. Can help to build trust between a community and the researchers or 'agency' (important if the end result of study is to implement an intervention).	High level of skill/training required by administering staff. Difficult to administer to a high number of respondents.

(cont.)

TABLE 1 *(cont.)*

Data Collection Tool	Can be used for	Strengths	Weaknesses
Proportional piling	Specific technique used within participatory workshop (but may be used in any face-to-face interview) to obtain relative measures. e.g. distribution of farm output into different market routes, distribution of breed types among farmers in a village... etc.		
Ranking	Specific technique used within participatory workshop (but may be used in any face-to-face interview) to obtain measure of ordinal (first, second, third, etc.) importance of different factors.	Flexible tool that can be used to provide quite complex information: e.g. consumers can be shown pictures, and asked to choose a hypothetical combination of risk and consumption utility.	
Participatory mapping	Specific technique used within participatory workshop (but may be used in any face-to-face interview) to obtain spatial information.		
Seasonal calendar	Specific technique used within participatory workshop (but may be used in any face-to-face interview) to obtain temporal information, e.g. seasonal variation in livestock surplus, meat consumption, demand for eggs, etc.		

A common feature of many of the techniques listed above, in common with any field study technique, is that there is risk of so-called researcher bias or observer bias. In general the more flexible and open the approach, the greater the risk of bias and therefore the greater the need for skilled field workers to avoid bias.

Value chain studies that are targeted at supporting animal health planning are required to be relatively flexible and open and therefore do require high skill levels in the practitioners. This in turn indicates a need for training in both the general semi-structured interview and other participatory methods, and also in the integration of risk analysis with value chain study and analysis.

Triangulation (collecting data on the same basic subject from different 'view-points') is another important tool to ensure good quality data.

Following are a series of data collection tips with suggestions for ensuring collection of good quality data

TIP 5

Strategies for minimising respondent bias include:

- Asking a set of related questions so as to test for strategic responses.
- Ask people what their neighbour does.
- Structure questions so that the answer cannot be linked in the respondents' minds to a cost or benefit to them personally

TIP 6

Monitoring price-differentials for live animals at different trading points will add additional value to observing direction and volume of trade movements.

- As a driver for livestock movement it is adding additional information, since changes in prices can quickly reverse observed movement streams of livestock; a Gravity model that looks at consumption and production clusters may in many cases already give a good overview of the livestock trade flows.
- Margins for traders and producers are essential to see incentives for compliance, power distribution and investments in the chain.
- A structured routine for price monitoring might be required for several input and output commodities.
- GIS-Flow-Tool on price differences (Cost-surface analysis) can be used to visualize and analyzed price differentials in maps.

TIP 7

!Capacity and training of data collectors is a key success factor.

- Experienced enumerators might have to be "retrained" depending on methodologies they have previously used.
- Consider tradeoffs between enumerators familiar with animal disease (potential bias) vs. enumerators not familiar with animal disease (might not understand survey).
- Carefully consider tradeoffs between enumerator incentives: per-survey payments require random monitoring – but per-day payments could affect productivity or decrease flexibility.

TIP 8

!Piloting of questionnaires and testing of preliminary results are essential to ensure data quality.

- Involve enumerators in survey testing and solicit their feedback.
- Use back translation for project staff who are not native speakers (translate the survey back to English to see if the translation is accurate).

TIP 9

Focus group discussions ...

- ... are useful and very cost-effective as a first step to get information on prices, trade volumes and profiles of stakeholders ...
- ... involve less costs and training demands compared with questionnaire surveys.

TIP 10

A core value of ***participatory engagement approaches*** (such as Focus Groups Discussion) is building trust:

- establishes rapport and ability to empathize with stakeholders' various perspectives;
- establishes valid communicative exchange (i.e. more likely to get more "truthful" responses to your questions);
- builds ownership in solutions developed.

Therefore, try to integrate ***participatory engagement approaches*** within all activities as appropriate.

TIP 11

Sample selection is important in relation to the study objective. The sampling strategy (e.g. representative sample, random sample, purposive sampling, snowballing) is usually a compromise between obtaining statistical rigour and practicality. It is usually not possible to carry out statistically representative surveys, but nor is it usually necessary for the purposes of effective decision making.

TIP 12

- Use the right tool for the job (select from Table 1 above and other available tools);
  - 'traditional' participatory tools,
  - 'traditional' survey tools,
  - disease risk quantification tools.
- Adapt study design to available human resources and organizational systems.
- Minimize use of tools which provide cross-sectional data and those which quantify risk based on opinion alone.
- Stay focused on the question of interest.

TIP 13

It is important to set some quality standard for data and to include in the data collection protocol a system to monitor data quality.

Standards of data quality include:

- level of precision
- validity: is it true?
- timeliness –things can change
- consistency – need to be comparable = sharing is important

Another important question to address regarding the quality of data is: What are the needs for either QUALITATIVE or QUANTITATIVE data?":

- depends on purpose, 'fit for purpose'
- Some level of quantification is needed – risk assessment is quantitative by nature
- Qualitative data is valuable as well, sometimes more than quantitative.

OVERVIEW OF DATA ANALYSIS AND MODELLING TECHNIQUES USED WITH AN ASSESSMENT OF THEIR STRENGTH AND WEAKNESSES

The FAO guidelines document provides, in part two, a general guide to the practical organisation of value chain and risk analysis studies.

Here we briefly list analytical tools that are among the most useful approaches to providing the information needed to answer questions such as those listed above and to produce the outputs as described above.

Choosing the right analysis tool / framework

During the Bangkok workshop the following data analysis tools were identified and discussed (Table 2). This list is by no means exhaustive, and other tools may be useful in particular situations.

