A Collaborative Research Project Funded by:

DFID Department for International Development

Implemented by:

FAO

RVC Royal Veterinary College University of London

IFPRI INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

HPAI PRO-POOR HPAI RISK REDUCTION

Poultry value chains and HPAI in Indonesia: The case of Bogor

Asep Sudarman
Karl M. Rich
Tom Randolph
Fred Unger

Africa/Indonesia Team Working Paper No. 27
April 2010

Table of Contents

List of Tables

List of Figures

Preface

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

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

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

Authors

Asep Sudarman, Animal Scientist, Centre for Tropical Animal Studies, Bogor Agricultural University

Karl M. Rich, Senior Research Fellow, Norwegian Institute of International Affairs and Agricultural Economist, International Livestock Research Institute

Tom Randolph, Agricultural Economist, International Livestock Research Institute

Fred Unger, Veterinary Epidemiologist, International Livestock Research Institute

Disclaimer

More information

For more information about the project, please refer to http://www.hpai-research.net.

Acronyms

ASOHI : Assosiasi Obat Hewan Indonesia (Indonesian Animal Drug Association)

CMU : Campaign Management Unit

Ditjennak (DGLS) : Direktorat Jenderal Peternakan (Directorate General for Livestock Services)

DKI : Daerah Khusus Ibukota (Special Capital District)

DLS : District Livestock Services (often referred to as *Dinas*)

DOC : Day-old chick

DOD : Day-old duckling

GPMT : Gabungan Perusahaan Pakan Ternak (Feed Mill Association)

GPPUI : Gabungan Pengusaha Perbibitan Indonesia (Association of Indonesia Poultry Breeder)

GPS : Global Positioning System

HPAI : Highly pathogenic avian influenza

IB : Infectious bronchitis

IBD : Infectious bursal disease

IDR : Indonesian Rupiah (roughly valued at 10,000 IDR=USD 1 at the time of the study)

IPWA : Ikatan Warga Pemotong Ayam (Association of Slaughter Point)

ND : Newcastle disease

PINSAR : Assosiasi Peternak Unggas Se-Indonesia (Indonesian Poultry Farmer Association and Information Centre)

PIR : Plasma Inti Rakyat (Nucleus-Plasma Farming System)

PPUI : Perhimpunan Peternak Unggas Indonesia (Indonesian Association of Poultry Farmers)

PDSR : Participatory Disease Surveillance and Response

PS : Poultry shop

PSH : Poultry slaughterhouse

PSP : Poultry slaughter point

RW : Rukun Warga (neighbourhood administrative unit)

UPTD : Unit Pelaksana Teknis Daerah (Regional technical implementing unit)

VCA : Value chain analysis

Glossary

Pullet : 6-month-old female layer ready to lay eggs

Farm Categories (FAO 2004)

Sector 1 farm : Industrial integrated system with high level of biosecurity and birds/products marketed commercially (e.g. farms that are part of an integrated broiler production enterprise with clearly defined and implemented standard operating procedures for biosecurity)

Sector 2 farm : Commercial poultry production system with moderate to high biosecurity and birds/products usually marketed commercially (e.g. farms with birds kept indoors continuously; strictly preventing contact with other poultry or wildlife)

Sector 3 farm : Commercial poultry production system with low to minimal biosecurity and birds/products entering live bird markets (e.g. a caged layer farm with birds in open sheds; a farm with poultry spending time outside the shed; a farm producing chickens and waterfowl)

Sector 4 farm : Village or backyard production with minimal biosecurity and birds/products consumed locally

Executive summary

Poultry is an important source of income and protein for poor households in Indonesia. In a normal year, the production of poultry meat in Indonesia is approximately 1.285 million tons per annum, representing around 62% of total domestic meat production. In addition, egg production amounts to 1.2 billion tons, with domestic production fulfilling domestic consumer demand for eggs. However, the entry of highly pathogenic avian influenza (HPAI) in Indonesia beginning in 2003 has had large negative impacts on rural livelihoods, both in terms of the production losses caused by the disease and the fears of its potential spread in humans. At present, HPAI is endemic throughout Indonesia and has affected all parts of the poultry business. Its spread in Jakarta, where a number of people died from HPAI, prompted the local government of Jakarta to adopt strict movement controls in controlling and monitoring poultry rearing and marketing in the metro Jakarta region.

These regulations will have important effects on the poultry sector in Indonesia. Given the importance of Jakarta as a destination for poultry products, the ban on live poultry markets will result in the reorganization of market chains that service Jakarta, providing specific opportunities for surrounding regions. One of the regions that could benefit from these new regulations is Bogor, a district located directly to the south of Jakarta. As with other parts of Indonesia, poultry industries in Bogor have been directly affected by HPAI. At the same time, the new poultry regulations imposed by the local DKI Government provide opportunities for the region provided that HPAI can be effectively controlled. However, the ability of Bogor to benefit from these new regulations requires an enhanced knowledge of the structure of the poultry industry in Bogor, its relationships and linkages with regional markets, and the extent to which specific links in the marketing chain potentially impinge on the ability of Bogor to supply poultry that meets the standards of the Jakarta market, including its ability to effectively control disease.

This study adopted a value chain approach to assess the impact of HPAI on the Bogor region, highlighting the direct commercial and livelihood impacts within Bogor itself and potential socio-economic risk factors emanating from these chains. Primary data were collected from four subdistricts in Bogor and in Bogor City itself. Research locations were defined purposively based on their spatial geography, with four subdistricts in Bogor chosen as research locations: Ciawi, Cibinong, Leuwiliang and Parung. Ciawi and Leuwiliang are dominantly occupied by the Sundanese ethnic group and are characteristic of the local culture in the region. By contrast, the inhabitants of Cibinong and Parung, located close to Jakarta, represent a multitude of different local cultures, and provide a more diverse perspective on local production and consumption habits. The inclusion of Bogor City provides insights on the dynamics of large wet markets (Pasar Anyar and Pasar Bogor) that absorb poultry products from Bogor and surrounding areas, and is home to a number of formal sector retailers and supermarkets.

Value chains for poultry in Bogor are quite diverse. Poultry production in Bogor is dominated by broilers, which represented over 73% of the poultry population in 2008. Indigenous kampong chicken populations have been falling over the past few years and in 2008 comprised around 7% of total poultry population in Bogor. Value-added generated from the poultry sector is estimated to be at least IDR 359 billion, or approximately USD 35.9 million. As this figure excludes many important linkages for which data were not available, it is not unreasonable to posit that the poultry sector and

its ancillary services contribute close to 1% of regional GDP in Bogor. Not surprisingly, the broiler sector comprises almost 80% of sector value added. Besides generating income, the poultry trade employs an estimated 6300 workers out of 1 million total labourers in Bogor District.

Governance relationships in the broiler sector involve a mix of contract farms and independent farms. Contract farming relationships formally link farms with a company that provides day-old chicks (DOCs), feed and other inputs to farmers in return for guaranteed purchases of contracted birds. Coordination and biosecurity in such chains is reasonably tight, with company standards strictly governing transactions and prices. Independent farms involve much looser coordination, although some coordination exists with feed suppliers. In the layer chain, spent female layers are sold almost entirely through independent farmers, while male layers are integrated in a contract farm relationship akin to broilers. Nonetheless, the layer business is supported by feed industry, pharmaceutical and vaccine industry, and other actors related to poultry distribution (collectors, slaughter points, restaurants etc.). In both chains, a large proportion of products are sold outside of Bogor, including to nearby markets in Jakarta.

The traditional kampong sector is largely uncoordinated. In general, the production of kampong chicken is not commercially oriented, with farmers selling their chickens only when they need to pay their bills, such as tuition fees for their children. Generally they sell 2-5 birds per 6 months. Kampong chickens also contribute to food security in the rural community and are used in social and cultural events, such as wedding parties.

The impacts of HPAI in Bogor varied notably by the type of value chain affected. Commercial producers of layers and poultry were greatly impacted by the outbreaks since 2003, with layer numbers falling by two-thirds, while broiler growth stalled. However, with the change in regulations in Jakarta banning live poultry in 2007, demand from nearby regions soared, and commercial populations of both broilers and layers in 2008 exceeded pre-HPAI numbers in 2003 in response to these new opportunities. Mortality rates rose for both contract and independent farmers, but were higher for independent farmers. Feeding costs also rose, as feed conversion rates increased. This impacted independent farmers more than contract farmers. Interestingly, while consumer prices fell by around 20% due to a drop in consumer demand during one major consumer scare, prices quickly recovered within one month. Poultry demand remains strong despite the HPAI outbreak as poultry is one of the cheapest sources of animal protein available in Indonesia.

In the kampong chicken sector, impacts were felt disproportionately among sector 3 farms. Interestingly, the kampong chicken sector was not that impacted by HPAI (relative to the commercial sector) in 2006, although the numbers of birds in the sector fell by over 30% over 2006-2008 as government depopulation and culling programs were implemented. Approximately 5% of kampong farms (mainly commercialized, sector 3 farms) went out of business as a result of HPAI. Those commercial kampong farmers that were impacted by HPAI were able to find other livelihoods in activities such as petty trading, but incomes fell by 40% relative to their previous income raising poultry. While compensation was paid to such farmers, government compensation rates for culled chickens were typically well below current market prices. By contrast, sector 4 backyard farms were not as impacted, although mortality rates of poultry rose. Moreover, new regulations banning backyard poultry production among households without land could potentially impact some sector 4 farmers, although it is not clear how well such regulations can or will be enforced.

A variety of risk hotspots potentially compromise the control of HPAI within the different Bogor-based value chains. Survey results regarding biosecurity knowledge and practices revealed that while most actors across different sectors (e.g. sector 1 through sector 4) could identify suspected HPAI cases, awareness was lower in the kampong chicken and duck sector. Disinfectants are rarely applied in traditional value chains, given perceptions that disinfectants are expensive. Live bird retailers are a particular risk point for the spread of HPAI given over 50% of live bird retailers reported that they simply throw away the dead birds, without any treatment. Slaughter points and traditional farmers (Sector 4 duck and kampong chicken farmers) are also potential risk points given the handling of dead poultry; the carcasses are either thrown away or fed to catfish.

There are two competing narratives with respect to HPAI control that emerge from the analysis: the commercial narrative with actors that have the incentive, capacity and institutionalized coordination mechanisms to adopt improved biosecurity on their own; and the informal narrative involving smaller-scale commercial or informal actors with little incentive, if any, to invest in mitigating HPAI risk. These narratives are relatively mutually exclusive, although the small-scale layer chain has a combination of coordination upstream between breeders and farmers and more amorphous transactions downstream by traders and retailers. At the same time, market-based interactions between each narrative potentially compromise the biosecurity of the sector as a whole, with interventions needed that understand these dynamics.

For this latter set of actors, public intervention and incentives justified by the public health dimension are likely to be required to stimulate the desired changes. With limited coordinating mechanisms, either through trade associations or other forms of social capital, a heavy reliance on informal, market-based transactions, and limited financial return from improved biosecurity, designing such interventions will be extremely challenging. Particular bottlenecks include traders, who may operate as mobile individuals rather than fixed businesses, and informal market retailers, whose knowledge and awareness of better biosecurity practices is often limited. Imposing biosecurity through regulation is one option, but not likely to be effective: enforcement would be nearly impossible with existing public resources. With the lack of coordination and leverage within these value chains, actors might be encouraged to ‘go underground’ and shift into the informal sector, potentially modulating disease risk even further.

Another option considered for HPAI control has been restructuring the value chains to concentrate more of the production and trade within the more coordinated actors; the restructuring of live bird markets in Jakarta is an example of this. Here, the government faces the critical trade-off of reversing its long-time and extremely successful promotion of small-scale poultry enterprises as a mechanism for broad-based development and income generation, and replacing it with higher industrial concentration, exacerbating income disparities and reducing resilience among lower-income groups.

A third option would entail ‘smart’ interventions carefully designed to create or align with actor incentives to enhance compliance, either through subsidies or through schemes that increase coordination and leverage among the actors in the value chain, such as creating professional associations with certification schemes. This option will require empowering chain-level ‘champions’ engaged in activities that can better coordinate the value chain to meet specified market needs. An often overlooked partner in such an option is the consumer, finding ways to tap into latent concerns

about food safety and public health, for instance. Organizing chains in a bottom-up, organic manner that provides opportunities to value-add production, improve biosecurity and target key consumer attributes is likely to be more sustainable over time than top-down mandates, particularly in chains as amorphous and constantly evolving as those found in the informal poultry sector.

1. Introduction

1.1 Study motivation and objectives

Poultry is an important source of income and protein for poor households in developing countries. Unlike other types of livestock, poultry has a short gestation period, with investment returns available much more quickly. Second, the land needed to raise poultry does not need to be as extensive as that for raising ruminants. Finally, the amount of investment required to engage in poultry production is relatively small. As a consequence, poultry production can serve as an important source of livelihoods in rural areas, both in terms of income and employment generation.

In a normal year, the production of poultry meat in Indonesia is approximately 1.285 million tons per annum, representing around 62% of total domestic meat production. In addition, egg production amounts to 1.2 billion tons, with domestic production fulfilling domestic consumer demand for eggs (Ditjennak 2007). However, the entry of the virulent H5N1 strain of highly pathogenic avian influenza (HPAI) into Indonesia in 2003 has had large negative impacts on rural livelihoods, both in terms of the production losses caused by the disease and the fear of its potential spread in humans. At present, HPAI is endemic throughout Indonesia and has affected all parts of the poultry sector. Its spread in Jakarta, where a number of people have died as a result of HPAI, has forced the local government of Jakarta to adopt strict movement controls for managing and monitoring poultry rearing and distribution in the Daerah Khusus Ibukota (DKI) Jakarta region. These culminated in the adoption of two poultry regulations: Peraturan Gubernur (Governor Regulation) No. 15/2007 (Pemprov DKI Jakarta 2007a) and Peraturan Daerah (Regional Regulation) No. 4/2007 (Pemprov DKI Jakarta 2007b), which mandated that Jakarta communities ban the rearing of poultry in residential areas while slaughtering of local poultry is to take place in specialized areas in the city. These regulations have particular effects on the poultry trade in Indonesia. Given the importance of Jakarta as a destination for poultry products, the ban on live poultry markets will result in the reorganization of market chains that service Jakarta, creating specific opportunities for surrounding regions.

One of the regions that could benefit from these new regulations is Bogor, a district located directly to the south of Jakarta. As with other parts of Indonesia, poultry industries in Bogor have been directly affected by HPAI. At the same time, the new poultry regulations imposed by the local DKI Jakarta government offer opportunities for the region provided that HPAI can be effectively controlled. However, the ability of Bogor to benefit from these new regulations requires an enhanced knowledge of the structure of the poultry industry in Bogor, its relationships and linkages with regional markets, and the extent to which critical control points in the marketing chain potentially impinge on the ability of Bogor to supply poultry that meet the standards of the Jakarta market, including its ability to effectively control disease.

The main objective of this study is to understand the nature of the poultry sector in Bogor and its market linkages in the context of HPAI control in Indonesia. A major gap in our knowledge of HPAI is the means by which interactions within the marketing chain serve to exacerbate the risk of disease introduction and spread within a region. Related to this is a limited understanding of how HPAI impacts different value chain actors and how these impacts would influence various incentives for disease control. Our unit of analysis in this study is the *value chain*, defined by Kaplinsky (2000: 121)

as “the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production, delivery to final consumers and final disposal after use.” The emphasis on the value chain is critical in the context of an animal health outbreak because of the systems context in which diseases take place. Indeed, the impact of an animal disease is felt not only at production level, but also through the marketing chain (traders, processors, retailers etc.), necessitating a more holistic understanding of its economic effects. Moreover, because disease impacts can affect different groups in different ways, understanding the incentives behind disease control is critical to conceiving successful, system-oriented interventions that can better contain HPAI.

Given the interactions of Bogor with the greater Jakarta market and the potential that successful disease control could have on the poultry sector in Bogor, this case study provides insights into the effects and risks of HPAI at a regional level. It is hoped that this case can provide broader insights into disease control implications in other settings in Indonesia and beyond.

Research Questions

Specific research questions addressed in this study include the following:

1. What are the characteristics of participants in the poultry business in Bogor?
2. What types of market chains exist for major types of poultry products generated in Bogor, and how do such chains differ by level of commercialization? What is the flow of volume and value by chain?
3. Who benefits from value chain participation in terms of the shares of value added received by different actors in the chain?
4. What are the governance structures of the value chain for poultry products? To what extent can these be mobilized to effectively enhance disease control? To what extent do governance structures impede compliance with control mechanisms?
5. What types of negative impacts, in terms of economic impacts and effects on employment, have been caused by HPAI?
6. What are the critical points for disease risk in the value chain and what types of mechanisms could be adopted to enhance incentives for disease control?

For the purposes of this study, we focus on veterinary risk of HPAI introduction and spread among poultry and birds rather than the associated public health risk.

1.2 Methodology and approach

Overview of value chain analysis

The methodological approach taken in this analysis follows the value chain framework spelled out in Kaplinsky and Morris (2001). This analysis characterizes value chains through a four-step process: chain mapping, governance relationships, upgrading in the chain and distribution effects. An important advantage of this approach is that it is a systematic, peer-reviewed way of highlighting the linkages and interactions between key actors in the value chain, highlighting not only the nature of economic transactions but also social, political and cultural factors that influence how such transactions take place. This approach has been applied in the context of livestock systems (Humphrey and Napier 2005; SADC 2009) and in the analysis of livestock diseases (Kobayashi 2006; Taylor et al. 2008; McLeod et al. 2009). An advantage of utilizing the value chain framework in the context of animal health is in its ability to identify risk hotspots (sometimes loosely referred to as "critical control points," despite their more specific meaning in the Hazard Analysis Critical Control Point [HACCP] literature) that might impede disease control in their socio-economic and value chain level context (Taylor et al. 2008).

Figure 1 illustrates that the poultry industry in Bogor provides many advantages to local communities through its contributions of household income and employment. HPAI outbreaks have had direct (i.e. by reducing the volume of birds reared and traded) and indirect (i.e. via regulations limiting backyard poultry) impacts on both income and employment. Our value chain analysis helps to illuminate those linkages and impacts more systematically to better assess those parts of the chain that were more or less influenced by the occurrence of HPAI.

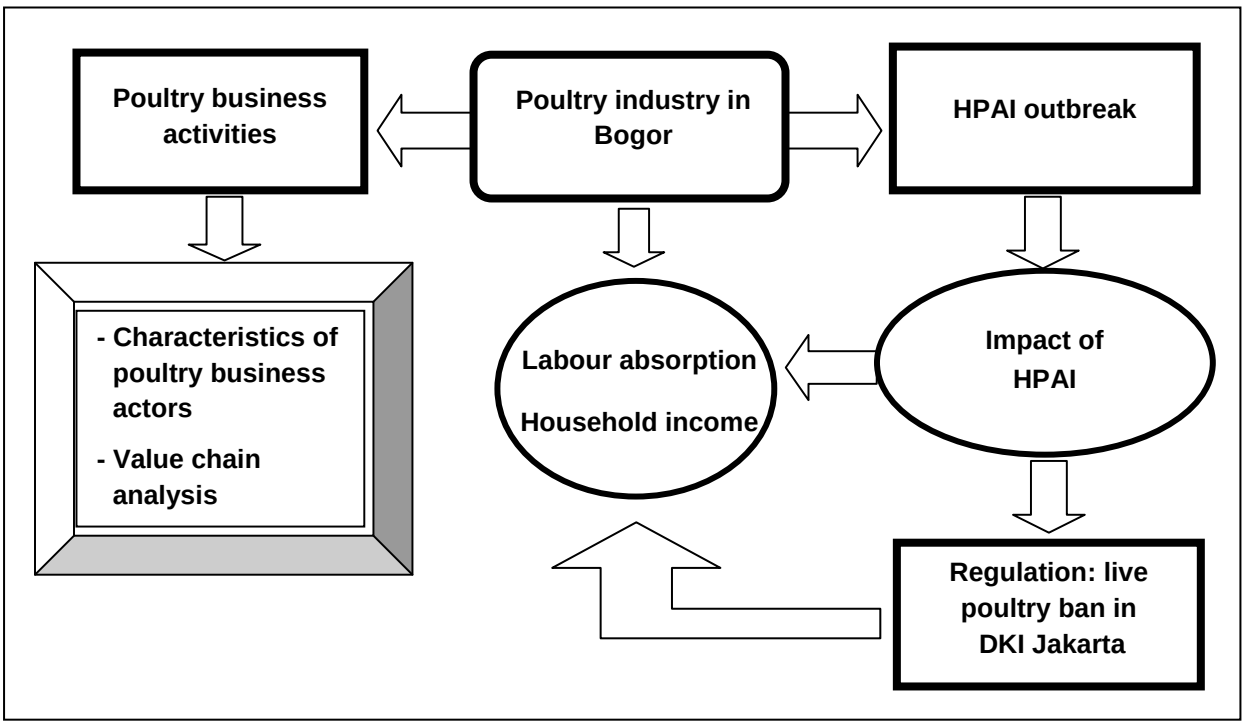


Figure 1. Framework for poultry value chain analysis

The first step in a value chain analysis (VCA) is to systematically map the actors participating in the production, distribution, marketing and sale of a particular product (or products). This mapping assesses the characteristics of actors, profit and cost structures, flow of goods throughout the chain, employment characteristics and the destination and volumes of domestic and foreign sales (Kaplinsky and Morris 2001). As illustrated in a generic example in Figure 2, livestock value chains are replete with a multitude of different chain actors. At a basic level, livestock value chains consist of producers; intermediaries including traders, processors and wholesalers; and various types of retailers (butchers, supermarkets, restaurants and hotels). Different types of ancillary service providers, such as feed manufacturers and animal health service providers, further support livestock value chains. Moreover, as illustrated in Figure 2, there is a range of products derived from the primary production of animals, including meat, hides, eggs, manure and other by-products, each with its own value chain. Other examples of livestock value chain mapping are provided in Annex 1.

Value chain analysis is suitably flexible enough to examine the broader commodity chain or specific characteristics of particular subsectors, though a broader analysis will come at the expense of specific sector detail. Mapping of the overall value chain can highlight the general structure and links between key points in the chain, as shown in Figure 3 in an illustrative example from the Egyptian poultry sector. Mapping of a specific subsector, such as the chain for layers within the poultry sector, describes its detailed linkages (including the volume and value of flows between actors) from production to final consumption. An example from Egypt is displayed in Figure 4. The approach taken in this study is to first identify the larger poultry value chain and to then elucidate details of the most important subchains.

A second component of VCA is the role of governance in the value chain. Governance in a value chain refers to the structure of relationships and coordination mechanisms that exist between actors in the value chain. Many of the issues in the governance of the value chain are related to who decides what is produced, how the rules of trade are determined and the nature of relationships between the participants. The extent of chain power may be related to the relative size of a particular firm in the chain in terms of the share of chain sales, share of chain value added, share of chain profits, share of chain buying power and control over a key technology. Some authors have looked at governance from the standpoint of power relationships, with the emphasis on which actors in the value chain are responsible for coordinating activity (Dolan and Humphrey 2000). Gereffi et al. (2005) have recently proposed a typology of five governance structures of increasing integration based on the complexity of transactions, the ability to codify transactions and the capabilities in the supply base. The analysis of chain governance is important from a policy perspective since it allows for the identification of institutional arrangements that may need to be targeted to improve capabilities in the value chain, remedy distributional distortions and increase value-added in the sector.

Such governance structures can be graphically mapped based on the level of coordination in a particular chain; Figure 5 presents such an example for the layer chain in Egypt. In this study, we try to identify the nature of transactions in terms of whether there is no coordination (i.e. reliance on anonymous market transactions), partial coordination (i.e. informal relationships that govern transactions) or formal coordination (i.e. contracts between value chain actors).

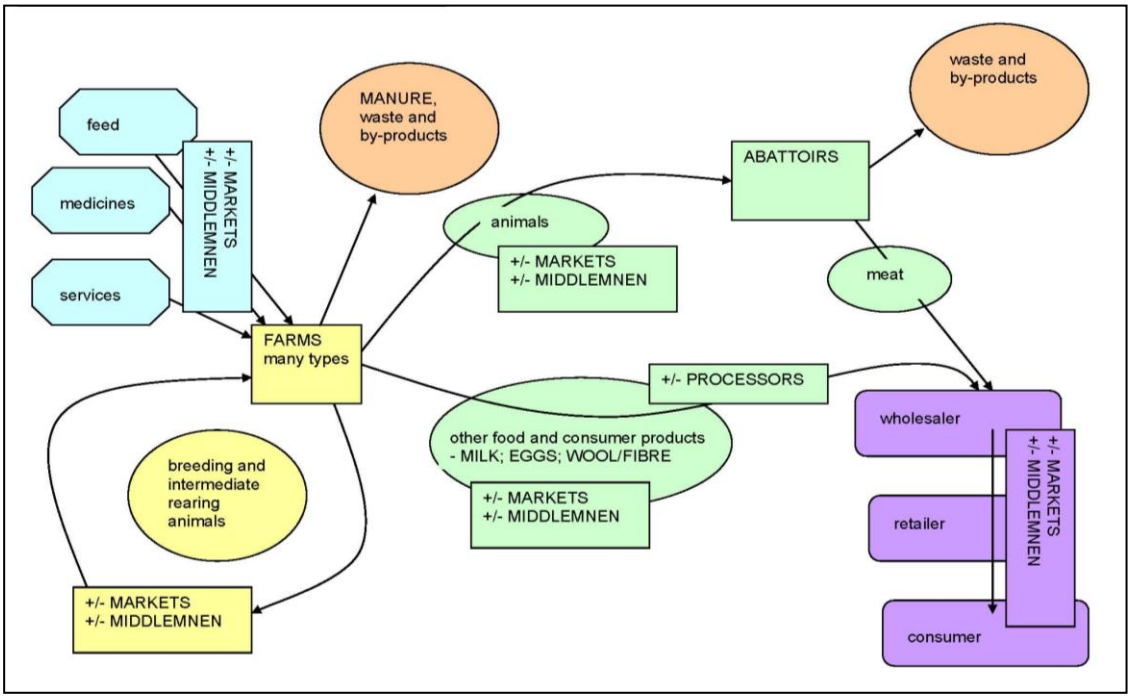


Figure 2. A generic livestock value chain (Source: Taylor et al. 2008)

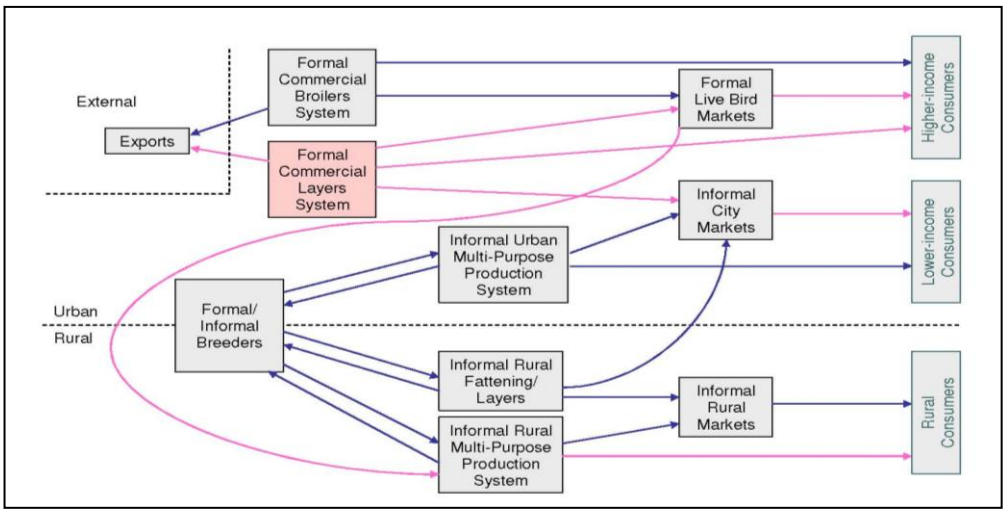
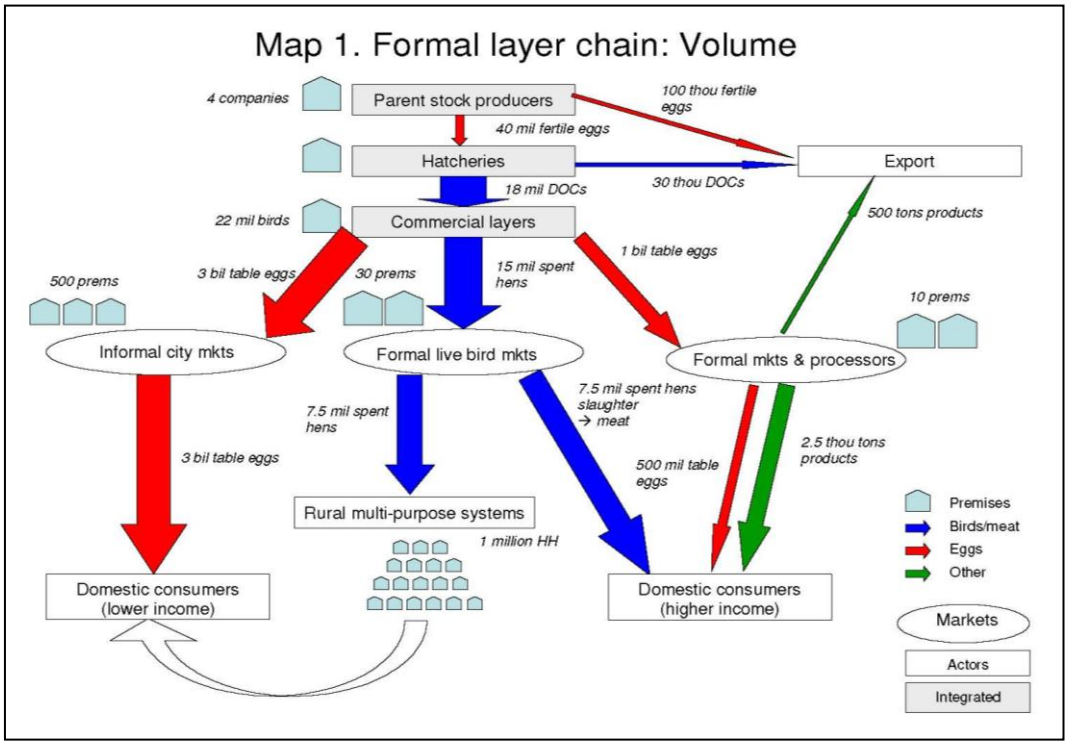


Figure 3. A value chain mapping of the entire chicken industry in Egypt
(Source: Kobayashi 2006)



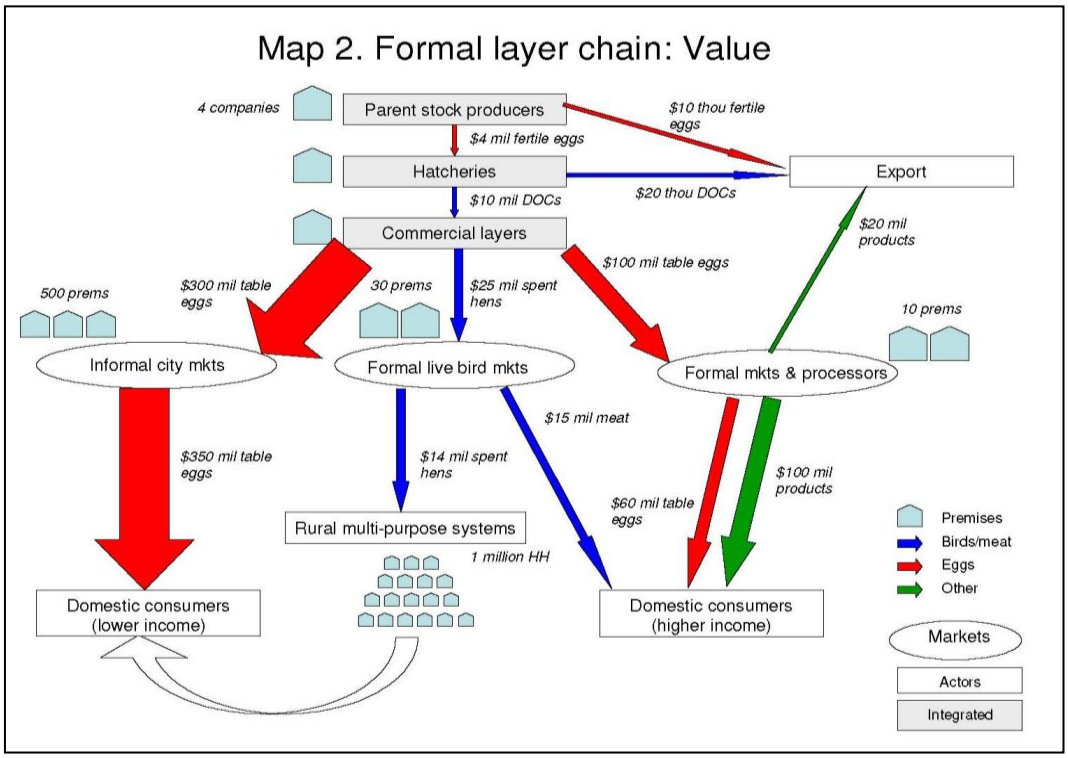


Figure 5. A value chain mapping of the layer sector in Egypt indicating volumes and value of product flows between actors (Source: Kobayashi 2006)

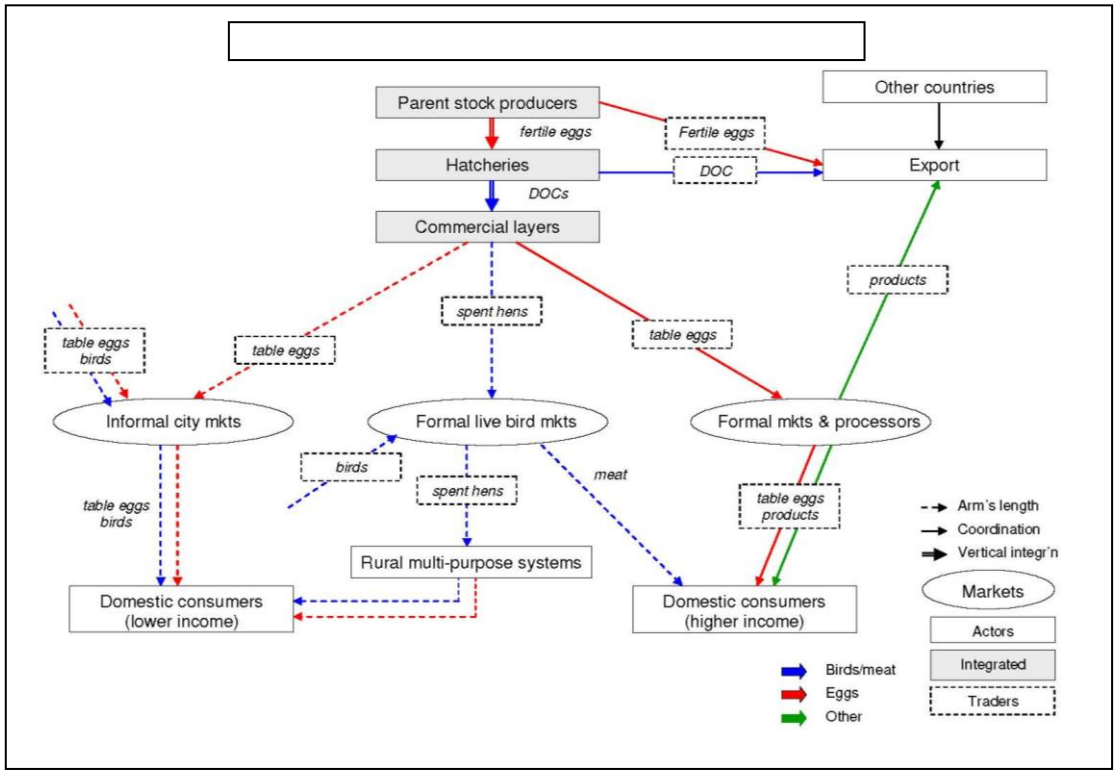


Figure 6. An example of mapping governance mechanisms in the formal layer value chain in Egypt (Source: Kobayashi 2006)

Third, VCA can be used to examine the impact of upgrading within the chain. This differentiates it from the filière approach, which tends to take a static view of relationships within the chain (Kaplinsky and Morris 2001). Upgrading can involve improvements in quality and product design that enable producers to gain higher value or diversify the product lines served. In the context of animal health, upgrading has been applied to better understand how the chain adapts to and copes with shocks (past and present), in terms of products, markets, relationships and the cost of compliance with new regulations (Rich et al. 2009).

An analysis of the upgrading process includes an assessment of the profitability of actors within the chain as well as information on constraints that are currently present. As noted in UNCTAD (2000), governance issues play a key role in defining how such upgrading occurs. In addition, the structure of global regulations, entry barriers, trade restrictions and standards can further shape and influence the environment in which upgrading can take place. Upgrading further addresses the capabilities of actors to innovate and ensure continuous improvement in product and process development.

Finally, VCA can play a key role in identifying the distribution of benefits of actors in the chain. That is, through the analysis of margins and profits within the chain, one can determine who benefits from participation in the chain and which actors could benefit from increased support or organization. This is particularly important in the context of developing countries (and agriculture in particular), given concerns that the poor are vulnerable to the process of globalization (Kaplinsky and Morris 2001). One can supplement this analysis by determining the nature of participation within the chain to understand the characteristics of its participants. In the context of animal diseases, these distributional effects can be studied to assess the impact of HPAI – and measures to

control it – on different actors in the chain to better assess incentives and capacity for control. This provides further insights on the nature of potential risk points along the value chain.

Research schedule and location

This research was divided into four phases. First, secondary data on the sector were collected from online sources, libraries and reports from relevant institutions. This activity was conducted during January 2009. Second, an enumerator workshop in the methodology of participatory rapid appraisal and VCA was conducted during the same period (19-21 January) to train study participants in VCA tools and to finalize data collection instruments. Third, based on the survey instruments developed in the training workshop, primary data were collected in various sites in Bogor from February to March 2009. Finally, preliminary data analysis and report writing were carried out during March 2009.

Primary data collection

Primary data were collected from four sub-districts in Bogor and in Bogor city itself. Research locations were defined purposively based on spatial geography (see Chapter 2 for a map of site locations). Four sub-districts in Bogor were chosen as research locations, namely Ciawi, Cibinong, Leuwiliang and Parung. These four sub-districts represent a geographical distribution covering the southeast, northeast, southwest and northwest of Bogor District, respectively. Ciawi and Leuwiliang are dominantly occupied by the Sundanese ethnic group, which represents the indigenous culture. The inhabitants of Cibinong and Parung, which are located closer to Jakarta, represent a multitude of different local cultures. Other reasons for choosing these sub-districts were: (1) their access to main roads; (2) presence of a sub-district wet market; and (3) presence of a *unit pelaksana teknis daerah* (regional technical implementing unit) of livestock.