TABLE 2
DATA ANALYSIS TOOLBOX - A selection of data analysis tools of potential use in value chain studies

Data Analysis Tool	Can be used for	Strengths	Weaknesses
Meta-analysis	Review of current knowledge (e.g. literature review).	Provides a formal framework for combining information from several sources. Makes maximum use of existing knowledge.	Reliability of the information in existing reports may be difficult to verify – information may be of poor quality and/ or misleading.
Analysis of knowledge gaps	Review of current knowledge (e.g. literature review); identification of study objectives.		Reliability of the information in existing reports may be difficult to verify – information may be of poor quality and/ or misleading.
Behavioural analysis			
KAP study analysis	To understand the link between what people know and how they actually behave.	Formal design and method to produce a standardised output that may be comparable with other studies (across time and location).	
Theory of reasoned behaviour	A useful framework to understand the drivers of behaviour and to identify entry points for extension messages etc. in order to modify behaviour.	Is particularly focused on identifying key influential stakeholders. i.e. those who must be engaged in risk mitigation strategies.	
Economic analyses			
Consumers: demand function / elasticity; willingness to pay for quality characteristics	To assess the scope and feasibility for demand driven risk reduction measures, such as certifying and labelling safe products. To understand consumer behaviour and supply chain/industry trends.	The process of quantifying demand and price correlations for specific product characteristics enables to assess the feasibility of demand driven risk reduction measures. Understanding consumer demand is an important aspect of value chain analysis.	The hypothetical and actual willingness to pay can often differ considerably. Pilot experiments in existing chains might be required to test the actual willingness to pay.
Analysis of product prices, trading and production costs along the value chain	To assess the power and information distribution along the chain. High trading or production margins can be an indicator for information advantages and monopolistic status of stakeholders.	Enables the identification of important stakeholders who have power and control in the chain and need to be paid special attention when designing disease control measures.	It is very resource demanding to get statistical reliable estimates for prices and costs.

(cont.)

TABLE 2 *(cont.)*

Data Analysis Tool	Can be used for	Strengths	Weaknesses
Enterprise budgets, margins and income distribution	To understand the economic motivations of: Input suppliers; producers; marketers	Identifies the attention stakeholders will pay to this activity and potential changes due to control measures.	In many cases this sensible data is not easily collected or shared.
Stepwise demand analysis			
Household surveys: Non-statistical analysis of expenditure on livestock products; mapping of demand and consumption	Establishing current livestock production consumption and consumer attitudes and behaviours.	Relatively easy to implement; provides important baseline data on consumption.	Descriptive analysis might not capture long term trends or precisely identify key factors driving consumer preferences.
Demand function analysis: Elasticity for income, other livestock products etc. Hedonic price analysis Demand function analysis for production characteristics such as safety	Establishes consumer response to prices and the impact of income on demand. Establishes the impact of different factors on market price. Elasticities are needed for CGE modelling/ sector-wide modelling of the impact of different interventions.	Statistical analysis allows for control of observable factors so relationships can be more accurately identified.	Requires more time and training to implement and appropriately interpret results.
Willingness to pay experiments	Assessing consumer acceptance of new certification schemes, measuring consumer demand for safer food.	Experimental methodologies overcome problems with hypothetical bias.	Can be complicated and costly to implement.
Disease risk in value chains			
Analysis of behaviours (e.g. related to biosecurity)	Qualitative / semi-quantitative risk assessment.		This usually relies heavily on expert opinion. Therefore highly dependent on choice of experts and experts' perceptions.
Risk scoring	Qualitative / semi-quantitative risk assessment.	Easy to use by local veterinary staff. Standardized methodology to identify high risk cross-border trade points .	Perception and quantification of the risk may result in differences between assessors and countries. Risk assessment results do not identify follow up management/disease control actions for risk reduction.
(Social) Network Analysis Other approaches to network analysis: e.g. using graph theory on trader networks	To identify and (semi-)quantify potential infectious contact opportunities.	Makes use of an established analytical method that generates objective and quantitative measures of 'contact'.	Requires skill and training to apply.

(cont.)

TABLE 2 *(cont.)*

Data Analysis Tool	Can be used for	Strengths	Weaknesses
Genetic typing of pathogens	To trace movements and transmission events.	Provides very precise information about probable geographic transmission of pathogens.	Requires skill, training and specialised resources to apply.
Spatial analysis			
Descriptive mapping – visualisation	To summarise in a visual way the movements of livestock and livestock products – and associated infrastructure and inputs.	Relatively simple to apply. May be done as part of a participatory exercise. Final maps may be produced digitally.	Analysis relies on the interpretation of visual information by the observer.
GIS tools Cost / Price / Demand 'surfaces' Analysis of production and consumption potential	To model the potential for livestock and products to be moved based on basic population and livestock productivity data. However, does not necessarily have to be linked to a GIS.	Can generate quantitative parameters to describe potential for livestock and products to be moved.	Requires skill, training and specialised resources to apply. Output is modelled interpretation of input parameters rather than actual 'on the ground' fact.
Other... socio-economic plus animal production			
Delphi – expert opinion	'Expert' assessment of risk, prioritisation, ranking, scoring, weighting (etc.) of risk factors.	Formal DELPHI workshop follows precise methodology that is designed to minimise bias.	Dependent on choice of experts and experts' knowledge.
Content and narrative analysis Discourse analysis	To categorise, summarise and analyse information collected as 'free text'. May use specialised software such as NVivo.		

SUMMARY

Designing and implementing a value chain study should be driven in the first place by the issues and questions to be addressed. The questions and issues will dictate the data required to be collected and the analytical tools that will be most appropriate. Then the mix of data collection tools to be used can be chosen according to the data requirements and taking account of the resources (time, finance, skilled personnel) available.

During the Bangkok workshop a matrix was developed which presents a logical link between disease control problems and related risk questions, information requirements and some tools suited to provide timely, appropriately accurate information in a resource efficient manner. This matrix (Table 3) is presented as one example of how to match up appropriate tools with specific questions in order to generate the desired output.

TABLE 3
Example: response to a novel threat from outside the country

Risk Question	Information Required	Information gathering and analytical tool(s) to be used
What is the risk of introduction of a particular pathogen?	Basic epidemiology of the disease Current situation in neighbouring countries and trading partners. Movement patterns between neighbouring countries and trading partners.	***Review of current knowledge*** Literature review, expert consultation, key informant interview. Epidemiological assessments in neighbouring countries and trading partners. ***Rapid Value Chain Study*** Description / analysis of host and any vector populations. Focus group interviews. Direct observation.
How can the risk of introduction be minimised?	Identify key pathogen release pathways. Understand stakeholders and their incentive structures.	***Detailed Value Chain Study*** for specific commodities of concern. Focus group / stakeholder interviews (snowball interviewing).
Has the disease already been introduced?	Targets for surveillance activities.	Surveillance (active and passive) ***Rapid Value Chain Study*** can help to identify targets for surveillance. Stakeholder (key informant and/or focus group) interview. Participatory disease searching.
What are the likely consequences of introduction?	Identification of transmission pathways. Understanding of transmission dynamics in susceptible population (knowledge of dynamics of population at risk and movement patterns, contact rates, pathogen behaviour).	***Detailed Value Chain analysis*** Literature review. Focus group discussions. Participatory mapping. Social network analysis.
What are the options and capacities to respond?	Identification of Control Points and specific interventions.	***Risk pathway and Value Chain analysis*** Focus group / key informant interviews. Social network analysis.
How likely is it that the disease will be maintained?	Understanding of transmission dynamics in susceptible population (knowledge of dynamics of population at risk and movement patterns, contact rates, pathogen behaviour).	***Rapid and Detailed Value Chain analysis, including longitudinal studies*** Literature review. Focus group discussions. Participatory mapping. Social network analysis.

TIP 14

Critical Control Points

Value chain and risk analysis can identify risk hotspots in the value chains, but not all risk hotspots will necessarily be critical risk control points. For designation as a critical control point the most important criteria are the following:

1. Is there a significant risk of the hazard at this step?
   - Use a risk scoring method or other semi-quantitative assessment to support conclusion.
   - Points where the impact/consequences component of the risk assessment are high will be viewed as more critical (e.g. points where disease could be widely dispersed); knowledge of the value chain is important here.
2. Do control measures exist at this step?
   - Is the risk at this point amenable to risk mitigation?
   - Knowledge of the risk pathway is important here as well as questions of feasibility.
3. Would the measures eliminate or reduce risk to an acceptable level (impact of the measure on risk)?
   - Could control at this step alone make the whole hotspot safe? If so, it is fitting to call this a critical control point.
4. If answer to questions 2 and/or 3 is "no", will a subsequent step eliminate or reduce risk to an acceptable level?
   - If sufficient risk reduction is not achievable at this step then we need to think of applying control measures elsewhere in the chain.

After a critical control point has been identified it is then necessary to undertake an assessment of practical feasibility of control at this step. This requires an assessment of impacts on stakeholders of both the hazard to which the risk pertains and of the proposed control measures. For control to be effective there must be reasonable, and perceptible incentives for people to change their behaviour and comply with measures. Reduction of the risk itself may be sufficient incentive for some stakeholders (e.g. those who stand to lose out in case of disease outbreaks) but others may require different encouragement in the form of subsidy incentives and/or threat of sanctions.

Some examples of successful application of tools described in this document

DEMAND DRIVEN RISK REDUCTION – ECONOMIC PERSPECTIVE IN RISK REDUCTION APPROACHES ALONG THE VALUE CHAIN

Jenny Ifft

Demand driven risk reduction relies on the consumer preferentially selecting products that derive from chains that carry less disease risk.

Jenny Ifft has worked on the value chain that supplies poultry to the consumers of Hanoi in Vietnam. Jenny focused on the economic aspects of the chain that are important to assess when trying to develop demand driven (and funded) risk reduction interventions.

Hanoi consumers were studied to learn about preferences and knowledge of disease risks and willingness to pay (higher price) for 'safe' poultry. A trial was carried out using cheap, single-use tags for traceability of poultry.

The study showed that it could be possible to generate added value at the consumer end of a poultry chain that could be used to fund risk reduction measures further back in the chain (towards trader and producer).

The study used the following economic tools to carry out a stepwise demand analysis:

- **Household surveys:** Non-statistical analysis of expenditure on livestock products; mapping of demand and consumption; **Demand function analysis:** Elasticity for income, other livestock products etc., Demand function analysis for production characteristics such as safety; hedonic price analysis;
- **Willingness to pay experiments.**

Application of the methodology

Household surveys were the basis for all activities in this study. Representative sampling methods were used, as blocks were randomly selected for participation. All households in each block were identified, and then systematic sampling was used (every nth household was selected). The survey instrument had questions on average chicken consumption, recent chicken consumption, household demographics, meat consumption, attitudes towards meat quality and safety, and basic disease knowledge. The survey instrument was entirely quantitative, with no open-ended questions. Data from the survey provided an accurate picture of practices and beliefs relevant to poultry consumption.

Demand analysis was undertaken using two approaches. One approach estimated an incomplete demand system for chicken consumption, which provided price and income elasticities for the three main varieties of chicken purchased for home consumption in Ha Noi. Demand system can be estimated using a variety of methods which are well estab-

lished in the agricultural economics literature; for example, simple log-log estimation, almost ideal demand system (AIDS), and incomplete demand system estimation. This study used the latter. Hedonic price analysis was also used, which involves linear regression of price on various factors that might impact price. Hedonic price analysis is straightforward to implement with standard statistical software and allows for identification of which factors have the strongest relationship with prices.