Bogor City is the central business district of Bogor. There are two big wet markets in the city, Pasar Anyar and Pasar Bogor, where a large number of poultry product retailers operate. These markets absorb poultry products from farmers in Bogor and its surrounding areas. There is also a central slaughter point, Kebon Pedes. Hence, Pasar Anyar and Pasar Bogor were selected for sampling retailers and Kebon Pedes for workers at the abattoir. In addition, two modern retail markets, Yogya and Super Indo, were also sampled to represent large and small modern markets.

Primary data were collected from the various poultry chain actors. Categories of actors were identified during the training exercise and included breeders, poultry shops, farmers, collectors, slaughterhouses and retailers. The training exercise further identified four main poultry commodities to be covered in the study: broilers, layers, kampong chickens and ducks. All primary data, with the exception of information from kampong and duck farmers, were collected through semi-structured interviews guided by checklists that identified specific information required from each type of value chain actor. Five different questionnaires were used to guide the interviews according to the category of actor: retailer, collector, slaughter house/point, commercial farmer (sector 2 and 3 broiler and layer) and sector 4 farmer (kampong chicken and duck). In the case of duck and kampong chicken farmers, we relied on focus group discussions that were facilitated by checklists for farm-level information. For all actor categories, checklists solicited information on enterprise

characteristics, linkages with other actors, flows and values of products traded, governance mechanisms in the chain, experiences with HPAI and associated coping mechanisms, and the effects of new regulations and compliance programs. Two kinds of primary data were collected: recent and recall. Recent data were needed for the VCA analysis, while recall data were needed to undertake a descriptive analysis of the pattern of poultry farm input and output prices and to gauge the impact of previous HPAI outbreaks.

Data analysis

The value chain mapping as described in the preceding sections was used as the principal analytical framework for synthesizing information collected during the data collection. A key challenge was using a combination of secondary data and respondent answers – usually in the form of estimated market shares—to derive estimates of the volumes and value of commodities moving between actors. Where possible, quantitative data were aggregated and analyzed to provide perspectives on commodity flows, trade and prices in each of the surveyed chains. Based on simple price (and, where available, cost) data collected, aggregated and averaged at different parts of the chain, we calculated value-added generated along the chain using the Hayami method (Hayami et al. 1987). Table 1 describes the basic elements and computations used in the Hayami method to estimate value added (item #10) and related indicators. There were two particular challenges faced in our analysis. First, at certain parts of the chain, we found actors involved in discrete activities (e.g. collecting birds) alongside those engaged in collection, slaughter and retail, each with different cost structures and supply bases (and consequently, different prices of procurement and sales). Since upstream and downstream actors will feed into one or both of these chains at any given period of time, analysis of the distribution of value added throughout the chain was extremely problematic. Second, the regional nature of the analyzed chains often confounds simple averaging of prices at different chain nodes.

Analysis of value provides both information about distributional issues and an indicator of program achievement. Steps in the Hayami analysis are:

1. Constructing the commodity chain including specifying the form of a commodity (e.g. as live birds or carcasses) and any transformation it undergoes along the chain.
2. Identifying financial transactions and their characteristics occurring along the chain.
3. Defining basic computations.

The computation of value added takes into consideration the cost of basic raw materials, labour and other additional inputs. Some variables related to the analysis of added value are:

- The conversion factor, which expresses physical output per unit of input
- The direct labour coefficient which describes labour use for processing per unit of input
- Output value per unit of input

Table 1. Key components and computations of the Hayami Method to analyze value added

No.	Output, Input, Price	Unit	Notation/Formula
1.	Output	Bird	A
2.	Input of main raw material	Bird	B
3.	Input of Labour	Man day	C
4.	Conversion factor		D = A/B
5.	Labour factor		E = C/D
6.	Price of output	IDR*/bird	F
7.	Average wage labour	IDR/Man day	G
Income, Profit			
8.	Cost of main raw material	IDR/bird	H
9.	Cost of other inputs	IDR/bird	I
10.	Value of output	IDR/bird	J = D * F
11.	a. Added value	IDR/bird	K = J – H – I
	b. Ratio of added value to total value	%	L = K/J * 100
12.	a. Labour opportunity cost	IDR/bird	M = E X G
	b. Labour as share of added value	%	N = M/K * 100
13.	a. Profit	IDR/bird	O = K – M
	b. Profit as share of output value	%	P = O/J * 100
Opportunity Cost of Input Factor			
14.	a. Margin	IDR/bird	Q = J – H
	b. Labour income	%	R = M/Q * 100
	c. Share of other input	%	S = I/Q * 100
	d. Institution profit	%	T = O/Q x 100

Note: IDR = Indonesian Rupiah

2. The Bogor poultry sector

2.1 Overview

Bogor is divided into two administrative areas, Bogor City and Bogor District, with Bogor City located in the middle surrounded by Bogor District.

The north side of Bogor District borders on the capital city of Jakarta, Depok City and Tangerang District; to the south side are Sukabumi and Cianjur Districts; to the east, Karawang and Bekasi Districts; and to the west, Banten Province. The climate is tropical with average temperatures varying from 25^{o}C in the north to 21^{o}C in the south and humidity at 70%. Precipitation averages 2500-5000 mm per year over most of Bogor.

Its 299,000 ha of land area lie mainly between 15 and 1000 m above sea level, and is divided between protected areas (38%) of forest and estates, and utilized urban and rural areas (62%).

The District of Bogor consists of 40 sub-districts and 427 villages, with a population of 4,237,962 as of 2007, representing 10% of the West Java Province total. Among those of working age, 6% are farmers, 30% are entrepreneurs, and 27% are manual labourers, with the remainder in skilled labour or other professional employment. Bogor City consists has 6 sub-districts, 68 villages and a population of 750,250 as of 2006 (Renstra Kota Bogor 2007).

There are seven main roads connecting Bogor with other cities, including two roads to Jakarta and five others to Sukabumi, Cianjur, Banten Province, Tangerang and Bekasi. Given this infrastructure and geographical position, there is considerable movement of goods and people in and out of Bogor.

2.2 Research area description

The locations of interviews held in the study sites were recorded using GPS and are shown in Figure 6 by category of respondent.

2.3 Identification of actors

For the broiler and layer chains, the major actors found in Bogor area were breeders, feed millers, sector 2 and 3 farmers (commercial farm), collectors of live birds, collectors of eggs, slaughter points/houses and retailers in either traditional markets or modern markets (supermarkets). However in the duck and kampong chicken chains, the main actors were sector 3 and 4 farmers, collectors of live birds, collectors of eggs, slaughter points/houses and retailers in traditional and modern markets (specifically for kampong and duck eggs). Table 2 shows the number of respondents interviewed in each study location. Our target research group in each location consisted of breeders, feed mills, livestock farmers, poultry shops, collectors, slaughterhouses, slaughter points, retailers and supermarkets. Based on information provided by Livestock and Fisheries Services of Bogor District (Disnakan 2009), we identified nine breeders (PT. Kerta Mulya Sejahtera, PT. Central Avian

Pertiwi, PT. Cibadak Indah Sari Farm, PT Dasa Asta Utama, PT. Isa Indonesia, PT. Multi Breeders Adirama Indonesia, PT. Anwar Sierad, PT. Super Unggas Jaya and PT. Satwa Borneo Jaya Breeding Farm) and four feed millers (PT. Wellgro Feedmill Indonesia, PT Sinta Prima Feedmill Indonesia, PT. Cargill Indonesia and PT Allied Feeds Indonesia) with operations in Bogor District; no breeders and feed millers were found in Bogor City. The number of sector 4 farmer respondents was the highest with 125 respondents (53% of the total) reflecting the use of focus group discussions for collecting information within this group.

Table 2. Number of respondents by actor category and by location

Actor Category	Number of Respondents					
	Bogor District					Bogor
	Ciawi	Cibinong	Leuwiliang	Parung	Total	City
Breeder	0	0	1	0	1	0
Feed mill	0	2	1	0	3	0
Farmer Sector 2 &3	7	9	7	6	29	0
Farmer Sector 4	30	30	35	30	125	0
Poultry shop	1	1	2	1	5	0
Collector	4	6	7	3	20	5
Slaughterhouse	1	1	0	0	2	0
Slaughter point	2	8	3	3	16	8
Retailer	5	13	14	4	36	22
Supermarket	0	0	0	0	0	2
Total	**50**	**70**	**70**	**47**	**237**	**37**

The following subsections provide some summary of the characteristics of respondents surveyed in this study, including gender, age and level of formal education, business period and the number of people employed.

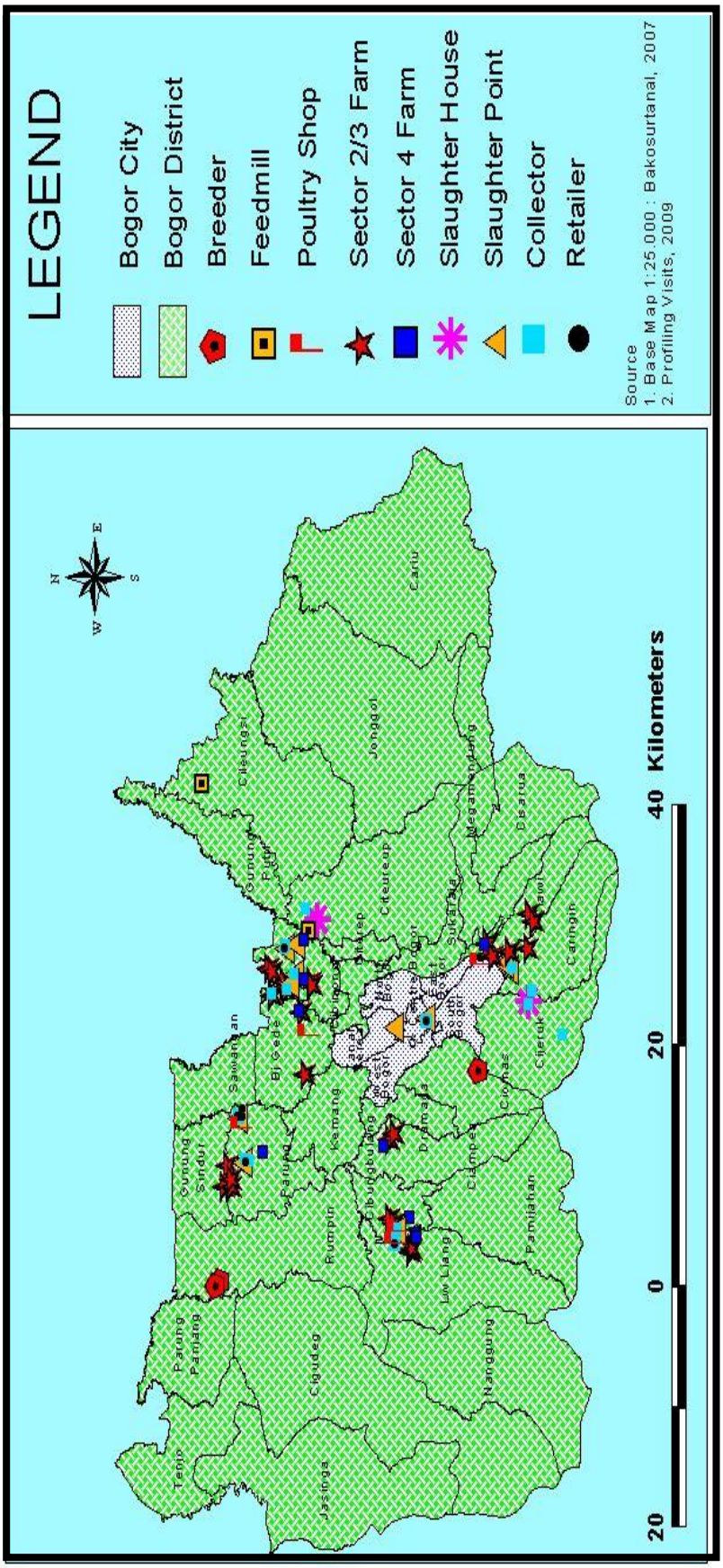


Figure 7: Map of Bogor and location of study interviews, by category of respondent

Gender

The gender category of respondents as shown in Table 3 revealed that most respondents (91%) were male. Women in poultry business were only involved in kampong chicken farms and as carcass retailers in traditional markets. Neither activity requires intense levels of energy, hence are suitable for women. Other poultry farming (duck, layer and broiler farms) and trading activities were mostly carried out by men. Those activities require high capital for transactions or high mobilization for transporting the product.

Table 3. Gender of respondents, by actor category for each commodity chain

Commodity	Actor Category	N	Gender		Percentage (%)	
			Male	Female	Male	Female
Broiler Carcass	Retailer	7	5	2	71	29
	Retailer	3	3	0	100	0
	Collector	7	7	0	100	0
Broiler	Slaughter point	14	14	0	100	0
	Slaughter house	2	2	0	100	0
	Farmer sector 2/3	15	15	0	100	0
	Retailer	3	2	1	67	33
Layer	Collector	1	0	1	0	100
	Slaughter point	2	1	1	50	50
	Farmer sector 2/3	10	8	2	80	20
Male Layer	Retailer	6	5	1	83	17
	Farmer sector 2/3	2	1	1	50	50
	Retailer	7	7	0	100	0
	Collector	6	6	0	100	0
Duck	Slaughter point	5	5	0	100	0
	Farmer sector 4	44	44	0	100	0
	Farmer sector 2/3	1	1	0	100	0
	Retailer	9	9	0	100	0
	Collector	6	6	0	100	0
Kampong	Slaughter point	3	3	0	100	0
chicken	Farmer sector 4	81	66	15	81	19
	Farmer sector 2/3	1	1	0	100	0
	Breeder	1	1	0	100	0
Layer eggs	Retailer	7	7	0	100	0
	Collector	5	5	0	100	0
Duck eggs	Retailer	8	8	0	100	0
Kampong eggs	Retailer	8	8	0	100	0
Feed mill		3	2	1	67	33
Poultry shop		5	5	0	100	0
Supermarket		2	2	0	100	0
	TOTAL	**274**	**249**	**25**	**91**	**9**

Age

Table 4 reveals that most of the respondents were between 40 and 55 years old, while only 9% of respondents were less than 25 years of age. This means that most actors in poultry business were in the mature productive age bracket.

Table 4. Distribution of respondents by age and actor category for each commodity chain

Commodity	Actor Category	N	Age (years)				Percentage (%)			
			< 25	25-39	40-55	>55	< 25	25-39	40-55	>55
Broiler Carcass	Retailer	7	2	3	2	0	29	43	29	0
	Retailer	3	0	2	1	0	0	67	33	0
	Collector	7	0	1	6	0	0	14	86	0
Broiler	Slaughter point	14	0	5	9	0	0	36	64	0
	Slaughter house	2	0	0	2	0	0	0	100	0
	Farmer sector 2/3	15	0	1	13	1	0	7	87	7
	Retailer	3	0	1	2	0	0	33	67	0
Layer	Collector	1	0	0	1	0	0	0	100	0
	Slaughter point	2	0	0	2	0	0	0	100	0
	Farmer sector 2/3	10	0	2	4	4	0	20	40	40
Male Layer	Retailer	6	1	1	3	1	17	17	50	17
	Farmer sector 2/3	2	0	0	1	1	0	0	50	50
	Retailer	7	0	0	4	3	0	0	57	43
	Collector	6	0	0	5	1	0	0	83	17
Duck	Slaughter point	5	0	0	3	2	0	0	60	40
	Farmer sector 4	44	6	10	15	13	14	23	34	30
	Farmer sector 2/3	1	1	0	0	0	100	0	0	0
	Retailer	9	0	2	4	3	0	22	44	33
	Collector	6	1	0	3	2	17	0	50	33
Kampong	Slaughter point	3	0	0	2	1	0	0	67	33
chicken	Farmer sector 4	81	11	33	28	9	14	41	35	11
	Farmer sector 2/3	1	0	0	1	0	0	0	100	0
	Breeder	1	0	0	1	0	0	0	100	0
Layer eggs	Retailer	7	0	1	4	2	0	14	57	29
	Collector	5	0	2	3	0	0	40	60	0
Duck eggs	Retailer	8	1	2	4	1	13	25	50	13
Kampong eggs	Retailer	8	1	2	4	1	13	25	50	13
Feed mill		3	0	1	1	1	0	33	33	33
Poultry shop		5	0	1	3	1	0	20	60	20
Supermarket		2	0	0	0	2	0	0	0	100
	TOTAL	**274**	**24**	**70**	**131**	**49**	**8.8**	**26**	**48**	**18**

Level of formal education

The level of formal education of respondents is presented in Table 5. Most of the respondents had reached elementary school level. The highest level of formal education of the respondents was university level. Respondents with university level education were found in sector 2/3 farms, feed mill factories and slaughterhouses.

The low formal education level of a large portion of the respondents may be due to the status of much of poultry business as an informal activity. Ramli (1992) reported that the informal business sector in urban areas has an important role as a potential source of income for such actors and their families.

Table 5. Distribution of respondents by level of formal education and actor category for each commodity chain

Commodities	Actor Category	N	Level of Formal Education				Percentage (%)			
			ES	JHS	SHS	HE	ES	JHS	SHS	HE
Broiler Carcass	Retailer	7	3	2	2	0	43	29	29	0
	Retailer	3	1	1	1	0	33	33	33	0
	Collector	7	1	3	1	2	14	43	14	29
Broiler	Slaughter point	14	7	3	2	2	50	21	14	14
	Slaughter house	2	0	0	0	2	0	0	0	100
	Farmer sector 2/3	15	1	1	4	9	7	7	27	60
	Retailer	3	1	2	0	0	33	67	0	0
Layer	Collector	1	1	0	0	0	100	0	0	0
	Slaughter point	2	2	0	0	0	100	0	0	0
	Farmer sector 2/3	10	2	0	5	3	20	0	50	30
Male Layer	Retailer	6	4	1	1	0	67	17	17	0
	Farmer sector 2/3	2	0	0	2	0	0	0	100	0
	Retailer	7	5	2	0	0	71	29	0	0
	Collector	6	4	2	0	0	67	33	0	0
Duck	Slaughter point	5	5	0	0	0	100	0	0	0
	Farmer sector 4	44	21	8	14	1	48	18	32	2
	Farmer sector 2/3	1	0	0	1	0	0	0	100	0
	Retailer	9	5	4	0	0	56	44	0	0
	Collector	6	4	2	0	0	67	33	0	0
Kampong	Slaughter point	3	3	0	0	0	100	0	0	0
chicken	Farmer sector 4	81	27	19	34	1	33	23	42	1
	Farmer sector 2/3	1	0	0	0	1	0	0	0	100
	Breeder	1	0	0	0	1	0	0	0	100
Layer eggs	Retailer	7	4	1	2	0	57	14	29	0
	Collector	5	2	1	2	0	40	20	40	0
Duck eggs	Retailer	8	3	1	4	0	38	13	50	0
Kampong eggs	Retailer	8	3	1	3	1	38	13	38	13
Feed mill		3	0	0	0	3	0	0	0	100
Poultry shop		5	0	0	2	3	0	0	40	60
Supermarket		2	0	0	0	2	0	0	0	100
	TOTAL	274	109	54	80	31	40	20	29	11

ES=elementary school, JHS=junior high school, SHS=secondary high school, HE=higher education

Business experience

Business experience of the respondents is presented in Table 6. Only a few respondents (7%) had extensive business experience of more than 25 years, which in some cases was because the respondents had continued a family business. Business experience of more than 25 years was found among respondents of slaughter points, sector 2/3 farms, collectors and feed mills.