Willingness to pay experiments were also used to assess how much consumers would pay for safety labelled (or safety certified) free range chicken. The experiment was undertaken in conjunction with a pilot project, so we were able to used actual safety labelled chicken in our experiment. Pilot projects for safety certification of livestock projects provide an ideal opportunity for willingness to pay experiments, as several different types of willingness to pay experiments can be implemented if real certified products are available. Our experiment involved offering household survey participants a choice between 2 discount coupons with randomly determined discounts. 1 discount coupon was for safety-labelled chicken, and the other was for non-labelled ("regular") chicken. The trade-offs made when households selected a coupon allowed us to calculate the average willingness to pay for safety labelled free range chicken.

Discussion and conclusions

Demand driven approaches to HPED risk reduction are underpinned by the principle that market incentives can induce behavioural change. If consumers demand safer livestock products, such approaches could be feasible. Consumer demand is also important for development of HPED control policies. Consumer preferences for livestock products shape market chain structure and can either support or undermine efforts to control HPEDs. Demand driven approaches to risk reduction require both a clear understanding of consumer preferences and the economic behaviour of all actors in livestock market supply chains. In addition to consumer demand, market chain analysis should consider multiple factors that affect economic behaviour and have implications for risk reduction. These factors include basic market incentives, perception of risk, institutions, and socio-economic factors.

Demand for livestock products takes into account product ***quality***, ***safety*** and ***price***. All of these product characteristics can be related to HPED risk and should be included in demand analysis. Demand for quality can often be linked to certain sectors of the livestock industry or production methods. For example, consumer studies of the poultry sector in Mekong countries have established that consumers are willing to pay for product quality that is characterized by free range production methods. Demand for safety can be measured using various methodologies. Studies in Viet Nam have found that poultry consumers in Viet Nam are also willing to pay at least a 10-15% premium for safety certification and support various efforts to develop this market. Consumer sensitivity to prices also has important policy implications.

The profit margins and sales volume of market chain actors can play a role in the spread of disease. Producers will decide whether or not to invest in livestock and risk prevention activities based on current prices and the importance of the enterprise to their own livelihood. Disease risk is another key factor in economic decision making, as it makes investments in livestock more costly. Producer responses to risk and attitudes towards risk can

be challenging to measure but can yield useful information and enhance epidemiological risk assessment.

Economic behaviour is also influenced by both formal and informal institutions. Institutions define the "rules of the game" that govern transactions between actors. Market chain analysis should aim to establish what institutions govern behaviour. These can include uncovering what official regulations are enforced, relationship of local regulators and market actors, and unwritten rules between trading partners. A key institution in poultry supply chains in Viet Nam is that trading relationships throughout the supply chains are repeated (with the same individual(s)) and often involve provision of credit.

Socio-economic factors are important factors in value-chain analysis. Poverty and gender are in particular are important to policymakers and also have implications for economic behaviour. Poorer or highly diversified rural households might not have the capacity or incentives to invest in biosecurity. Gender can also play an important role, as woman often have primary responsibility for livestock. If specific groups are regularly socially excluded or vulnerable, HPED control policies need to take this into account. Market chain analysis should identify how vulnerable groups participate and any constraints that they might face.

THE VALUE OF THE NETWORK ANALYSIS APPROACH –IDENTIFYING CONTROL POINTS LINKED WITH RISK DATA

Vincent Martin

An established analytical framework used in other areas of social science, ***social network analysis***, was applied to live bird market networks in South China in order to identify critical control points for control of HPAI. The study formed part of an ***'integrated risk management'*** approach, following the underlying principle of HACCP applied in marketing chains.

The study focused on live bird markets (LBMs), known to be risk points for transmission of HPAI. Visits to markets were carried out, with interviews of traders to establish sources and destinations of birds. Social network analysis was applied using UCINET software. The results quantify the 'linked-ness' of markets. Taken alongside information on stakeholder behaviour and geographic mapping of markets, markets that could contribute a high proportion of the risk of disease spread could be identified, allowing risk-based surveillance for avian influenza and targeted risk mitigation interventions to be planned.

Further economic studies were required since risk mitigation measures must take account of stakeholders' incentives if they are to be successful.

Requires well trained staff to carry out interviews and ask the right questions. In China getting the full answers at interviews required repeated visits to the same markets and the same traders to build up trust.

Application of the methodology

Study design and data needs

The study was carried out in three provinces of southern China. The value chains were initially mapped through group interviews. This mapping exercise was to:

- Identify major stakeholders and trade patterns;
- Identify main market chains and volumes;

- Qualitative risk assessment;
- Select chains of interest for further studies.

The subsequent social network analysis study was carried out as a longitudinal study to:

- Describe market hygiene and trade practices at market level;
- Provide data on networks by interviewing 5-10 vendors in each market for trade pattern analysis.

In addition, during the longitudinal study samples were collected from birds for the detection of HPAI H5N1.

Results

In a first cross-sectional study implemented in 2009, a set of LBM network maps were produced and the associated risks of HPAIV H5N1 within LBMs and along poultry market chains were estimated, providing new insights into how live poultry trade and infection are intertwined. More specifically, the study provided evidence that several biosecurity factors such as daily cage cleaning, daily cage disinfection or manure processing contributed to a reduction in HPAIV H5N1 presence in LBMs. The study also showed the association between social network indicators and the presence of HPAIV H5N1 in specific network configurations such as the one represented by the counties of origin of the birds traded in LBMs. This new information could be used to develop more targeted and effective control interventions.

In a second longitudinal survey implemented in 2010, four markets in Hunan province and Guangxi Autonomous region were surveyed monthly from January to April with the aim of investigating the association between network parameters and available epidemiological information regarding county' s previous history of HPAI H5N1 poultry and human outbreaks. This study confirmed the results obtained in 2009 in terms of the contribution of source network in infection persistence, capturing at the same time the seasonal fluctuations associated to trade during this time of the year. In addition, investigation of the association between flock and network level attributes and the protection of flock tested at Wulitin market between January and April 2010 has shown that:

1. spent hens were less likely to be unprotected than broiler flocks during the study period;
2. poultry originating from smaller flocks (<5000 heads) are more likely to be unprotected compared to poultry originating from bigger flocks (>7000).

Conclusions

Network analysis can be a very powerful tool to identify highly connected markets (super spreaders if disease is present). The use of social network analysis in combination with epidemiological surveillance in South China identified areas where the success of strategies for HPAI control in the poultry production sector may benefit from better knowledge of poultry trading patterns and the LBM network configuration as well as their capacity for maintaining HPAIV H5N1 infection.

These studies shows the huge potential offered by social network analysis in guiding policy makers in their efforts of defining targeted and cost-effective based interventions for HPAI H5N1 control .

INTEGRATING PARTICIPATORY AND CONVENTIONAL DATA COLLECTION TOOLS FOR UNDERSTANDING LOCAL CHICKEN MARKET CHAINS

Eric Brum

This study demonstrates the value of focus group discussion / semi-structured interviewing to get important detail on value chains.

Application of the methodology and results

An iterative investigation process was utilized to understand H5N1 risk to humans in Jakarta which was originating through the poultry market chain. A variety of tools were used to understand the nature of the risk and how it could be addressed.

First, observations were made of how risk was presenting to humans in Jakarta and to poultry found in Jakarta markets. When this study started there had been five human H5N1 cases within one week in the greater Jakarta area after a quiescent period. Although chickens appeared healthy in collector yards and markets, native chickens bought in Jakarta by the study team, and kept alive for observation, died within a day of being bought (chickens would normally have been slaughtered and consumed within this time).

The second step was to engage with key informants to rapidly assess the nature of the Jakarta poultry value chain. A semi-structured interview with a group of poultry collector yard traders was held, and proportional piling and participatory mapping tools were used to assess trading volume by bird type, and origins and destinations of birds traded through collector yards.

The third step was to conduct a poultry movement profiling and geo-referencing of markets and collector yards in the greater Jakarta area. A previously-conducted poultry value chain map of Jakarta was also consulted during this phase of the investigation. In addition to a geo-referenced database of all post-production marketing locations, the study also provided a cross-sectional view of poultry origins and destinations through each of the marketing locations and quantified the types of birds traded and the means of transport utilized.

The fourth step was to conduct surveillance at collector yards to identify high-risk poultry movements. Live bird sampling, environmental sampling, and sentinel bird monitoring were conducted in collector yards in two districts of greater Jakarta. Despite the study being designed to determine the cost-effective longitudinal collector yard surveillance technique, preliminary data from the sentinel bird monitoring component of the study identified high risk native chickens originating from a site in Central Java. The site in Central Java was determined to be another collector yard which sources native chickens from villages in East Java, Central Java, and Yogyakarta for onward transport to Jakarta.

Once the upstream collector yard was confirmed as a critical control point (CCP) for the introduction of infected native chickens into the Jakarta markets, a small multi-disciplinary team utilizing participatory engagement tools conducted a rapid site assessment to develop a risk reduction recommendation for consideration by stakeholders. The objective was to develop a mutually beneficial plan that would be accepted by both government and private sector market stakeholders without the need for strong regulatory enforcement. An assessment of the collector yard's organizational structure, infrastructure, marketing practices, cleaning and disinfection activities, and contribution to HPAI risk to humans in Jakarta

was prepared and accepted by local government authorities. Efforts are now underway to develop a risk reduction plan to collaboration with private sector market stakeholders.

Discussion

Regarding the value of utilizing participatory approaches in addition to, or integrated with, other data gathering techniques, the core benefit appears to that participatory approaches build trust with stakeholders. This trust enables rapport and mutual understanding to be established more effectively, as well as increasing the likelihood of valid communicative exchange being established when data are being gathered. Thus, the question is not whether to choose participatory approaches over conventional approaches, but rather how the addition of participatory approaches can improve the overall quality of data gathered regardless of the specific tool used.

In summary, the basic inquiry process utilized to identify and address this critical control point along the Indonesia poultry market chain is as follows:

1. Where is the problem (risk) being felt?
2. Where can the problem (risk) be addressed (Where is a CCP)?
   - What product is being moved?
   - Where is it coming from and where is it going?
   - How is it moving?
   - How long does it take?
3. How can one work with stakeholders at this CCP to fix the problem (reduce risk)?
   - What's the perspective of the stakeholder?
   - What's valuable and how is value determined?
   - What knowledge gaps exist?
   - How are decisions made?

CROSS BORDER MAPPING WITH INCLUSION OF CROSS-BORDER PRICE DIFFERENTIALS

Mohinder Oberoi

Cross border mapping in South Asia with inclusion of cross-border price differentials lead to the acceptance by Bangladesh that the unofficial importing of eggs from India was unavoidable and therefore should be made official and managed. This opens the opportunity for a proactive risk management strategy rather than an ineffective official ban on imports that creates unknown and uncontrolled risk.

Bangladesh shares long and porous borders with limited number of border guards and custom officials with India. There exists formal border trading; however, poultry and poultry products are not incorporated in the trading items list. A large number of families living near the border area have family bondage with other side of the border. Under the cross-border project a study was conducted in six selected cross border corridors of Bangladesh with India. From each target location five rural poultry markets were selected. At each market four categories of respondents were identified. These included poultry seller/retailer, trader, community people engaged in poultry rearing practice and key informants. Data collection was done on two occasions within a period of three months. A blend of qualitative and quantitative data was obtained using a variety of techniques.