The largest share of respondents had taken up poultry activities only recently, reflecting the large numbers of new farmers among the Sector 4 farmers. Otherwise, the intermediate range between 6 and 15 years was generally most frequent among many of the trade-related categories.

Table 6. Distribution of respondents by years of business experience and actor category for each commodity chain

Commodities	Actor Category	N	Years of Experience				Percentage (%)			
			<6	6-15	16-25	>25	<6	6-15	16-25	>25
Broiler Carcass	Retailer	7	2	3	2	0	29	43	29	0
	Retailer	3	3	0	0	0	100	0	0	0
	Collector	7	2	2	1	2	29	29	14	29
Broiler	Slaughter point	14	3	6	3	2	21	43	21	14
	Slaughter house	2	0	1	1	0	0	50	50	0
	Farmer sector 2/3	15	6	3	2	4	40	20	13	27
	Retailer	3	0	3	0	0	0	100	0	0
Layer	Collector	1	0	1	0	0	0	100	0	0
	Slaughter point	2	0	1	1	0	0	50	50	0
	Farmer sector 2/3	10	2	6	1	1	20	60	10	10
Male Layer	Retailer	6	0	2	4	0	0	33	67	0
	Farmer sector 2/3	2	1	1	0	0	50	50	0	0
	Retailer	7	0	3	4	0	0	43	57	0
	Collector	6	2	2	2	0	33	33	33	0
Duck	Slaughter point	5	1	2	2	0	20	40	40	0
	Farmer sector 4	44	24	14	3	3	55	32	7	7
	Farmer sector 2/3	1	0	1	0	0	0	100	0	0
	Retailer	9	1	3	5	0	11	33	56	0
	Collector	6	0	3	3	0	0	50	50	0
Kampong	Slaughter point	3	0	2	1	0	0	67	33	0
chicken	Farmer sector 4	81	49	20	6	6	60	25	7	7
	Farmer sector 2/3	1	0	0	1	0	0	0	100	0
	Breeder	1	0	0	1	0	0	0	100	0
Layer eggs	Retailer	7	3	2	2	0	43	29	29	0
	Collector	5	2	3	0	0	40	60	0	0
Duck eggs	Retailer	8	4	3	1	0	50	38	13	0
Kampong eggs	Retailer	8	4	3	1	0	50	38	13	0
Feed mill		3	0	1	1	1	0	33	33	33
Poultry shop		5	1	3	1	0	20	60	20	0
Supermarket		2	0	0	2	0	0	0	100	0
	TOTAL	**274**	**110**	**94**	**51**	**19**	**40**	**34**	**19**	**7**

Number of labourers employed

Labour employed in poultry business is categorized as either family or hired labour. Table 7 indicates that most of the respondents have one to five labourers employed. Broiler commodity absorbs the most labourers, especially the slaughter points and slaughterhouses. The survey results showed that the type of labourers employed were mostly family labourers, especially among the retailers, collectors and slaughter points. This practice minimizes the cash burden of employing labour, thereby increasing their financial profit.

Table 7. Distribution of respondents by number of labourers employed and actor category for each commodity chain

Commodities	Respondents	N	Number of Employees			Percentage (%)		
			1-5	6-10	>10	1-5	6-10	>10
Broiler Carcass	Retailer	7	6	1	0	86	14	0
Broiler	Retailer	3	3	0	0	100	0	0
	Collector	7	6	1	0	86	14	0
	Slaughter point	14	10	1	3	71	7	21
	Slaughter house	2	0	0	2	0	0	100
	Farmer sector 2/3	15	8	4	3	53	27	20
Layer	Retailer	3	3	0	0	100	0	0
	Collector	1	1	0	0	100	0	0
	Slaughter point	2	2	0	0	100	0	0
	Farmer sector 2/3	10	5	0	5	50	0	50
Male Layer	Retailer	6	5	1	0	83	17	0
	Farmer sector 2/3	2	0	1	1	0	50	50
Duck	Retailer	7	7	0	0	100	0	0
	Collector	6	6	0	0	100	0	0
	Slaughter point	5	5	0	0	100	0	0
	Farmer sector 4	44	44	0	0	100	0	0
	Farmer sector 2/3	1	1	0	0	100	0	0
Kampong chicken	Retailer	9	9	0	0	100	0	0
	Collector	6	6	0	0	100	0	0
	Slaughter point	3	3	0	0	100	0	0
	Farmer sector 4	81	81	0	0	100	0	0
	Farmer sector 2/3	1	0	0	1	0	0	100
	Breeder	1	0	0	1	0	0	100
Layer eggs	Retailer	7	7	0	0	100	0	0
	Collector	5	5	0	0	100	0	0
Duck eggs	Retailer	8	8	0	0	100	0	0
Kampong eggs	Retailer	8	8	0	0	100	0	0
Feed mill		3	0	1	2	0	33	67
Poultry shop		5	5	0	0	100	0	0
Supermarket		2	0	0	2	0	0	100
	TOTAL	**274**	**244**	**10**	**20**	**89**	**4**	**7**

2.4 Identification of product flows

Product flows start from the farmer who has backward and forward linkages with different input and output value chain actors. Backward linkages are especially important for commercial farms and relate to the inputs required for production such as day-old chicks (DOC) or day-old ducklings (DOD), pullets, feed and other production requirements. Forward linkages relate to selling the product. Figure 7 presents product flows for the overall poultry sector in Bogor.

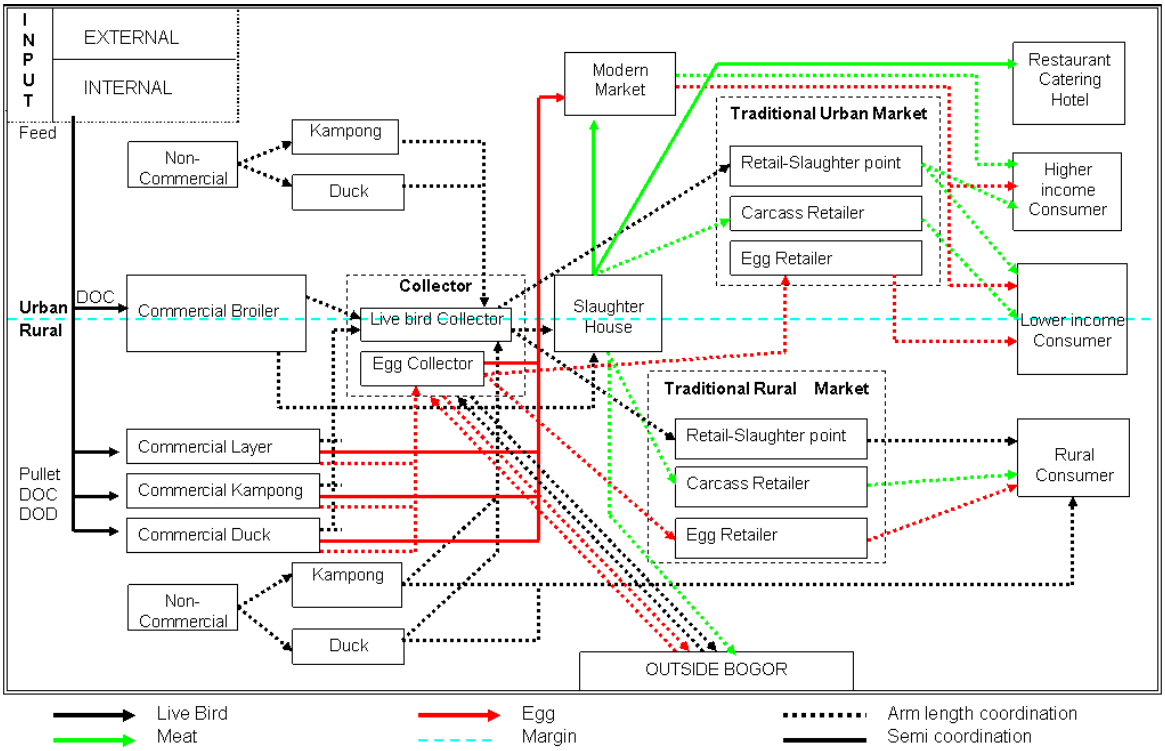


Figure 8. Map of value chains in the Bogor poultry sector

The poultry sector in Bogor has all of the main poultry value chains represented. Poultry meat is derived from production of exotic and indigenous kampong chickens and, on a smaller scale, ducks, either as broilers or as by-products from egg producers in the form of male or spent layers. Live birds are traded along the supply chains with slaughter occurring anywhere from the point of production to the point of consumption. Eggs are produced commercially mainly from exotic chicken breeds, but also to a minor extent from kampong chickens and ducks.

Whereas some products are sold directly by producers to the final consumers – restaurants and individuals – most pass through specialized live bird and egg collectors to supply poultry slaughterhouses and wet markets, or may be delivered to supermarkets ('modern markets'). Each specific production system tends to be associated with a particular set of supply routes.

Larger-scale commercial production relies almost entirely on exotic breeds of broilers and layers in timed all-in, all-out production cycles, though there are some smaller scale commercial operations (generally <5000 birds) specializing in kampong chickens or ducks. Otherwise, the majority of

kampong chickens and ducks are kept in small flocks in backyard systems by sector 4 farmers who sell their poultry products in small numbers in a much less systemized fashion, or use for their own home consumption.

A light blue line in Figure 7 distinguishes those components of the various value chains that are located in rural versus urban areas within Bogor. While much of the production is based in rural zones, there are some commercial farms in peri-urban zones, and sector 4 kampong chickens and ducks can be found nearly everywhere. As expected, much of the trade gravitates from the rural zones towards the highly populated urban areas, so live and slaughtered birds (carcasses) and eggs are transported and traded across both zones with final markets and end consumers found in both.

The Bogor poultry sector is very open in the sense that a large share of inputs, including DOC and pullets, are imported into the district, and similarly a large share of the products produced are exported to neighbouring districts, especially DKI Jakarta.

2.5 Identification of governance and coordination mechanisms between actors

Governance and coordination between actors in poultry business in Bogor area can be classified under two main mechanisms, as indicated in the legend in Figure 7. The first is arm's-length coordination (dotted lines in Figure 7) which usually occurs in semi-commercial or traditional one-time transactions, such as often occurs when consumers buy directly from retailers. The second is what we term "semi-coordination" (solid lines in Figure 7) which occurs in commercial sector transactions, e.g. from producers to retailer supermarkets or to restaurants.

Semi-coordination in the commercial sector consists of a spectrum of arrangements. In some cases, farmers are relatively independent, but have a type of "informal contract" based on mutual trust with a collector, and similarly between collectors and slaughter points/houses, and between slaughter points/houses and retailers. In these cases, prices of the products traded depend on the cost of production especially with respect to prices of inputs (mainly feed and DOC) offered by feed millers and breeder companies, but are primarily established based on the current balance between supply and demand in the market. In this system, when business conditions are not conducive, the actor in the chain bearing the most risk and absorbing the most financial loss is the farmer. Membership in a poultry farmer association usually provides improved access to market information to help the farmer manage the price risk dimension better. Market information in the form of spot prices (Table 8) is also available at the PINSAR (Asosiasi Peternak Unggas Se-Indonesia = Indonesian Poultry Farmer Association and Information Centre) website (www.pinsar.com) maintained by the poultry business association, but few farmers have access to the Internet. As indicated in Table 8, there is a well established size classification for pricing of broilers by weight.

Table 8. Representative price list of live bird poultry on different dates, Oct-Dec 2008 (IDR)

Item	Date		
	20/10/08	19/11/08	19/12/08
Broilers: < 1 kg	15,300	15,700	14,000
Broilers: 1 – 1.2 kg	14,700	14,200	12,500
Broilers: 1.2 – 1.4 kg	14,500	13,500	11,800
Broilers: 1.4 – 1.6 kg	14,300	13,300	11,400
Broilers: 1.6 – 1.8 kg	14,100	13,300	11,000
Broilers: 1.8 – 2.0 kg	14,100	13,300	10,600
Broilers: > 2.0 kg	14,400	13,300	10,200
DOC Broilers (head)	2,750	3,250	1,500
DOC Layers (head)	7,000	8,000	8,000
Egg (kg)	14,400	11,900	11,900
Male	24,500	16,000	19,000
Spent Layers	15,000	14,500	13,000
Spent Parents	18,500	15,000	8,500

Source: CJ Feed Indonesia (2008)

Also commonly practised is coordination in the form of business partnership systems in which contractual relationships are more formalized, with a company providing its farmers with production input and technical service and helping them in marketing their product. The partnership contract is signed by both parties, usually lasts for one production cycle, and can be repeatedly renewed. Some companies cover rearing costs for the farmer, while the farmer provides the poultry house and labour for keeping the birds from DOC until maturity. Specific partnership terms are decided by the contracting company, such as the prerequisites for becoming a contracted farmer, input and output product price decisions, production practices and any reward and punishment system. When broiler prices at harvest time are higher than the one stated in the contract at signing time, the farmers usually receive bonuses from the company. This type of business partnership started in 1987 and began becoming popular in the early 1990s.

For kampong chickens and ducks, collectors seem to have a significant role in defining product prices either when buying from farmers or selling to retailers. The price defined by the collector depends on the cost of transport and supply and demand conditions.

3. Specific poultry value chains

Based on mapping the overall poultry sector in Bogor (Figure 7), we identified four primary value chains within the poultry sector as the focus of this study: commercial layers, commercial broilers, kampong chickens and ducks. In this chapter, we describe each of these subsector chains in more detail, including flows and linkages and governance relationships.

3.1 Commercial layers

Layer population

The layer population in Bogor represents around 3% of Indonesia's total layer population. Table eggs produced by layer farmers in Bogor serve not only Bogor consumers but also those outside Bogor, particularly Jakarta. Since the beginning of the outbreak of HPAI in 2003, layer populations in Bogor declined somewhat, with a particularly dramatic drop in 2006 when the layer population fell from 3.0 million to 1.1 million birds (Table 9), though the population quickly rebounded the following year to 3.8 million birds.

The more recent increase in female layer population was due to expansion of scale on existing farms rather than new entrants; the number of female-layer farmers in Bogor only increased by one, from 128 in 2006 to 129 in 2007 (Disnakan). The data thus reveal that the impact of HPAI was short term and the poultry sector was able to recover quickly. As of 2008, Bogor had 125 larger-scale commercial layer farms (more than 15,000 birds per farm) with a total population of 3.7 million birds and had become the main supplier for Jakarta's table eggs.

Table 9. Female layer population in Bogor, 2002-2008

Area	Layer population (1,000 birds)						
	2002	2003	2004	2005	2006	2007	2008
Bogor City[1]	0	0	0	0	0	0	0
Bogor District[2]	3,581	3,439	3,055	3,045	1,102	3,792	3,679
Total Bogor	3,581	3,439	3,055	3,045	1,102	3,792	3,679
Total Indonesia[3]	78,039	79,206	93,416	84,790	100,202	111,489	116,474
% Bogor on Indonesia	4.59	4.34	3.27	3.59	1.10	3.40	3.16

Source : [1] Dinas Agribisnis 2009
[2]Disnakan, 2009
[3]Ditjennak, 2009

Characteristics of actors in the layer chain

The layer business is generally run by commercial farms classified as sector 2 and 3 as their main household income. There are two types of layer businesses in Bogor, female layer systems that produce eggs and male-layer systems that produce meat. Male layers are a by-product of layer parent stock, and are discussed briefly. The focus of discussion, however, is the female layer system.

Female-layer farms were found in all four study areas in Bogor, while male-layer production was only found in Parung. Male-layer DOC are a by-product of layer DOC breeders, and are produced in

limited numbers. Only a few farmers (those in Parung) have access to purchasing male-layer DOC. The number of female layers raised on a farm ranges between 1,600-40,000 birds; male layers, on the other hand, are raised on a larger scale of between 50,000-60,000 birds per farm.

Table 10. Layer population per sampled farm in Bogor

Population (birds/farm)	Number of Respondents					
	Ciawi	Cibinong	Leuwiliang	Parung		Total
	Female	Female	Female	Female	Male	
1,600	0	1	0	0	0	**1**
3,000	0	1	0	0	0	**1**
3,750	1	0	0	0	0	**1**
5,000	1	0	0	0	0	**1**
7,500	1	0	0	0	0	**1**
10,000	0	1	0	2	0	**3**
25,000	0	0	0	1	0	**1**
30,000	0	1	0	0	0	**1**
40,000	0	0	1	0	0	**1**
50,000	0	0	0	0	1	**0**
60,000	0	0	0	0	1	**0**
Total	**3**	**4**	**1**	**3**	**2**	**13**

Source: survey data

Farmers raise male layer DOC for six to eight weeks similar to broilers; feeding male layers beyond this period is not profitable. The live weight of a male layer ready for slaughter is around 0.8 to 1.0 kg, and fetches a price of IDR 11,000-16,000 per bird. Farmers rear female layers either starting with the DOC or buying already grown pullets (a pullet is a 6-month-old female layer ready to lay eggs).

Unless treated, female layers are culled at 17 months old; with molting treatment, female layers can be kept until the age of 24 months. Molting is a treatment to make female layers continue producing sufficient numbers of eggs. Egg production by female layers declines after the age of 24 months.

Day-old chicks are transported from hatcheries (breeder farms) to layer farms in ventilated trucks owned by the breeding company. Live pullets are brought in plastic, bamboo or wooden baskets on open trucks. The purchase of new female layer DOC by farmers occurs three times within a 24 month period, so the number per delivery of DOC is equal to 33% of existing layers.

At the time of the study, the price of a male layer DOC was IDR 1050 to IDR 2000 per bird while the price of a female layer DOC was IDR 7000 to IDR 8500 per bird, and a pullet was IDR 33,600 to 35,000 per bird. Price fluctuations in layer DOC are generally aligned with those for broiler DOC for meat, reflecting the opportunity cost in the production of layer DOC in terms of broiler DOC. When the demand for broiler DOC increases (followed by an increase in price), breeders will prefer to hatch broiler DOC, leading to reduced supply and higher prices for DOC layers.

Fluctuations in prices of male layer DOC compared to those of female layer DOC are also subject to other supply and demand forces. Like broilers, male layers are also produced for meat. There is seasonal demand of DOC for meat due to seasonal demand for chicken meat. The peak demand for chicken meat occurs during month of Ramadhan (the Muslim fasting month) and Idd ul Fitr, and

increases farmer demand for DOC in the two months prior to those festive periods, since it takes six to eight weeks to raise male layers.

The farm management system in female layers is generally divided into three phases based on feeding formula; namely, starters (0 to 8 weeks); growers (9 to 20 weeks); and layers (21 to 78 weeks). In the starter and grower phases, birds are housed in floor houses. The floor is made of slats or litter (from rice hulls or sawdust). During the layer phase, birds are kept in cages/battery in open-sided poultry houses.

The nature of layers in producing eggs can be described as *s* shape (sigmoid curve). There are three stages in producing eggs i.e. increasing stage, peak stage and decreasing stage. In order to maintain stability in the volume of production throughout the year, layer farmers usually raise layers in four age cohorts. Therefore, in the farm there are four chicken group houses, i.e. a group for growers (1-20 weeks old), and three groups for layer based on their particular age cohort (21-40 weeks, 41-60 weeks and 61-78 weeks old). The number of birds in each group represents one fourth of the layer population in the farm.