The data were collected through interviews of 618 individual respondents, 110 focus group discussions (FGDs) and four larger group discussions (including all categories of respondents). 'Price difference' was a big factor for cross border illegal poultry trading. Findings specifically from the Comilla (Bangladesh) - Sonamura (India) corridor indicated huge volume of poultry and poultry products (chicks and eggs) transportation across border into Bangladesh. In most of the markets in this border corridor, Indian farm produced eggs were being sold openly at a cheaper rate compared to the Bangladeshi products. Both farmed and native eggs of various quantities were coming on regular basis but the inflow was mainly of day old chicks (DOCs). Here, overall 50-70 percent DOCs come from India because price of chicks in Bangladesh was very high (approximately double the proce paid for Indian DOCs). Approximately 4-5 hundred white Indian eggs entered daily into Bangladesh. Some of the people directly or indirectly involved in unofficial trading included, people who were involved in the poultry business, traders (middle men, who make contract with both sides businessmen across border), syndicate of businessmen, disguised social workers, political leaders and law enforcement agency personnel. Some of the main reasons for cross border poultry and poultry products trading from India were higher demand in Bangladesh and lower price in India.

Partly on the basis of the information provided by this study, the Government of Bangladesh has decided to allow the official importation of 10 million eggs and day-old chicks (DOC) from India in 2010-11. This is basically a pragmatic decision in the face of an irresistible economic incentive for the trade to take place, officially or not. The decision opens the opportunity for a proactive risk management strategy rather than an ineffective official ban on imports that creates unknown and uncontrolled risk.

However, such a decision has triggered strong resentment among the local poultry farmers, because it effectively removes a protectionist mechanism and exposes them to international competition. They said this will cause widespread loss to them and lead to closure of thousands of small farms. Another interpretation could be that the Bangladeshi egg and DOC producers now have a strong incentive to improve their management standards to the level of their Indian competitors: those who rise to this challenge will survive and be in a better position than before.

VALUE CHAIN MAPPING AND SUBSEQUENT RISK ASSESSMENT OF CROSS-BORDER CHICKEN TRADE BETWEEN NORTHERN VIETNAM AND CHINA

Andrew Bisson

Value Chain mapping and subsequent risk assessment of cross-border chicken trade between Northern Vietnam and China prompted a review of trade policy to control movements and stronger collaborative links in considering an alternative managed cross-border trade mechanism.

Background

The risks associated with movement of livestock and livestock products across the China-Vietnam border have been appreciated for some time. Spent hen trade in particular is driven by powerful economic drivers and it was recognised that preventing such trade with the available resources was not feasible. However identifying alternative solutions was a challenge.

Methodology

In order to develop more effective risk reduction strategies there was a need to better understand and characterise the cross-border trade. A range of participatory approaches including stakeholder interviews, seasonal calendars and supply chain mapping were used. The information gathered was very difficult to verify directly but through cross-checking by triangulation and consistency of information obtained from a number of key informants a clear pattern emerged and permitted a semi-quantitative description of the trade. This was combined with simple economic analysis.

Findings

Studies were able to document the scale and sophistication of unofficial cross-border poultry trade as well as the intricacies of the unofficial system and the incentive structures for those involved. The emerging evidence base became a useful advocacy tool confirming that existing control approaches were not effective and encouraging a policy debate seeking alternative solutions.

The value-chain work also provided a foundation for further detailed risk assessment exercises. These highlighted the fact that the trade movements did not occur only at the border but were part of a wider trade system. This in turn helped identify transmission risks and to target potential control opportunities at a number of nodes along the supply chain including on both sides of the border as well as at the border.

With an improved understanding of the mechanisms of cross-border trade and the economics behind the movements, policy options to support carefully regulated trade (rather than prohibiting it) are being considered which have the potential for greater impact in reducing overall disease transmission risks. Preliminary risk reduction options identified include:

i. a HACCP-like approach applied at a number of control points along the chains;
ii. certification of farms of origin on one side of the border supplying birds or poultry products across the border;
iii. the development of a dedicated supply chain to manage higher risk poultry trade by excluding product (or pathogens) from leaving the specialised supply chain (so called dirty compartment approach).

For each of the options, alternative value chains need to be described and analysed for feasibility and appropriate incentive structures if trade is to be re-directed. Characterisation of the existing value chain provides important information on the current transaction costs of doing business unofficially and therefore helps to understand whether future re-designs of the value chain will be viable. Conventional quarantine and border policing systems may still be required to ensure transaction costs for undesirable channels remain higher than for managed commodity flows.

THE USE OF CROSS-BORDER MAPPING AND LOCAL INTERVIEWING OF STAKEHOLDERS TO UNDERSTAND THE UNOFFICIAL CATTLE TRADE ACROSS SOUTH EAST ASIA

Alexandre Bouchot

The SEACFMD campaign used cross-border mapping and local interviewing of stakeholders to understand the unofficial cattle trade across South East Asia so that more effective Foot-and Mouth Disease (FMD) control options could be developed.

Context

Animal movement is believed to be the predominant cause of new FMD outbreaks. This presents a difficult issue for all member countries of the SEACFMD campaign which is a long-run programme whose aim is to control Foot-and Mouth Disease in South East Asia by 2020. Given the importance of the livestock sector, including the economic value of the livestock trade, considerable animal movement is typical of the region. It is well recognized that changing economic circumstances in the region can cause fluctuations in the direction of animal movements. Amongst many other activities, ranging from transparency about disease information and regional commitment, it has been, and is still, very useful to for the SEACFMD members to have detailed information about stakeholders and transactions across the chain of trans-borders livestock transport so that attractive (from a cost/profit point of view) alternatives can be offered to producers, traders and buyers of these livestock to work in a risk-managed chain (e.g. controlled trade in vaccinated and quarantined cattle).

Application of the methodology

During the last three years, with the assistance of member countries, the RCU has developed notably through value chain analysis by semi-structured interviews or experts meetings a much better appreciation of the direction, nature, and extent of livestock movements in the region.