Feed is usually purchased from feed mills located nearby in West Java and Banten (Wonokoyo, Charoen Pokphand, Comfeed and Gold Coin feed companies) or is mixed by farmers themselves (generally a mixture of concentrate and corn). The type of feed given to female layers generally depends on the growing phase, i.e. starter, grower or layer feed. The female layer feed price is relatively constant at IDR 4000-5000 per kg depending on nutritional content. Feed portions depend on live weight and growth phase. For the layer phase, the amount of feed is relatively stable at around 100 g per bird per day. The price of male layer feed is also relatively constant at IDR 4000-4800 per kg. Farmers feed the male layers *ad libitum* (feed is always available). The feed conversion ratio for male layers is around 2.0 (i.e. male layers consume 2 kg of feed resulting in 1 kg of live weight).

Other inputs used in layer farms include vaccines for Newcastle disease (ND), infectious bursal disease (IBD), infectious bronchitis (IB) and HPAI. Some apply vaccine chicken pox. Farmers buy vaccines from a poultry shop or a vaccine producer. The average cost for each vaccine is IDR 1000 per bird. Altogether, such vaccine costs would be approximately IDR 4000 per bird during rearing.

Male layers from commercial farms are usually taken by collectors and sent to a slaughterhouse. In Bogor, most male layer meat is sold to restaurants, especially “Padang” restaurants, which prefer male layer meat that is considered tastier than that of broilers even though its price is relatively higher. Smaller shares are sold through traditional markets and supermarkets to middle-income socio-economic groups. Bogor consumers choose male layer meat because it has similar texture to backyard (kampong) chicken meat, but has a lower price.

Table eggs and spent layers (cull chickens) are the products of female layers. Commercial layer farms sell live spent layers at 17-24 months of age at a weight of 2.0-2.3 kg per bird. Seasonality has an important influence on price. In normal periods, the price of a live spent layer is IDR 15,000 per bird but during Idd ul Fitr it can rise to as high as IDR 20,000 per kg or IDR 40,000 per bird.

Output and input prices of male and female layers are shown in Table 11, with the range of minimum and maximum prices indicated. There was little variation in these prices across the four study sites.

Table 11. Input and output prices of male and female layers

Layer	Type of Input/Output	Unit	Price (IDR)	
			Minimum	Maximum
Female Layer				
Input Price	DOC	bird	7,000	8,500
	Pullet (15 weeks)	bird	33,600	35,000
	Feed	kg	4,000	5,000
Output Price	Live bird	bird	15,000	20,000
	Egg	kg	10,000	14,000
Consumer Price	Live bird	bird	22,000	25,000
	Egg	kg	12,000	16,000
Male Layer				
Input Price	DOC	bird	1,050	2,000
	Feed	kg	4,000	4,800
Output Price	Live bird	bird	11,000	16,000
Consumer Price	Live bird	bird	20,000	22,500

Product flow and governance mechanism map

Figure 8 summarizes the layer value chain in Bogor, providing estimates for 2008 of the volumes and value of commodities traded among the various categories of actors. Ranges are reported for the value to capture the price ranges reported in Table 11. The lines depicting commodity flows are also coded to represent the type of governance that generally characterizes the relationship between actors in each link. Not shown are backward linkages to input suppliers and services, including the feed, pharmaceutical and vaccine industries. These backward linkages are complex given the stringent requirements for feed, breed and management required by the exotic breeds used on layer farms, and these requirements have contributed to a relatively high degree of specialization within the layer sub-sector. The chain starts from breeders that produce final stock, to farmers who raise the birds and processors and other actors related to poultry distribution who supply poultry products to consumers.

Breeder farms produce 4.2 million female-layer DOC annually and sell the majority directly to large-scale commercial layer farms (50% of the breeder farm annual production, or 2.1 million DOC, and representing a total value of IDR 15-18 billion) and pullet farms (45%; 1.9 million DOC; IDR 13-16 billion), but also distribute a small share through agents or distributors (5%; 0.2 million DOC; IDR 1-2 billion). These agents supply poultry shops (IDR 2 billion), which sell the DOC to small-scale commercial layer farms (IDR 2 billion). After growing out the DOC, pullet farms sell all of their production (1.8 million birds, taking into account 5% mortality; IDR 60-62 billion) to small-scale layer farms. With the exception of poultry shop sales, the relationships between actors along these chains are considered semi-coordinated in the sense that they generally involve repeated transactions between suppliers and buyers as an informal arrangement. Farmers are less likely to have such

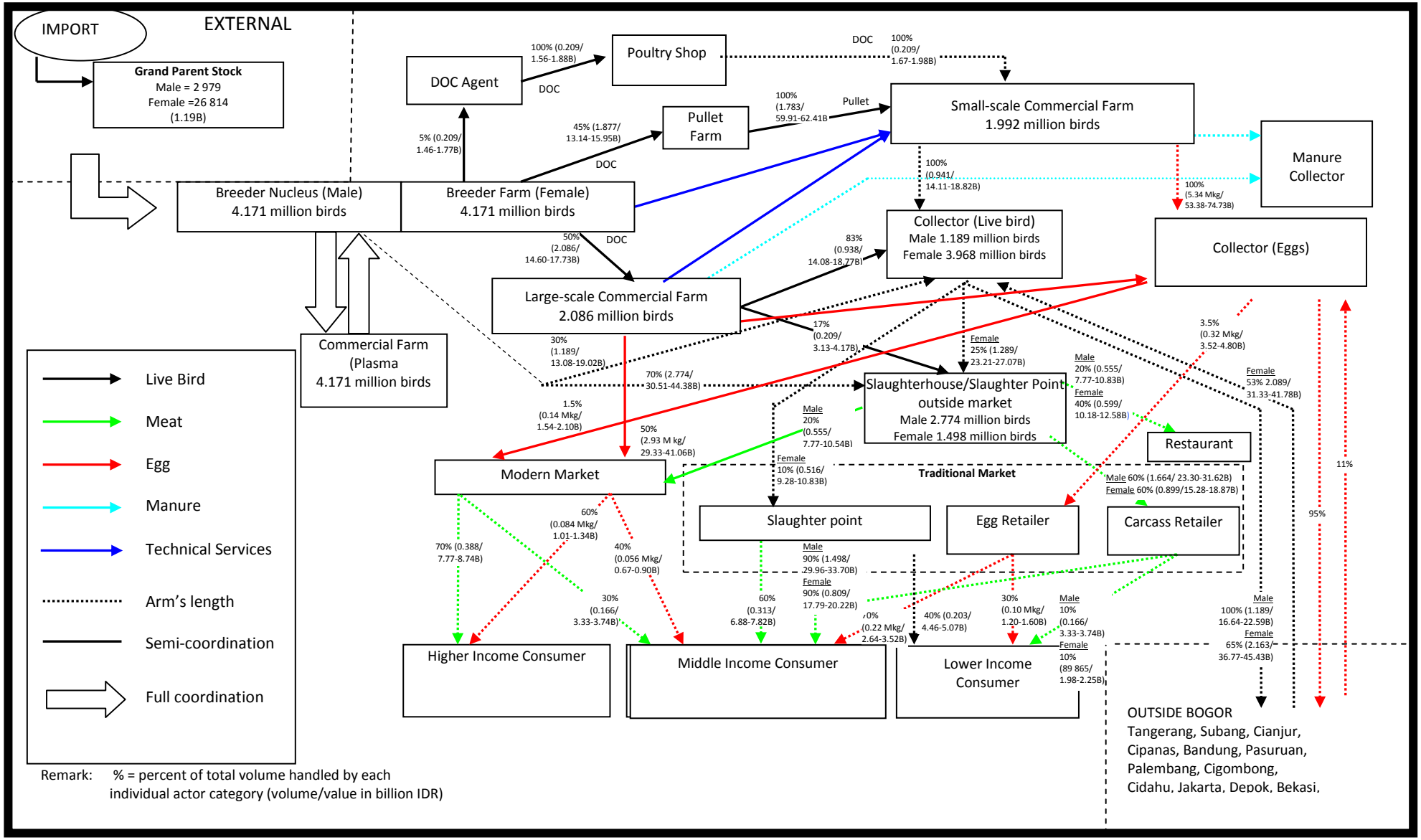


Figure 9. Layer value chain in Bogor (volumes and value)

longer term arrangements with certain poultry shops. Indeed, there are many poultry shops that farmers can choose the right for transaction.

Female-layer farms produce eggs and spent layers. Small-scale female-layer farmers in Bogor are generally independent farmers. They have no contract system for procuring inputs or selling table eggs. These farmers are free to decide from whom to buy feed, vitamins and vaccines, and to whom they sell the table eggs and spent layers. They do, however, usually have regular suppliers of pullets. Larger-scale farmers exhibit more systematic semi-coordination; they partner with feed suppliers and egg collectors in informal agreements. This coordination is important to ensure the continuity of feed supply and to ensure markets for selling products, both eggs and birds.

All eggs produced by small-scale farms are sold to collectors (5.3 million kg; IDR 53-75 billion), usually in arm's-length transactions, while those from large-scale farms are sold in roughly equal shares to regular buyers among collectors and modern markets (2.9 million kg; IDR 29-41 billion, respectively). Egg collectors also import an estimated 1.0 million kg (IDR 10-14 billion) of eggs from outside the district (especially Tangerang, Cianjur, Cidahu and Cigombong). Of the egg collectors' volume, an estimated 95% of eggs (8.8 million kg; IDR 97-132 billion) are exported to outside Bogor (Jakarta, Depok and Bekasi) in open-market transactions; the remaining 5% are sold in equal shares (0.3 million kg; IDR 4-5 billion each) as regular suppliers to supermarkets and in arm's-length transactions to egg retailers in traditional markets.

Female-layer farmers sell a cohort of spent layers every 20 weeks (5 months), so the number of spent layers marketed in a year should be close to 50 % of the layer population. Small- and large-scale commercial female-layer farms contribute roughly equal shares of spent layers. Large-scale farms sell spent layers through established relationships with buyers (semi-coordination) mainly to collectors (83%; 0.9 million birds; IDR 14-19 billion), with a smaller share going to slaughterhouses (17%; 0.2 million birds; IDR 3-4 billion). Small-scale farms sell all of their spent layers to collectors (0.9 million birds; IDR 14-19 billion).

The collectors in turn sell spent layers either to slaughter points inside traditional markets (10%; 0.5 million birds; IDR 9-11 billion), slaughterhouses (25%; 1.3 million; IDR 23-27 billion) and outside Bogor (65%; 2.2 million; IDR 37-45 billion), especially to Jakarta, Tangerang, Subang, Cianjur and Cipanas. From the slaughterhouses, outside market, carcasses are supplied either to carcass (poultry meat) retailers in traditional markets (60%; 0.9 million birds; IDR 15-19 billion) or to restaurants (40%; 0.6 million birds; IDR 10-13 billion) in open market sales. Slaughter points inside the traditional markets act as live bird retailers. Some consumers buy and slaughter the birds at the slaughter points (60%; 0.3 million birds; IDR 7-8 billion). Other consumer buy live birds (40%; 0,2 million birds; IDR 4,6-5.3 billion) and slaughter them at home.

In contrast, and while fewer in number, male-layer farm have much stronger market coordination with input providers and output buyers. All male-layer farmers that we interviewed in Bogor work under a written contract agreement with PT Salim Wijaya, in a variant of the Nucleus-Plasma Farming System (*Plasma Inti Rakyat*: PIR) system, representing full coordination. In PIR, there is a sharing of product resources and risks between the company and farmer. This business has grown from an initial contracting of 10 farmers to several hundred chicken farmers today. The company provides production inputs including male-layer DOC and sells the farmers' output, while the farmers provide chicken houses and rear the birds. The contract agreement covers one 6-8 week

cycle of growing out the male-layers like broilers, with the contract agreement repeatedly renewed for new production cycles. The male-layer system delivers roughly the same total number of birds annually as the spent layer system. At the end of the cycle, male layers are sold either to collectors (30%; 1.2 million birds; IDR 13-19 billion) or to slaughterhouses (70%; 2.8 million birds; IDR 31-44 billion). Collectors sell the male layers on the open market (arm's length) to areas outside Bogor. Carcasses from slaughterhouses are sold on arrangement to supermarkets (20%; 0.6 million; 8-11 billion) while those from slaughter points are sold on the open market to retailers in traditional markets (60%; 1.7 million; IDR 23-32 billion) and restaurants (20%; 0.6 million; 8-11 billion).

The average value-added for each commodity handled in the layer chain was calculated using Hayami's method (Table 1). As depicted in Figure 8, the marketing chain of spent layers starts from the live bird in the farm, which is subsequently bought by collectors and then sold to slaughterpoints. From slaughterpoints, poultry carcasses go to retailers and finally to consumers. Note that the chain could be handled by one person that acts as a collector, slaughter point and retailer, or by separate people at each node of the chain, which will influence the amount of value added generated by such a person. Table 12 shows that collectors combined with slaughterpoints and retailers had the highest value-added: IDR 7100 per bird. As a collector only, the value-added gain is at least IDR 2635 per bird.

The table egg marketing chain in Bogor includes two actors: collectors and retailers. The value-added of layer egg retailers was higher than that of the collectors with a value of IDR 791 per kilogram and IDR 135 per kilogram, respectively. Other input costs spent by retailers are retribution, water and electricity.

Table 12. Average value-added of spent layers and table eggs

Actor Category	Input Price	Output Price	Cost of Other Inputs	Average Value-Added
Spent layers (IDR/bird)				
Carcass retailer	21,000	24,000	209	2,791
Collector	15,000	18,000	365	2,635
Slaughter point & retailer	19,000	25,000	1,535	4,256
Collector & slaughter point	16,000	22,000	1,744	4,465
Collector, slaughter point & retailer	15,000	24,000	1,900	7,100
Table eggs (IDR/kg)				
Retailer	12,500	13,500	209	791
Collector	12,000	12,500	365	135

Role of associations

Industry organizations related to the layer business are found mainly at national level among input suppliers. These include, at the national level, the Association of Indonesian Poultry Breeders (*Gabungan Perusahaan Pembibitan Unggas Indonesia*: GPPUI), the Indonesian Animal Drug Association (*Asosiasi Obat Hewan Indonesia*: ASOHI) and the Feed Mill Association (*Gabungan Perusahaan Pakan Ternak*: GPMT). Three companies operating in Bogor are members of GPMT: P.T. Charoen Pokphand, P.T. Japfa Comfeed and P.T. Gold Coin (nationally, there are 18 GPMT member companies). GPPUI members include eight breeder companies and play an important role in

controlling the production of DOC to stabilize prices and control supply. In general, these associations play a key role as a partner to the government in regulating poultry and related industries. The main roles of the poultry industry associations are:

- Sharing information among members
- Serving as a partner of government in facing crises such as the HPAI outbreak
- In some cases, acting as a cartel in setting the prices of their products.

Layer farmers are represented by the Association of Indonesian Poultry Farmers (*Perhimpunan Peternak Unggas Indonesia*: PPUI) and PINSAR (Assosiasi Peternak Unggas Se-Indonesia = Indonesian Poultry Farmer Association and Information Centre). As with other poultry industry associations, the role of PPUI and PINSAR also includes sharing information on input and output prices among members, brokering between members in terms of sales, and in some cases yielding market power (not unlike a cartel) in establishing their output price.

At the local level in Bogor, there is also a Slaughter Point Society (*Ikatan Warga Pemotong Ayam*: IPWA). The members are slaughterhouse workers in the Bogor Area. They meet once a week to discuss recent issues concerning the supply of live birds from farmers and current demand for carcasses. The main role of this society is to ensure that there is a single price of carcasses in all traditional markets in Bogor, particularly at times when prices are potentially unstable.

Public policy and regulation

The local government has established regulations stating that it is compulsory for layer farmers raising more than 10,000 birds to meet environmental and regional planning requirements (Regents Regulation 2003). This law necessitates additional farmer expenses for environmental assessment and site suitability for farm location. Therefore in the registration form, it is very rare for farmers to state that their farm raises more than 10,000 birds to avoid these regulations. There were around 40 layer farmers who reportedly raised around 40,000 birds in Bogor without the local government permission.

Since the beginning of the HPAI outbreak, there have been several new policies and measures at the various levels of government to respond to the disease, e.g. on vaccination, culling and banning of poultry from residential areas; these are discussed in Section 4.6.

3.2 Commercial broilers

Broiler population

The total broiler population in Bogor (Bogor City and Bogor District) is around 1% of Indonesia's population, similar to the corresponding share of the human population. From 2002 to 2008, the broiler population in Bogor has experienced an upward trend, though stalling at 8.4 million birds in 2004-2006 before making a rapid jump in 2007 (Table 13).

Table 13. Broiler population in Bogor, 2002-2008

Area	Broiler (1,000 birds)						
	2002	2003	2004	2005	2006	2007	2008
Bogor City[1]	127	158	188	188	188	157	NA
Bogor District[2]	6,071	7,029	8,294	8,258	8,222	12,756	13,793
Total Bogor	**6,198**	**7,187**	**8,482**	**8,446**	**8,410**	**12,914**	**13,793**
Total Indonesia[3]	**865,075**	**847,744**	**778,970**	**811,819**	**797,527**	**891,659**	**1,075,885**
Bogor as % of Indonesia	0.70	0.85	1.09	1.04	1.05	1.45	1.28

Source : [1] Dinas Agribisnis 2009
[2]Disnakan, 2009
[3]Ditjennak, 2009

The jump in the broiler population in 2007 was caused by an increase in numbers of farms. The number of large-scale broiler farms (> 15,000 birds) in Bogor increased from 42 (2006) to 82 (2007). The data show that the impact of HPAI was transitory and the recovery was very fast. The number of broilers produced per fattening cycle (one cycle is 30-40 days) by the 87 large commercial farms in the district in 2009 reached 4.0 million birds or 24 million per year (the broiler production is 6 cycles a year).

Characteristics of actors in the broiler chain

Broiler farms were found in all four study areas. These are generally run as sector 2 and 3 family commercial enterprises for their main source of income. Farm sizes of sampled farms varied widely from 1200 to 1.5 million birds (Table 14).

Breeding companies supply DOC of exotic breeds specialized for broiler production, transporting them from the hatcheries on the breeder farms to client farms by ventilated trucks owned by the breeding company. At the time of the study (February-April 2009), the price of a broiler DOC was IDR 3200. Broiler DOC prices tend to fluctuate during the year, indirectly reflecting seasonal demand for chicken meat. Peak demand for chicken meat occurs during the Muslim fasting month and Idd ul Fitr and given that the broiler production cycle is four to six weeks, farmer demand for DOC increases in the month prior to that time. Demand for DOC tends to increase about 50-65% during this period, while the DOC price increases by 40-50% and can be as high as IDR 4500 per bird. When demand for broiler meat decreases (usually at the time when consumers are under pressure to allocate their income for tuition fees for their children), DOC prices drop as low as IDR 2000 per bird.