Semi-structured interviewing was the main methodology employed. Stakeholders meetings were also organised to cross-check some information, mainly through the use of participatory mapping, resulting in a set of peer-reviewed maps. The semi-structured interview methodology implemented to identify stakeholders and map the market chain of cross-border livestock movement was a non-probability sampling method known as ***Snowball Sampling***. This is a sampling method in which initial respondents for the survey are first selected and, through their response to questions in the interview, they elect the subsequent respondents. Snowball Sampling has been used in public health studies and is highly appropriate for where relational data is of interest and when the sampling frame is not available or unknown as it the case here with limited centralised information on livestock traders; absent or incomplete trader registration systems and, also, occurrence of unofficial trade.

In each of the study sites, key traders or other entry points (identified from available information from veterinary authority or previous studies) were selected as the 'initial respondent' and interviewed using a participatory approach to data collection aimed to gather information on, *inter alia*: the movement pathways and its seasonal trends, market

chains and trading behaviour and relationships. The information gathered from this interview was then used to identify secondary respondents who were linked, through trade movements of livestock, to the initial respondents. This method was continued as far as possible in both 'upstream' and 'downstream' directions until the source and destination of livestock (as far as possible) were reached.

Results

Although the overall general movement pattern seems well established for cattle and buffalo, over shorter timeframes patterns can change rapidly in response to changes in demand and price signals. For pigs, patterns are more dynamic over short periods, often reflecting supply and demand imbalances due, sometimes, to disease outbreaks (e.g. PRRS). Recent years have seen a marked increase in movements of cattle into Vietnam and north into China. Such changes highlight the need for greater flexibility in developing a control strategy for the future. Although China, Vietnam, and Malaysia are likely to remain the major markets for cattle, buffalo and goats, and movements in these general directions can be anticipated with some confidence, prudence suggests undertaking periodic reviews of the trends that stimulate animal movement. For pigs, the dominant pathway is from Vietnam to Lao PDR, Cambodia and, sometimes, Thailand (frozen suckling piglets). Some pigs are moved for slaughter from Thailand to Cambodia and Lao PDR.

Perspectives

Patterns of animal movement remain a critical element in designing future strategy. Movements are exceptionally difficult to control, following as they do, well established demand and price gradients, and it now seems wiser and more appropriate to simply facilitate movements in the direction that market demands dictate. Trying to alter or slow livestock movements only encourages increasing rates of illegal movement. The best strategy, in seeking more effective controls of animal movement, is to reduce costs, improve the efficiency of legal animal movements, and encourage traditional movements to conform, at least in part, to some form of inspection. Reduced costs and free FMD vaccination for border traders or even at source would encourage more legal animal traffic. The range of animal movement management processes needs to be examined annually to identify risks and opportunities for a more efficient system. Traceability with the aid of ear tags, brands, and ear notches helps; and the growing popularity of such devices should be encouraged.

Control at source and improved inspection techniques are to be developed for livestock movements across the supply chain.

In this approach, a current partnership between private sector and public veterinary services of both Myanmar and Malaysia represents a pilot experience worth to be noted. In this case, a Malaysian private company has set up in Central Myanmar a private quarantine station, run by local management, where up to 400 cattle are gathered every month. Those animals are bought in the neighbourhood at usually a better price than the market price. Those animals are identified and individually vaccinated against FMD by a Myanmar Official soon after entering the station, are kept more than 21 days after the injection, and then sent accompanied by a certificate to Yangon by road and then straightforward to Malaysia

by boat without any more quarantine delay at arrival. As trust increases, this mechanism is significantly increasing the security, the rapidity of the market chain, and as a consequence the value of the trade for all stakeholders.

Such an approach shall serve as an example when thinking about reducing administrative burdens along other trade pathways in the region. For instance, there are probably currently relative money losses at quarantine station at borders: it is well known that many traders are trying to avoid the attached taxes, fees, cost of use and loss of time by smuggling their animals, infected or not, through the porous borders. As a consequence, this approach of quarantine stations at borders is considered more and more as inefficient. The money saved by reducing what finally appears as obstacles to trade could be usefully employed by vaccinating and holding identified animals closer to the source of production. This could be done first on a pilot basis and then become the rule for the ASEAN free trade agreement that is supposed to take place in 2015. For this approach to be successful requires precise knowledge of who are the stakeholders that are currently taking advantage, formally or informally, of the trade along the market chain. Then it would be necessary to propose to everyone (private sector [traders, smallholders, final buyers...], public sector [veterinary services, customs...]), through intense consultation and participatory approaches, an alternative that provides as much as possible to every one of them incentives to get involved in a safer trade. At least, the system proposed should not hamper anyone's livelihood as it would even give them an incentive to block such a safer trade if it was the case.

Final words

FLEXIBILITY

The target of applying the combination of value chain and risk analyses described here is to address disease risk and contribute to disease control planning. Therefore the value chain analysis needs to focus on elements that either increase disease risk or are critical in disease risk management, which avoids the need to carry out a complete value chain analysis. Otherwise there is the danger that value chain mapping and analysis are carried out in unnecessary detail or with the wrong focus. The best way to achieve this is to ensure that veterinary epidemiologists and social scientists work together throughout the process at all levels and at all stages from design through to the field work to the analysis and reporting.

The methodological approach presented here should not be seen as a rigid prescription. The approach can be flexible: It is important to work at different levels of detail. An overview is needed to ensure that no important risks in the value chains are omitted. Attention to detail is needed in identifying and appraising risk reduction measures. The amount of detailed data and detailed analysis required should be driven by the requirements of disease control decision making. The iterative nature of data gathering should be noted. It is not necessary or practical to get everything 'perfect' before making decisions. The value chain / risk analysis process will identify areas where better data are critically needed so that focus data collection efforts can be focused and prioritised.

The processes described may be carried out by a few experts working together or with full involvement of all stakeholders through series of workshops, discussions or personal interviews (often the choice here depends on availability of experts, time constraints and budget available).