There are two kinds of feed used in the broiler sector: starter feed (<3 weeks old) and finisher feed (3-6 weeks old). During the fattening period, broiler chickens stay in the same poultry house (all in, all out system) with litter floor (made from rice hulls or sawdust). Feed is usually purchased from

Table 14. Population of broilers per sampled farm in Bogor

Population (birds/farm)	Number of Respondents				
	Ciawi	Cibinong	Leuwiliang	Parung	Total
1200	0	1	0	0	1
2500	1	0	0	0	1
5000	1	0	1	0	2
8000	0	0	0	1	1
9000	0	1	0	0	1
20,000	0	0	1	0	1
30,000	0	0	1	0	1
36,000	0	1	0	0	1
42,000	0	1	0	0	1
100,000	0	0	1	0	1
102,000	0	1	0	0	1
120,000	0	0	1	0	1
150,000	0	0	1	0	1
1,500,000	1	0	0	0	1
Total	**3**	**5**	**6**	**1**	**15**

feed mills around West Java and Banten such as Wonokoyo, Charoen Pokphand, Comfeed and Gold Coin. The price of broiler feed is relatively constant at IDR 4000-5000 per kg. Feed consumption per bird depends on the length of their growing cycle. *Ad libitum* feeding is practised (feed always readily available). The feed conversion ratio after fattening is around 1.7-1.8 (i.e. farmers spend 1.7 to 1.8 kg feed to get 1 kg live weight of broiler). Other inputs used in broiler farms are vaccines against ND and IBD, which farmers buy from poultry shops or vaccine producers. The vaccine price was IDR 43,000–50,000 per 1000 doses. Cost for vaccine during fattening was reported to average IDR 150 per bird.

Commercial broiler farms sell live broilers at a weight of 0.8-1.6 kg per bird after 30-40 days of fattening. Broilers from commercial farms are usually taken by collectors to slaughterhouses, which produce carcasses. The live chickens are transported from the farm in open trucks in plastic, bamboo or wooden baskets. From slaughterhouses, carcasses are sold to restaurants, supermarkets and traditional markets. Most Bogor consumers choose broiler meat as a protein source, because it is cheaper than kampong chicken and other types of meat. The broiler price at present is IDR 20,000 per bird, but during Idd ul Fitr (a special day) it increases up to IDR 25,000 per bird. The ranges of 2008 output and input prices for broiler systems are shown in Table 15.

Table 15. Input and output prices in broiler chain, 2008 (IDR)

Price Category	Item	Unit	Price	
			Minimum	Maximum
Input	DOC	bird	2,000	4500
	Feed	kg	4,000	5000
Output	Live bird	bird	11,000	16,000
Consumer	Live bird	bird	20,000	25,000

Product flow and governance mechanism map

The broiler value chain is mapped in Figure 9. As in the case of layers, the breeds used for broiler production are exotic and therefore entail stringent requirements for feed, breeding and management and lead to specialization within the production portion of the broiler chain. Again, backward linkages to these specialized inputs and services (such as the feed, pharmaceutical and vaccine industries) are not shown, with the exception of the breeding companies. The chain starts from these breeding companies which produce final stock, then to farmers who raise the birds, and onto processors and traders who provide poultry products to consumers.

There are two types of broiler farmers. The first is non-contract, independent farmers, accounting for approximately one-third of broiler farms. These farmers are free to decide from whom they buy inputs (feed, vitamins and vaccines) and to whom they sell the output, whether in open-market arm's length transactions or according to informal arrangements with regular clients. More common (two-thirds of broiler farms) is the second type being full coordination in the form of the integrated contractual collaboration (PIR) between broiler farmers and a company, similar to that described above for male-layer farms. The company acts as the nucleus, providing production input and marketing the farmers' output, while farmers act as plasma, providing chicken houses and rearing the broilers. This contract is valid for one fattening cycle and can be prolonged. The contract agreement between a company and a farmer will usually consist of (1) an input supply agreement from the company to provide DOC, feed, drug, vitamins, vaccines and disinfectant under a contract price; (2) provision by the farmer of a land certificate as a guarantee to the company, a poultry house with standard equipment and an obligation to look after the chickens during fattening; (3) purchase by the company at a contract price of all fattened chickens produced; (4) no sale of the chickens by the farmer to anyone other than the company; (5) the difference between the cost of input used by farmers and the value of output will be the basic profit (or could be loss) for the farmer.

There are several breeders in Bogor who sell broiler DOC to contracted farmers (60% of total DOC production; 48.8 million birds; representing a total value of IDR 98-220 billion), independent farmers (15%; 12.2 million; IDR 24-55 billion) and poultry shops (25%; 20.3 million; IDR 41-92 billion). There are two types of poultry shops: non-nucleus shops which sell DOC to independent farmers (70%; 14.2 million; IDR 36-71 billion) and nucleus shops which sell to plasma farmers (30%; 6.1 million; IDR 15-31 billion).

Once the cycle is completed, plasma farms send roughly half of their ready-to-slaughter broilers to processing plants belonging to the nucleus and sell the other half to collectors, under direction of delivery orders issued by nucleus (50%; 26.1 million; IDR 287-417 billion, respectively). Independent farmers sell their production to slaughterhouses (20%; 5.0 million; IDR 55-80 billion), collectors (70%; 17.6 million; IDR 193-281 billion) and slaughter points (10%; 2.5 million; IDR 28-40 billion).

Collectors in turn export over two-thirds of the live birds they handle (69%; 34.2; IDR 479-616 billion) to destinations outside Bogor (e.g. Rancamaya, Sukabumi, Subang, Bekasi, Tangerang, Lampung and Central Java) The remainder are distributed to slaughter houses (8%; 4.0 million; IDR 55-71 billion) and slaughter points inside traditional markets (3%; 1.5 million; IDR 21-27 billion) and outside these markets (20%; 9.9; IDR 138-178 billion).

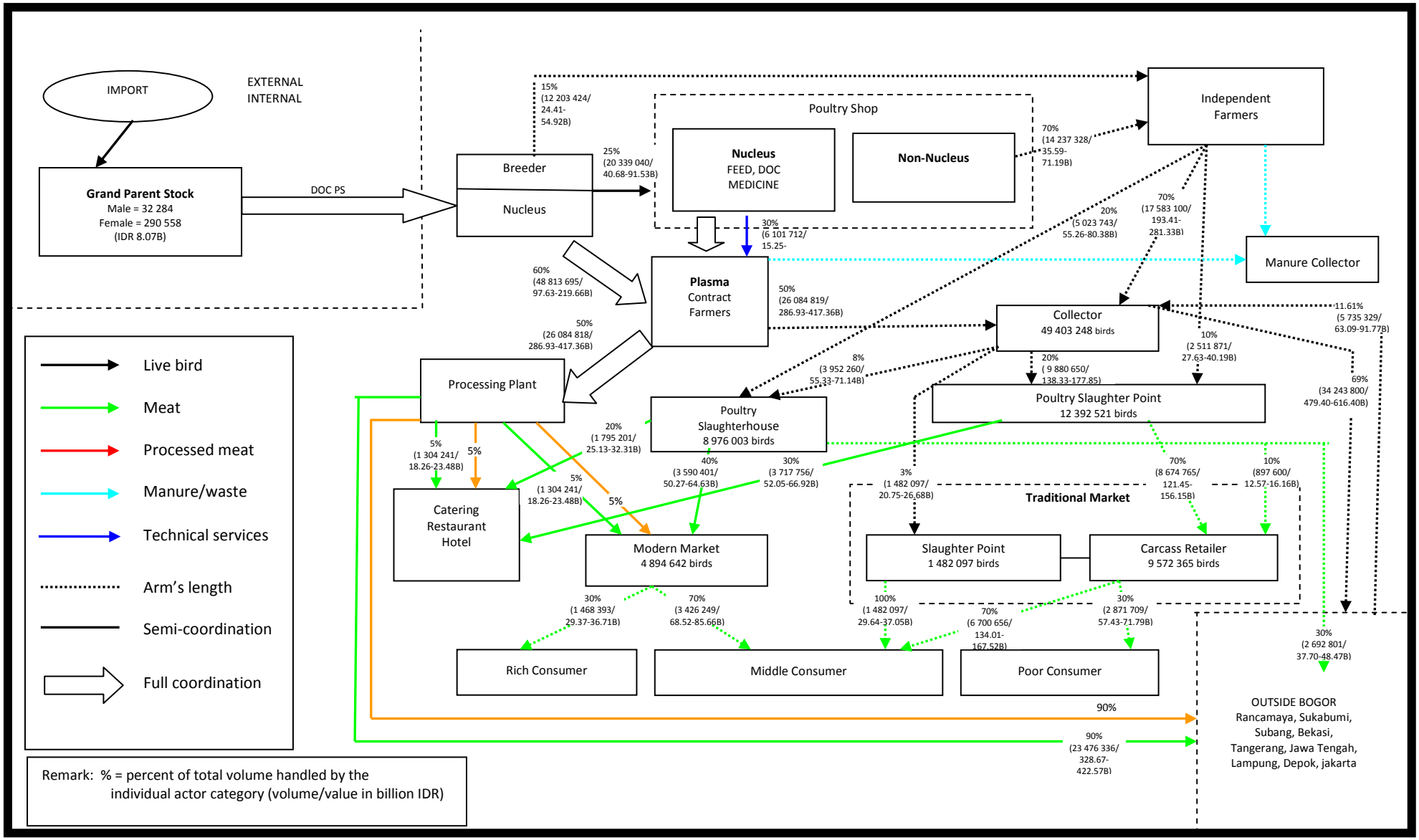


Figure 10. Broiler value chain in Bogor (volumes and value)

After slaughtering, carcasses and other products from processing plants are mostly (90%) exported outside Bogor (especially to Jakarta, Depok, Bekasi, and even to Batam), with the remainder sold to modern markets (5%) and restaurants (5%). Processing plants produce a mix of products for different market segments. They cut carcasses (meat) into several commercial parts such as breast, drumstick, back, thigh, wing, and also for fillet. Each product has different values, so volume and value estimates are not reported here.

Carcasses from slaughter houses are sold to modern markets (40%; 3.6 million; IDR 50-65 billion), restaurants (20%; 1.8 million; IDR 25-32 billion), carcass retailers (10%; 0.9 million; IDR 12-16 billion) and exported outside Bogor (30%; 2.7 million; IDR 38-48 billion), e.g. to Jakarta, Depok, Bekasi, Sukabumi, Lampung and Central Java. Carcasses from slaughter points are sold to restaurants (30%; 3.7 million; IDR 52-67 billion) and to carcass retailers in traditional markets (70%; 8.7 million; IDR 121-156 billion). From traditional markets, carcasses are sold to low-income consumers (30%; 2.9 million; IDR 57-72 billion) and middle-class consumers (70%; 6.7 million; IDR 134-168 billion), while those from modern markets are sold to middle-income consumers (70%; 3.4 million; IDR 69-86 billion) and upper-class consumers (30%; 1.5 million; IDR 29-37 billion).

The average of value-added for each major downstream actor category was calculated using the Hayami method (Table 1). Table 16 shows that layer business actors that combine the function of slaughter point up to retailer generate the highest value added: IDR 6576 per bird. For a simple carcass retailer, value-added gain is an estimated IDR 1791 per bird.

Table 16. Average value-added in the broiler chain, by actor category (IDR/bird)

Actor Category	Input Price	Output Price	Cost of Other Inputs	Average Value Added
Carcass retailer	22,000	24,000	209	1791
Collector	13,400	16,000	365	1915
Slaughter point	14,583	21,000	1535	4463
Slaughter point & retailer	15,200	24,000	1744	6576
Collector & slaughter point	13,800	21,000	1900	4880

Role of associations

The constellation of industry organizations is the same as that described for the layer value chain.

Public policy and regulation

As for layer farms, the government has made specific regulations targeted to broiler farmers raising more than 15,000 birds to meet environmental and regional planning requirements (Regents Regulation 2003). Again, farmers rarely declare that their farms have more than this number of birds to avoid those regulations. More regulations and measures on local and national level to respond to the disease through targeting of vaccination, culling and banning of poultry from residential areas are discussed in Section 4.6.

The government provides certain services to protect and promote the value chain, including provision of free Pullorum vaccine to breeders and monitoring of quality of feed and DOC every two

months. The livestock services also take blood samples of DOC to send to Balitvet Bogor to confirm the HPAI status of flocks.

3.3 Kampong chickens

Kampong chicken population

The kampong chicken population is the second largest poultry population in Bogor after broiler chickens and represents around 0.5-0.8% of the national total, which is relatively smaller than Bogor's 1% share of the national human population. Table 17 indicates that kampong chicken population in Bogor has trended downward from 2.1 million in 2002 to 1.3 million in 2008 (Table 17). HPAI is associated with high mortality among kampong chickens. Also, local government policies (see also Section 4.6) which focused initially on the depopulation of kampong chickens within a certain area (for Bogor only the afflicted Rukun Warga [RW]), may have contributed to a further decline in backyard farmers rearing kampong chickens and subsequently the numbers of kampong chickens. However, later on once HPAI was considered to be endemic, only voluntary focal culling of the infected flock was applied. Thus, the effect of depopulation on the kampong chicken population has probably not been very significant.

According to the District Livestock Service (DLS) for Bogor District, compensation was rarely applied at any time since the first introduction of HPAI. If paid, however, farmers incurred significant losses from the depopulation of kampong chicken because the compensation rate for depopulated chicken was only 50% of the chicken value, depending on availability of funds for the program. Some farmers even stopped rearing kampong chickens (5% according to respondents in focus group discussions, and switched to other activities like trading, rearing other livestock (goats and sheep) or factory labour.

Table 17. Kampong chicken population in Bogor, 2002-2008

Area	Numbers of Kampong Chicken (1,000 birds)						
	2002	2003	2004	2005	2006	2007	2008
Bogor City[1]	642	642	721	721	721	308	NA
Bogor District[2]	1,543	1,418	1,418	1,233	1,202	1,007	1,306
Total Bogor	**2,185**	**2,060**	**2,139**	**1,954**	**1,923**	**1,315**	**1,306**
Total Indonesia[3]	275,292	277,357	276,989	278,954	291,085	272,251	290,803
% Bogor on Indonesia	0.79	0.74	0.77	0.70	0.66	0.48	0.45

NA= not available

Source : [1] Dinas Agribisnis 2009

[2]Disnakan, 2009

[3]Ditjennak, 2009

Characteristics of actors in the kampong chicken value chain

Of the respondents keeping kampong chickens (n=82), nearly all (98%) kept small flocks of less than 100 birds. Most kampong chickens are still raised in a traditional system in small backyard flocks ranging free to scavenge for feed. The other farmers in the sample (2%) kept larger flocks of 100-170 birds per farm, and it is also reported that there are a few larger farms in the district that produce

large cohorts of kampong chickens using the small-scale broiler system with over 1000 birds in an all-in, all-out cycle. Nearly all of the respondents were classified as sector 4 farmers; only one was classified as sector 3.

Farming, though, is actually a secondary activity for many people who keep kampong chickens; the main activity of respondents in the sample was government employees (10% of the sample), village office staff (40%), traders (20%), factory labourers (5%), private workers (15%) or housewives (10%). Respondents keeping kampong chickens tended to be better educated, but with less business experience than other actors in the chain, and 15% were women (Tables 3 to 7). Rearing kampong chickens is often not considered a business enterprise as such, but serves several functions. First, it provides a source of food for home consumption, enhancing food security in the household and community (through gifts). Farmers usually sell their chickens only when they need to pay bills, for example tuition fees for their children, so keeping chickens also serves as a type of financial savings and liquidity instrument. Respondents reported selling 2-5 birds per semester (6 months). They are also used in social and cultural events, such as wedding parties or other events in which kampong chickens cannot be replaced by any other poultry. Kampong chickens are always available and have a special position in society, as well as simply being appreciated as a popular hobby. For these reasons, as well as the low investment required and its ease, keeping kampong chickens is ubiquitous and evenly distributed across the district.

The management system used for kampong chickens ranges from extensive in small flocks, to semi-intensive and intensive as flocks get larger. Sector 4 kampong chicken keepers generally source chicks from their own flock (88%), but may also buy in pullets from other farms (12%). The pullet price was IDR 35,000-40,000 per bird, higher than final bird price, because it has high quality to be used for hen replacement stock. There is frequent exchange of breeding stock through informal loans, gifts, exchanges and such purchases. Sector 3 producers may also import kampong DOC from suppliers outside the district.

Feed is usually mixed by sector 4 farmers (83% of respondents) themselves – generally mixture of concentrate and corn – or food waste, and chickens are often allowed to range freely to scavenge as well. Farmers feed the chickens in the morning, giving them 1 kg per 15 birds per day. In the more intensive management system, feed may be purchased from poultry shops or agents or a combination of all sources. The price of kampong chicken feed was relatively constant at IDR 2000-3500 per kg depending on the nutrients contained in the feed and the place purchased. Feed and drinking troughs are usually made by the farmers themselves (65%) or purchased from poultry shops (35%). Other inputs include ND and HPAI vaccines, though some do not use vaccines (20 %). Only 10% of the farmers buy vaccines from poultry shops or vaccine producers, priced at IDR 25,000 per 500 doses; most (70%) use vaccines from livestock services when provided for free. Most kampong chicken farmers sampled (87%) keep only kampong chickens, while the remaining respondents mix kampong chickens with other breeds (broilers) and species, especially ducks. Kampong chickens and ducks were kept in separate henhouses but allowed to roam in the same yard.

Sector 4 kampong chickens are kept until they are anywhere between 6-12 months old, and slaughtered for home consumption or sold when cash is needed or for other reasons. Hens may be retained longer for egg production and raising chicks. Households with larger flocks are generally more commercially oriented with more regular sales and production cycles. Sector 3 producers

follow practices similar to the broiler and layer systems for exotic breeds. At the time of the study, the farm gate selling price was IDR 20,000-25,000 per bird and IDR 18,750-25,000 per kg of eggs.

Given the dispersed small-scale nature of most kampong chicken production, collectors play a key role in linking farmers to retailers. Local collectors transport live chickens and eggs to traditional markets by bicycle, motorcycle or public transport. Collectors also handle the larger volumes of table eggs, kampong broilers and spent hens produced from the commercial larger-scale kampong chicken farms. Wholesalers transport chickens or eggs from Bogor and other districts, especially Sukabumi and Cianjur, in open trucks to traditional markets in Bogor or to Jakarta and other districts, where they are sold to retailers or taken to slaughter points.

Retailers sell live kampong chickens in traditional markets, often keeping them in bamboo/wooden baskets. Some retailers also provide slaughtering facilities, or may send chickens to slaughter points and then sell the carcasses. Bogor consumers choose kampong chicken because it has a delicious taste (especially among the rich) or for ritual ceremonies. Consumers prefer to buy kampong chickens from live bird retailers, which may relate to the Muslim preference to make sure of the 'halal' status of the bird they consume. Ethnic Chinese also buy live kampong chickens and have them slaughtered at slaughter points for consumption and for the "Imlek" celebration. Kampong chicken eggs are popular as traditional medicine.

Kampong chicken prices at the agent (wholesaler) level were relatively constant at IDR 25,000 per bird. Retail prices were around IDR 30,000-50,000 per bird on a normal day, and increased up to IDR 100,000 per bird during Idd ul Fitr. Table 18 summarizes maximum and minimum prices from the chain in 2008.

Table 18. Input and output prices in the kampong chicken chain (IDR/unit)

Category	Item	Unit	Price	
			Minimum	Maximum
Input Price	DOC	bird	4,000	5,000
	Pullet (15 weeks)	bird	35,000	40,000
	Feed	kg	2,000	3,500
Output Price	Live bird	bird	20,000	25,000
	Egg	kg	18,750	25,000
Consumer Price	Live bird	bird	30,000	50,000
	Egg	Kg[1]	25,000	32,500

[1]1 kg = 20 eggs

Product flow and governance mechanism map

Figure 10 summarizes the structure of the kampong chicken value chain, including both egg and meat commodity chains. Estimates of product volumes and value handled by the various actors were conditioned by the dispersed, variable and non-linear nature of sector 4 production and marketing systems and our reliance on information from a relatively small sample of farmers, so they should be considered qualitatively representative rather than quantitatively accurate.

Kampong chickens are raised predominantly on sector 4 backyard farms (95% of annual production; 1.4 million birds), with the remainder on sector 3 commercial farms (5%, 76,000 birds).

Commercial kampong chicken farms buy DOC from breeders outside Bogor or hatch the chickens themselves. Backyard farms buy pullets from collectors (69,000 birds; representing a value of IDR 2 billion) or from traditional markets (86,000 birds; IDR 3-4 billion). The rest are hatched from their own flocks (89% of annual production).

Due to different market segments, kampong chicken eggs are sold in units of eggs, while table eggs are denominated in units of kilograms. Kampong chicken eggs from commercial farms are sold as an open market (arm's-length transactions) to egg collectors (90% of commercial farm production; 2.3 million eggs; IDR 2 billion) and under informal arrangements to clients in modern markets (10%; 0.2 million eggs; IDR 195-260 million). Egg collectors, who also import additional eggs supplies from other districts, re-sell most of their stocks to egg retailers in traditional markets within Bogor (76%; 2.2 million eggs; IDR 2 billion), and part to modern markets within Bogor (20%; 0.6 million eggs; IDR 1 million), with a small portion (6%) exported outside the district (Jakarta). Eggs produced by backyard farms are largely consumed by farmers, shared with relatives or hatched for replacement stock.

Most demand for kampong chicken is either for direct consumption or religious purposes (i.e. no processing industry for kampong products such as meatballs, chicken nuggets etc.). The primary consumers of kampong chickens are exclusive restaurants and households. Demand for kampong chicken is unstable and formalized transaction arrangements (such as contracts) are not utilized. Kampong chickens from commercial farms are sold to collectors (80%; 51,000 birds; IDR 1 billion) as open-market transactions and to restaurants (20%; 13,000 birds; IDR 0.3 billion) under informal arrangements. Note that the mortality rate of kampong chickens while on farm was reported to be 15%, so the number of chicken sold is 15% lower than the number of DOC used.

Kampong chickens from backyard farms are sold to collectors (60%; 0.7 million; IDR 15-18 billion) or given to relatives (25%; 0.3 million; IDR 9-15 billion) and the remainder consumed on farm.

Collectors distribute kampong chickens to slaughter points and retailers inside traditional markets (50% of their total volume traded; 0.9 million birds; IDR 22-30 billion) and to slaughter points outside traditional markets (5%; 0.1 million; IDR 2 billion), to restaurants (20%; 0.3 million; IDR 9-12 billion), to farm (4%; 0.07 million; 1.7-2.4 billion), or export them outside Bogor (21%; 0.4 million; IDR 9-13 billion).

Carcasses from slaughter points outside traditional markets are all delivered on a regular basis to restaurants. Birds delivered to traditional markets are sold directly to consumers, either as carcasses from slaughter points to middle-income consumers (50%; 0.4 million; IDR 13-22 billion) and to rich consumers (20%; 0.2 million; IDR 5-9 billion), or by retailers as live birds to middle-economic consumers (20%; 0.2 million; IDR 5-9 billion) and to backyard farms as replacements (10%; 0.1 million; IDR 3-4 billion).

Table 19 shows that a kampong chicken business player that acts as a collector up to retailer gains the highest added value, IDR 7891 per bird. As a collector only, the added value gain is the least, IDR 2635 per bird. The added value of kampong chicken eggs gained by a retailer is IDR 4791 per kilogram.

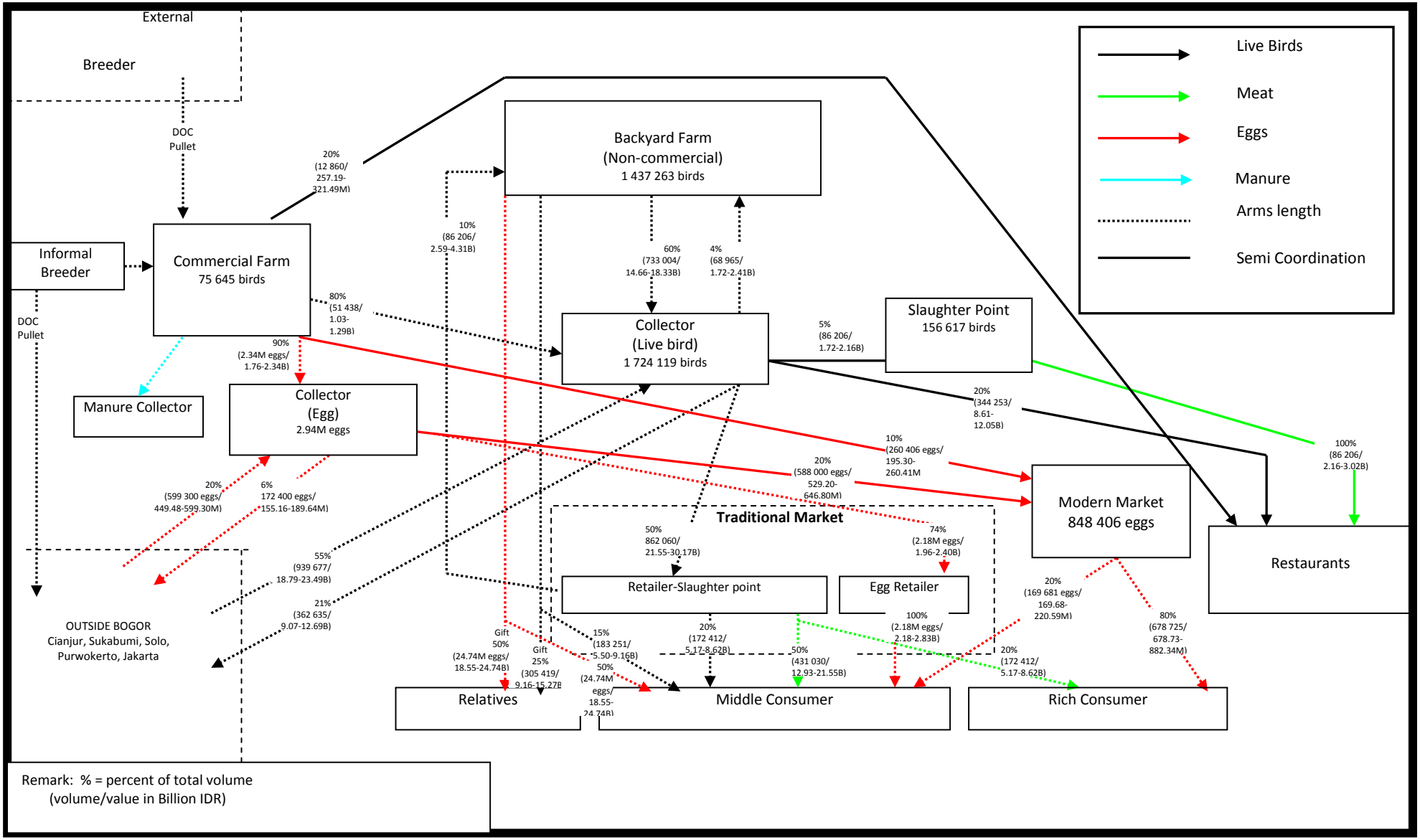


Figure 11. Kampong chicken value chain in Bogor (volumes and value)

Table 19. Average value added in the kampong chicken chain, by actor category

Actor Category	Input Price	Output Price	Cost of Other Inputs	Average Value Added
Kampong Chicken (IDR/bird)				
Live bird retailer	24,500	30,000	209	5,291
Collector	22,000	25,000	365	2,635
Slaughter point & retailer	24,000	32,000	1,743	6,256
Collector, slaughter point & retailer	20,000	30,000	2,109	7,891
Kampong chicken egg (IDR/kg)[1]				
Retailer	20,000	25,000	209	4,791
Collector	18,750	20,000	350	900

[1] 1kg=20 eggs

Role of associations

Associations related to kampong chicken business are found among sector 4 farmers. There are nine farmers' associations at subdistrict level in Sukamakmur, Citeureup, Cigombong, Ciomas, Parung, Gunung Sindur, Rumpin, Dramaga and Sukaraja. Based on focus group discussion respondent data, most of these are not listed as official poultry associations, except the group in Ciawi. Generally, the main role of the poultry business association is sharing information among members about difficulties in running the business, good practices in marketing or poultry management and also handling disease.

Public policy and regulation

Policy and regulation does not generally penetrate into sector 4 kampong chicken farming given its dispersed, small-scale nature. The link between public extension services and kampong chicken farmers is weak; a majority of the respondents (65%) reported not having information about poultry rearing management and handling poultry disease. The government made new regulations for kampong chicken farmers in order to control HPAI including measures related to culling, vaccination and banning chickens from residential areas (see Section 4.6). A specific regulation now provides vaccination only to farmers who keep their chickens in cages. As for layer and broiler farms, the government has also made specific regulations targeted to kampong farmers raising more than 300 birds to meet environmental and regional planning requirements (Regents Regulation 2003).

3.4 Ducks

Duck population

The duck population in Bogor has varied widely since 2002, at first increasing slightly until 2005, nearly doubling in 2006, then falling off dramatically in 2007 and 2008 (Table 20). Although HPAI is not associated with mortality in ducks, ducks are seen as carriers of the virus and those on sector 4 farms have been subject to restrictions and depopulation as part of the government response to the outbreak, contributing to a decline in backyard farmers keeping ducks and duck numbers. Bogor

ducks account for 0.26-0.77% of the national population, lower than the area's corresponding 1% share of the human population.

Table 20. Duck population in Bogor, 2002-2008

Area	Numbers of Ducks (1,000 birds)						
	2002	2003	2004	2005	2006	2007	2008
Bogor city[1]	8	8	8	8	8	8	NA
Bogor district[2]	121	122	129	136	241	151	95
Total Bogor	**129**	**129**	**137**	**144**	**249**	**151**	**95**
Total Indonesia[3]	46,001	33,863	32,573	32,405	32,481	35,867	36,931
% Bogor on Indonesia	0.28	0.38	0.42	0.44	0.77	0.42	0.26

Source : [1] Dinas Agribisnis 2009
[2]Disnakan, 2009
[3]Ditjennak, 2009

Characteristics of actors in the duck value chain

As in the kampong chicken chain, ducks are raised in small flocks in extensive backyard systems on numerous small-scale sector 4 farms (98% of duck farms); and in larger flocks in more intensive systems on a small number of sector 3 commercial farms (2% of farms).

On sector 4 farms, most ducks are still raised in the traditional system with fewer than 100 birds per farm (usually between 25-75 birds). Farmers that raise backyard ducks do so on farms that are individually owned and the ducks are raised as an additional activity, not usually as a main source of household income. Referring again to Table 3, all sector 4 duck farmers involved in the FGD were men. These respondents confirmed that duck keeping is largely male-dominated, both in terms of labour inputs and decision-making, which is attributed to the practice of moving ducks to paddy fields for feeding after the rice harvest to minimize feed cost. Since this activity is done far from home, it is mainly done by men. Women are nonetheless involved in collecting eggs and sweeping the duck houses. Otherwise, sector 4 duck farmers are of similar age and education background as other actors in the poultry sector, though with somewhat less business experience.

All of the duck farms focus primarily on the production of eggs. Farmers raise local varieties such as Tegal, Cirebon or Alabio. They are usually situated close to ponds and swamp wetlands, providing a favourable habitat and natural feed sources such as small fish or fish not used for human consumption. During the day, farmers let their ducks feed in the wetlands. At night, farmers house their ducks and give supplementary feed from food waste, rice bran or other by-products, as much as 100 grams per bird. Utilization of local resources in this manner enhances sustainability of this type of low-input system. Feed and stable equipment such as feed and drinking troughs are purchased from poultry shops or homemade, depending on the scale of the farm. Ducks were usually kept in open houses with earth floors. Some farmers combined it with litter (rice hull or rice straw). Other inputs include vaccines against ND and HPAI, although many (60%) do not apply vaccines. Farmers bought vaccine from poultry shops or vaccine producers (15%) or received them from the livestock services for free (25%). Vaccine prices ranged from IDR 35,000-50,000 per 1000 doses. These farms produce table eggs and live ducks for meat.

In general, these households only keep ducks (62% of sector 4 duck farms) though a significant share (38%) mix ducks with other species, especially kampong chickens. As noted above, kampong chickens and ducks are housed separately poultry houses but were allowed to roam in the same yard.

As duck flocks kept get larger, farms are more commercially oriented and practice more intensive production systems. Many of such small-scale commercial farms keep flocks of 100-150 ducks. There are two kinds of duck farmers at this level: those who keep female layer ducks and duck breeders. Female layer duck farmers produce table eggs and spent layer ducks. Duck breeders produce duck pullets, fattened male ducks and spent layer ducks. Pullets are transported from hatcheries at breeder farms to other farms by motorcycle or public transport. At the time of the study, the price of a pullet was IDR 25,000-30,000. Male ducks were raised for 8-12 weeks for meat, while layer ducks were kept for 18 months. Inputs such as feed and medicines were obtained from poultry shops. The price of duck feed was relatively constant at IDR 1500 (in huller) to IDR 2500 (in poultry shops) per kg depending on the location of purchase. Duck farms sell live ducks at a weight of 1.0-1.5 kg per bird.

Live-bird off-take from duck farms is handled primarily by specialized collectors and distributed to the same marketing channels as described for kampong chickens. Local collectors transport small numbers of ducks to traditional markets by bicycle, motorcycle or public transport, or in larger numbers in bamboo or wooden baskets in open trucks; 20-30 live ducks are put into bamboo baskets with a hole made for the neck and head. The consumer price of live duck during normal days was IDR 27,500 per bird, but during Id ul Fitr (special day) was up to 33,000 per bird.

Both collectors and wholesalers play an important role in egg distribution. Collectors collect eggs from farms, and then sell them to wholesalers in traditional markets for final sale by retailers. Egg trays are used to pack duck eggs, with thirty eggs per tray, packing ten trays together. There is no coordination among the actors (farmers, collectors and wholesalers) involved in the distribution of live ducks and eggs. Duck egg consumers are mainly *tukang jamu* (traditional medicine) vendors, *martabak* traders or salty egg producers. The price of duck eggs was relatively constant, but during rainy season it increased due to a decrease in production. Retail prices of duck eggs were IDR 1200-1500 per egg.

Ranges of output and input prices in the duck value chain in 2008 are shown in Table 21.

Table 21. Prices in the duck value chain, 2008 (IDR/unit)

Category	Item	Unit	Price	
			Minimum	Maximum
Input Price	Pullet (15 weeks)	Bird	25,000	30,000
	Feed	Kg	1,500	2,500
Output Price	Live bird	Bird	20,000	25,000
	Egg	Kg	16,000	19,200
Consumer Price	Live bird	Bird	27,500	33,000
	Egg	Kg[1]	19,200	24,000

[1] 1Kg = 16 eggs

Product flow and governance mechanism map

The value chain map for ducks is presented in Figure 11. There is generally little market coordination between duck farmers in Bogor, input providers and output buyers.

The chain starts from sector 3 farms outside Bogor that supply DOD (day-old ducklings) and pullets to other sector 3 and sector 4 farmers. Sector 3 farms sell male and spent ducks to collectors (70,000 birds per year equal to IDR 1-2 billion). Backyard farms sell 95% (140,000; IDR 3 billion) of male and spent ducks to collectors and the rest (7,000; IDR 0.2 billion) is given to relatives or sold directly to middle-income-group consumers.

Collectors export the majority of live ducks outside Bogor, especially to Jakarta, Depok, Tangerang (80%; 252,000; IDR 5-6 billion) and distribute the remainder to restaurants (4%; 13,000; IDR 0.3-0.4 billion), retailers/slaughter points in traditional markets (15%; 465,000; IDR 1 billion), and to backyard farms (1%; 3,000; <IDR 0.1 billion). Ducks bought by retailers/slaughter points in traditional markets are sold as live birds to middle-income consumers (25%; 11,000; IDR 0.3-0.4 billion) and backyard farms (5%; 2,000; <IDR 0.1 billion); or as carcasses to restaurants (20%), rich consumers (10%) and middle-income consumers (40%).

Duck farms sell all of their eggs to collectors (2.8 million eggs; IDR 3 billion). Collectors then re-sell these eggs, together with additional supplies imported from outside Bogor (especially Cianjur, Karawang, Bekasi, Solo, Purwokerto; 0.3 million eggs), to restaurants (5%; 0.17 million; IDR 0.2 billion), modern markets (20%; 0.6 million; IDR 0.7-0.8 billion), wet markets (68%; 2.1 million; IDR 2-3 billion), and to areas outside Bogor, e.g. Jakarta (7%; 0.2 million; IDR 0.2-0.3 billion).

The average value added indicates that duck business players that combine the functions of collectors up to retailers have the highest added value at IDR 9891 per bird. The collector function alone generates the least added value: IDR 4635 per bird. The added value of table egg retailers is IDR 2991 per kg.

Table 22. Average value added in the duck chain, by actor category

Actor Category	Input Price	Output Price	Cost of Other Inputs	Average Value Added
Duck (IDR/bird)				
Live bird retailer	35,000	40,000	209	4791
Collector	30,000	35,000	365	4635
Slaughter point & retailer	32,000	40,000	1744	6256
Collector, slaughter point & retailer	28,000	40,000	2109	9891
Table egg (IDR/kg)				
Retailer	17,600	20,800	209	2991
Collector	16,000	17,600	380	1220

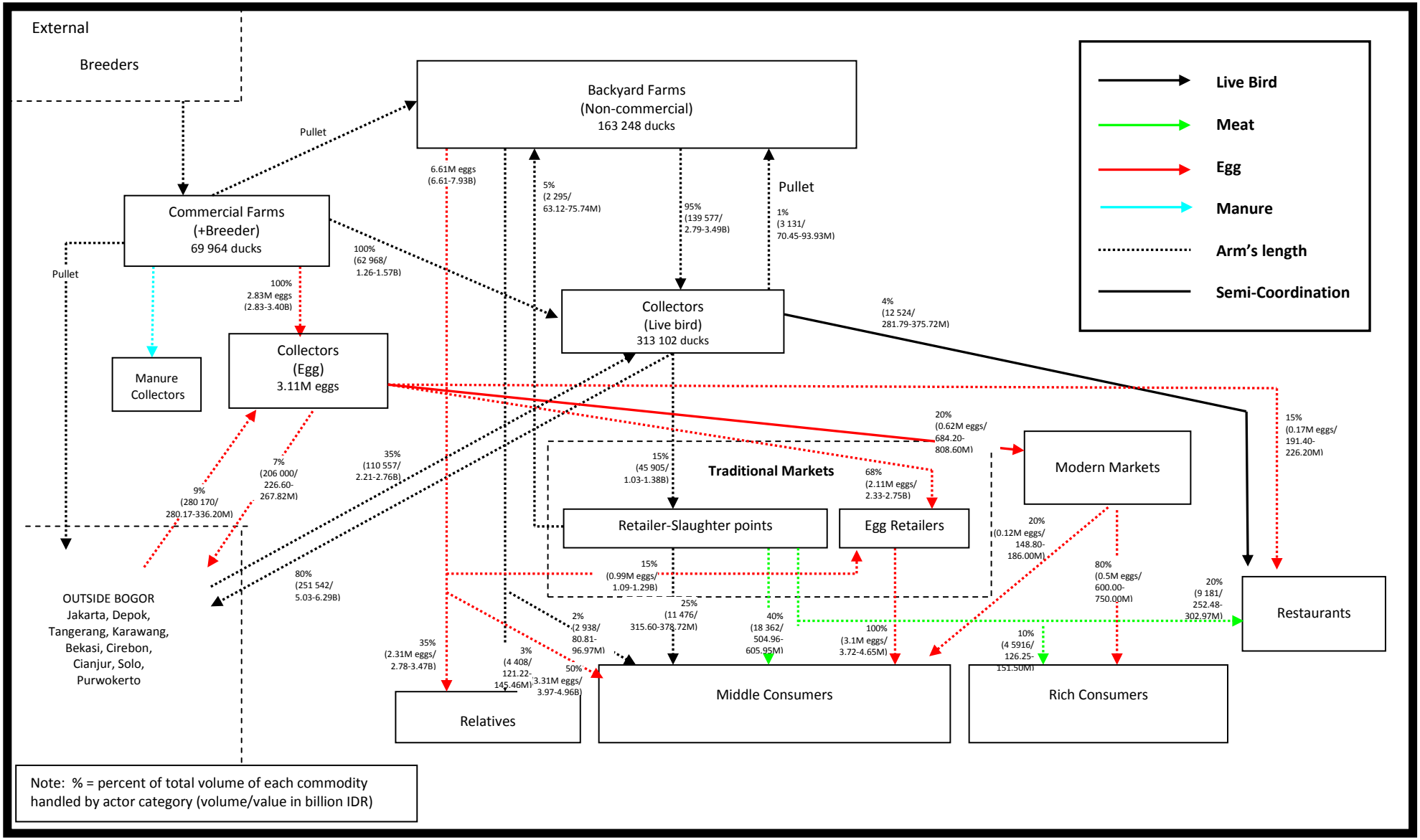


Figure 12. Duck value chain in Bogor (volumes and value)

Role of associations

Associations within the duck chain are found primarily among sector 4 farms. In Bogor District, there are five duck farmer associations at subdistrict level in Tanjung sari, Cileungsi, Klapa Nunggal, Ciomas and Ciampea sub-district. The main role of the farmer associations is sharing information among members about difficulty in managing the farm, marketing and also handling disease.