The analyses and monitoring of risk in value chains should be carried out as an element of preparedness for disease, not only in response to outbreaks. Then, an understanding of the 'usual' patterns of movements of animals, products, materials, people and vehicles etc. would lead to better understanding of how disease *could* spread *if* introduced into the system at different places, which in turn allows for planning of strategies to reduce risks.

It is important for veterinary services to monitor changes in value chains and assess how these may change in time and space, e.g. reactions to market shocks, or long term trends in consumer preferences and supply. Variations in prices (short or longer term) between areas within a country or across national boundaries may affect flows and relative importance of different value chains, that in turn could affect disease risk. Risk factors can change seasonally and also change over long term as livestock sectors develop. Veterinary services need to monitor changes and be responsive to different risk levels.

Value chain and risk analysis can also be useful to permit advanced risk assessment or long-range forecasting and also help to guide decision makers in contingency planning and design of early warning systems.

At a regional level it may be possible to apply the principles of this approach very quickly to rapidly assess production systems, epidemiological situation of disease and socio-political situation within several countries to identify countries where disease control interventions for specific diseases may be feasible or not feasible in the short or medium term.

DATA SHARING

It is essential to ensure that concerned disease control decision makers have easy access to the generated value chain analysis results. Geographic Information Systems can be used to include a large amount of value chain information in maps. These maps would indentify production system clusters, value chain transaction routes and processing points. Market price information and differentials can be included as price surface layers. Tables with names, phone number and trade/collection patterns of traders would be of interest for sharing with public veterinary staff in the field for day to day surveillance and disease monitoring.

TIP 15

Pitfalls to be avoided

Cautionary tales.

- Avoid collecting value chain information without focusing on the important data required to explain disease spread;
- Ensure that incentive structures are fully developed since these may be important in designing implementable control strategies.
- Avoid presentation of results from non-representative, often convenience sampling as though they were randomly obtained. The sampling methodology should be clearly and completely described when presenting results. Limitations and uncertainties MUST be emphasised.

Annex 1
Glossary of technical and related terms in value chain and risk analysis

Technical term	Definition
Stakeholder	Any person (or institution) who is affected by an issue, and particularly has anything to gain or lose. *They hold a 'stake' in the situation just as a gambler stands to gain or lose money from the outcome of a football match.*
Value chain	Value chains are the input, production and marketing chains that supply livestock products to the consumer. The chains are operated by people as an economic activity. Therefore we can say that: Value chains are **groups of people** linked by an activity to **supply** a specific commodity. Value chains ***describe*** the processes through which inputs, animals and products pass during the production process.
Value chain analysis	Value chain analysis includes not only description of the production and marketing processes but also **analyses the economic and social drivers of the chain**. Full value chain analysis therefore requires economic expertise.
Risk analysis Also see OIE handbook[1] and code[2]	Structured standard process used to **evaluate and manage risks**. Consists of four components: Hazard identification; Risk assessment; Risk management; Risk communication.
Hazard	**Hazard** is an agent that can cause harm or damage (e.g. heavy rainfall, a virus).
Hazard Identification	The first part of risk analysis in which the dangerous agent, or agents if there are several, are defined.
Unwanted outcome	The **unwanted outcome** is the harmful or damaging event that may (or may not) be caused by the hazard (e.g. flooding, an epidemic).
Risk Assessment	Risk assessment is the part of risk analysis where we **assess the risk** (see below).
Likelihood / probability	In risk assessment, this is the **estimated probability** that the unwanted outcome will occur in a given population and during a given period of time. The probability is expressed in words (low, medium, high) in qualitative risk assessment. In quantitative risk assessment the probability is calculated mathematically.
Consequences	In risk assessment, 'consequences' are the **effects of an unwanted outcome**. A description of consequences should provide information on how different stakeholders are affected by the outcome (e.g. consequences of an outbreak of avian influenza could include: farmers lose birds to mortality; veterinary services have increased workload; traders cannot trade in quarantine area… etc.).
Impact	In risk assessment, 'impact' describes or quantifies the **cost of the unwanted outcome**. To evaluate this cost requires first that the consequences are described. The total impact will be a summation of impacts on different stakeholders.
Risk	In risk assessment, the risk we assess is a **combination of the likelihood of the unwanted outcome happening and its impact**.
Risk Management	Risk management covers all **measures taken to protect against unwanted outcomes**. Risk control measures may be targeted at reducing the likelihood of the unwanted outcome or reducing the impact.
Risk Communication	Risk communication covers all processes of **sharing information about risks between all stakeholders**. Risk communication is a (multi-way) process whereby risk mangers learn about risks from those directly affected and communicate and consult on risk management strategies.

[1] OIE (2004). Handbook on Import Risk Analysis for Animals and Animal products. Volume 1, Introduction and qualitative risk analysis. Volume 2, Quantitative risk assessment. Paris: World Organisation for Animal Health.

[2] OIE (2008). Chapter 1.3.2. Guidelines for import risk analysis. http://www.oie.int/eng/normes/mcode/en_chapitre_1.2.2.htm.

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Availability: January 2012

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Value chain studies, including production system and market chain studies, are essential to value chain analysis, which when coupled with disease risk analysis is a powerful tool to identify key constraints and opportunities for disease control based on risk management in a livestock production and marketing system. Several production system and market chain studies have been conducted to support disease control interventions in South East Asia. This practical aid summarizes experiences and lessons learned from the implementation of such value chain studies in South East Asia. Based on these experiences it prioritizes the required data for the respective purpose of a value chain study and recommends data collection as well as data analysis tools.

This practical aid is intended as an adjunct to the FAO value chain approach and animal diseases risk management guidelines document. Further practical advice is provided for more effective use of value chain studies in South and South East Asia as part of animal health decision support.

ISBN 978-92-5-107139-7

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I2583E/1/01.12