Public policy and regulation

Government regulations regarding the duck value chain relate mainly to the response to HPAI. The government requires HPAI vaccination of ducks and has provided this vaccine free of charge to sector 4 farmers. As mentioned for other poultry, the local government has made specific regulations targeted to duck farmers raising more than 15,000 birds to meet environmental and regional planning requirements (Regents Regulation 2003). Furthermore, raising of ducks requires fenced areas or cages which are at least 10m away from residential structures (Regents Regulation 2007; see also Jakarta No. 5/2007, West Java No. 19/2007, and Banten No. 1/2007, which are based the Ministry of Domestic Affairs Instruction No. 440/93/SJ).

4. Impact of HPAI: livelihoods, economics and regulations

4.1 Overview of HPAI in Bogor, 2003-present

Highly pathogenic avian influenza (HPAI) was first reported in Indonesia in mid 2003 and officially declared in January 2004. Figure 13 shows how the outbreak has evolved over time in Bogor, measured in terms of numbers of villages each year having reported at least one local outbreak. The graph splices data from two sources: passive surveillance data from DLS Bogor for 2003-2008 (reported in Nuryartono and Mango 2010) and active surveillance data from PDSR which began in 2006 (FAO 2010); the data are presented in more detail in Appendix 3. Comparison of the two sources of data for 2006-2008 suggests that the actual numbers of villages affected was considerably higher than reported to DLS Bogor for 2003-2005.

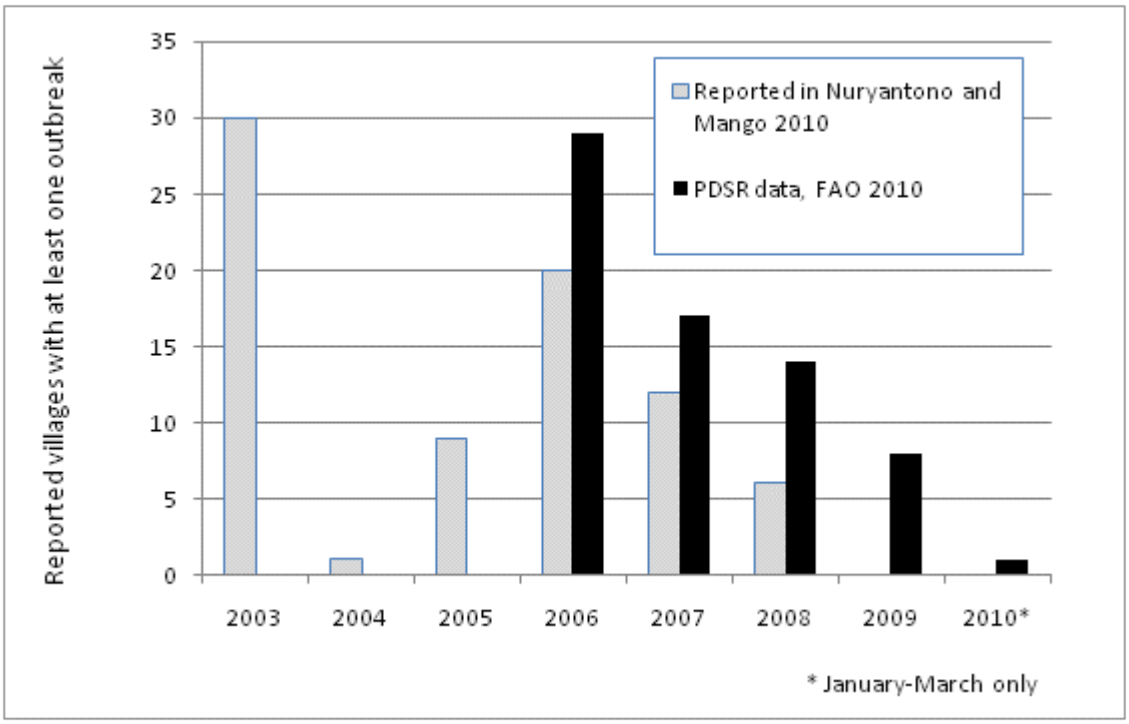


Figure 13. Numbers of villages in Bogor reporting at least one HPAI outbreak, 2003-2010

Social and economic impacts of HPAI outbreak in Bogor varied across the different poultry commodity value chains because of the differences in their structure and composition of business actors. Key social and economic impacts of the HPAI outbreak were mainly due to loss of poultry through death caused by HPAI, government regulations concerning poultry depopulation (in particular in 2004-05 with culling of all poultry in the afflicted RW) and a market scare that temporarily reduced consumer demand and prices for poultry products. Over time, the Bogor local government tended to prefer promoting use of HPAI vaccine to depopulation in attempting to control the disease. As mentioned, depopulation was later only implemented as focal culling on a voluntary basis due to the lack of appropriate compensation measures and changes in policy (see also Section 4.6).

4.2 The importance of Bogor poultry production and trade

The mapping of the main poultry value chains from the previous sector confirms the importance of poultry production and trade as economic and livelihood activities in Bogor. In this section, we provide some additional insights on the scope of the sector to make some general comments about the sector to evaluate the different dimensions of its economic importance.

Table 23 summarizes the estimated annual value of production and value-added generated in each of the major value chains covered in this study for links in which data were available (the duck chain is excluded here). Additional information on profits and labour costs derived in each chain can be found in Appendix 2. One should note that the value-added figures in these tables and the appendix are somewhat different, as the former averages out the seasonality of the values derived in the chain throughout the year.

As some data were lacking, particularly for farm input costs and value-added of certain downstream actors (e.g. restaurants), the calculation of value-added (IDR 359 billion, or approximately USD 35.9 million) is likely significantly understated but provides an indication of the importance of the poultry sector in Bogor. Given 2007 estimates of GDP of over IDR 51 trillion, it is not unreasonable to posit that the poultry sector and its ancillary services contribute close to 1% of regional GDP (Nuryartono and Mango 2010). Besides generating income, the poultry trade employs an estimated 6300 labourers (Table 24) out of a total 1 million labourers in Bogor District. Not surprisingly, the broiler sector comprises almost 80% of sector value-added (Table 24). Within each chain, a significant portion of value-added is generated by collectors, with retailers also contributing an important share, particularly in the layer and broiler markets. In the kampong chain, unit value-added is high, given the limited links in the chain, but low traded volumes mitigate the contribution of this sector to regional growth.

A crude evaluation of productivity in the poultry value chain sheds some additional insights on the sector. In **Error! Reference source not found.**5, value-added is calculated on a daily basis and per orker for the broiler and kampong sector, based on the daily transaction volumes and labour figures given in Table 24. Not surprisingly, productivity is much higher in the broiler sector, particularly among collectors. Lower productivity potentially limits the scope for the traditional sector to cope with shocks to production, such as HPAI, as subsequent data on impacts and production practices will reveal.

Table 23. Estimated annual volumes and value added generated by poultry trade in the principal poultry value chains in Bogor

Commodity	Actor	Commercial volumes traded ('000 birds or '000 kg eggs)	Value added per Unit (IDR)	Total annual value added (Billion IDR)	Share of value added (%)
Broilers	Poultry shops	20,339	512	10,41	4%
	Contract farmers	52,170	739	38,55	14%
	Independent farmers	25,119	530	13,31	5%
	Collectors	49,559	2,135	105,81	37%
	Processors	26,085	965	25,17	9%
	Retailers	9,572	6,291	60,22	21%
	Modern market	4,895	4,756	23,28	8%
	Slaughter points	1,482	4,756	7,05	2%
	TOTAL			**283,80**	
Kampong chicken	Farmers	1,222	20,189	24,66	57%
	Collectors	1,569	7,135	11,19	26%
	Slaughter points	86	5,797	0,50	1%
	Carcass retailers	862	8,257	7,12	16%
	TOTAL			**43,47**	
Layers (female)	DOC agent	209	500	0.10	1%
	Poultry shop	209	500	0.10	1%
	Collector	3,968	1,362	5.41	50%
	Slaughter point	516	2,465	1.27	12%
	Carcass retailers	899	4,291	3.86	36%
	TOTAL			**10.74**	
Eggs	Collector	5,340	640	3.42	90%
	Modern market	140	791	0.10	3%
	Egg retailers	320	779	0.25	7 %
	TOTAL			**3.78**	
Layers (male)	Collector	1,189	2,635	3.13	18%
	Slaughterhouse	2,774	1,518	4.21	24%
	Modern market	554	4,491	2.49	14%
	Carcass retailers	1,664	4,533	7.54	43%
	TOTAL			**17.38**	
TOTAL				**359,16**	

Table 24. Labour absorbed by poultry trade

Commodity	Volume in Bogor (birds per day)	Number of labourers absorbed		
		Collector	Slaughter point	Retailer
Layer	11,427	457	381	352
Broiler	222,894	41	2,336	1,930
Kampong chicken	4,145	240	207	284
Duck	478	26	22	27
Total	238,944	764	2,946	2,593

Table 25. Value added per day by sector and selected actor

Actor	Value added of daily turnover (USD)		Daily value added per labourer (USD)	
	Kampong chicken	*Broilers*	*Kampong chicken*	*Broilers*
Collectors	2,957	30,514	12,32	744,25
Retailers	1,881	17,367	6,62	9,00
Slaughter points	132	2,033	0,46	0,87

** USD exchange rate: USD 1 = IDR 10000*

4.3 Impact on livelihoods

When viewed at the sector level, the timing of the HPAI outbreak in Bogor appears to be associated with a three-year period of stalled growth in the broiler subsector, and a decline in layer numbers; both subsectors recovered and began growing again in 2007, probably driven to some degree by filling the gap created by restrictions on chicken production in Jakarta. Ducks also experienced a substantial decline in numbers in Bogor from 2004 to 2007, but not at national level. Kampong chicken numbers appear to be largely unaffected. Kampong chicken population decreased significantly because of HPAI.

Based on the focus group discussion with kampong chicken farmers, only a minority of farms (an estimated 5%) experienced significant losses to HPAI, whether due to an outbreak in their flocks or culling by the livestock services after an outbreak nearby. An outbreak on their farm would kill at least half in their flock. In addition local government regulations required, at least initially, culling of all flocks in the afflicted RW. Compensation was rarely applied—it was never implemented in Bogor according to DLS Bogor—and if paid, the value could not cover the live-bird price (see Table 26). Such losses were catastrophic for sector 3 farmers, many of whom lost their farm businesses as the result, with some reported to have switched their jobs to petty trading. On average, their income decreased from about IDR 1,500,000 per month (as farmers) to IDR 900,000 (as traders).

Losses in the small flocks kept by sector 4 farmers as a secondary activity were much more modest, so backyard kampong chicken farmers were much less affected by HPAI. Flock sizes since 2005 kept by sector 4 farmers generally remained stable (Table 26), and there were still some farmers taking up kampong chicken keeping as a new activity. The government also conducted HPAI vaccination campaigns among kampong chicken farmers or provided the vaccine for free to reduce their risk of the disease.

Table 26. Trend in size of flock kept by farmers, 2005-09

Value Chain	Percentage of respondents who have experienced:			Number of respondents
	Decrease	Increase/ newcomer	No change	
Female Layer	20	30	50	10
Broiler	7	67	27	15
Kampong Chicken	5	7	88	82
Duck	13	2	84	45

The increases in broiler and layer populations in Bogor were largely associated with the expansion of the production scale on existing broiler and layer farms. The Jakarta local government banned poultry keeping in the city in April 2007 (Pemprov DKI Jakarta 2007b; Forster 2009), creating an opportunity for commercial farmers in Bogor to enlarge their production volume to fill the vacuum in Jakarta.

4.4 Impact on cost

From a cost perspective, the HPAI outbreak affected Sector 3 farmers (broiler and layer) and collectors the most. Both actors deal with live birds. There were two kinds of costs incurred by farmers and collectors because of the HPAI outbreak; losses due to increased poultry mortality (indirect cost) and costs for improved biosecurity measures, such as disinfectant and HPAI vaccine (direct cost) to reduce the risk of HPAI being introduced.

In broiler systems, plasma farmers are provided with technical services (TS) by the nucleus company to control flock biosecurity. Thus, a plasma farmer generally faces lower mortality than the independent farmer. During the HPAI outbreak, average chicken mortality increased from 3% to 9% in plasma farms and 8% to 13% in independent farms. The higher mortality was also reflected in increased cost for DOC per kg output of ready-to-slaughter broilers. Cost for DOC increased 6% in plasma farms and 5% in independent farms. Unit costs for feed also increased during the HPAI outbreak as the feed conversion ratio for broilers increased from 1.6 to 1.8 in plasma farms and 1.7 to 1.9 in independent farms. This meant that cost for feed increased as much as 9% per bird produced in plasma farms and 12% in independent farms.

Since growing broilers takes only around 30 days, there is no broiler farmer in Bogor applying the HPAI vaccine to their flock. The HPAI vaccine is only applied by layer farmers to their 6-month old layers. The cost for HPAI vaccine was IDR 1000 per bird. Vaccine application can keep layer mortality to a constant level of around 3.3-3.8% per annum.

Farm costs for sector 4 backyard systems for ducks and kampong chickens were not significantly affected by the HPAI outbreak, though production cost increased to some degree due to mortality, which rose from 10-18%. Otherwise, sector 4 kampong chicken farmers have continued to let their birds range freely in their backyard with poor or no effective biosecurity measures. These farmers

rarely spend money on buying vaccines, even the HPAI vaccine; they prefer to wait for HPAI vaccine provided free by local government programs.

4.5 Impact on price

Announcements about the initial HPAI outbreak in January 2004 and reports of human cases in 2005 raised consumer concerns about the safety of poultry products, resulting in immediate dramatic drops in demand. These consumer scares were responsible for losses across actors within the various value chains, mostly in terms of lowered prices and volumes of business, but the scares were of short duration – less than one month for the first major scare – and demand quickly recovered. At first, media attention to HPAI frightened consumers and they tried to avoid disease transmission, refusing to have any contact with poultry products such as eggs, live birds or carcasses. This mass action made the price of poultry product decline by 20%. After several days, as media attention died down, consumers were less concerned and demand began to pick up. Poultry products are the cheapest animal-source food for consumers in Bogor and its surrounding areas, so they find it difficult to avoid. Following the initial HPAI scare, the price of poultry products even increased. The lowest farm gate price for broiler immediately after HPAI outbreak issue in 2006 was IDR 7800 per kg live weight, compared to the normal price of IDR 9800-15,500.

4.6 Impact on government regulation

With the first reported fatal case of HPAI in humans in June 2005 and increasing numbers of additional reports thereafter (especially in the Greater Jakarta Area), heightened concerns of a global pandemic and an increased number of confirmed reports of HPAI in poultry due to a more effective surveillance (as PDSR was implemented from 2006 onwards), the Indonesian government came under considerable pressure to implement more vigorous control measures. This resulted in the establishment of new institutional bodies and ministerial-level committees and issuing of new regulations and degrees. Certain key steps on institutional level are mentioned below:

- November 2005: HPAI Emergency Team established within the Ministry of Agriculture with tasks to establish network/monitoring and a reporting system, to implement control and eradication of HPAI, and to coordinate with the Ministry of Health and local government in conducting control action.

- January 2006: Adoption of the National Strategic Work Plan for Progressive Control of HPAI in Animals 2006-2008. Key elements: Campaign Management Unit (CMU) created within the DGLS, vaccination in sectors 3 & 4, culling with compensation, strengthened surveillance and epidemiology, diagnostic laboratory services, quarantine, legislation/enforcement and communication.

- March 2006: National Committee for Avian Influenza Control and Pandemic Influenza Preparedness (KOMNAS) established, a ministerial-level committee providing direction on

key areas of research and development, animal and human health, vaccine and anti-viral medicines, and mass communication.

- March 2006: CMU made operational as part of DGLS with its main purpose of coordination and leadership of HPAI control in animals in Indonesia.

Key policies to enhance HPAI control in poultry were focussed on culling, vaccination and banning of poultry from residential areas.

a) Culling policy

By decree of the DGLS, from February 2004 selective culling was foreseen but restricted to 1 km around the infected premise and only in newly infected areas (DGLS 2004). As HPAI was soon afterwards considered to be endemic in many parts of Indonesia, this culling policy was rarely enforced. In endemic areas, culling was limited to the infected flock. Taking the endemic situation into account the 1 km culling policy was replaced by focal culling of the infected flock on a voluntary basis in 2006 (DGLS 2006).

For Bogor, the initial 1 km culling policy in newly infected areas was slightly modified and applied targeting only the RW in which the outbreak was detected. However, HPAI is considered to be endemic in Bogor, therefore only voluntary culling of the infected flock is foreseen (DGLS 2006; Regents Regulations 2007).

b) Vaccination policies

Based on a decree from the DGLS, from February 2004 free mass vaccination targeting kampong chicken, layer (up to 10,000 birds) and broiler farms (up to 15,000 birds) was introduced (DGLS 2004). Following changes in policy, this was changed to targeted vaccination in high-risk areas with effect from March 2007 (DGLS 2007). This was further modified in September 2009, limiting vaccination only to backyard farms with caged chickens or layer farms with up to 5000 chickens in high-risk areas (DGLS 2009).

For Bogor, the vaccination strategy followed the central government approach with the modification that mass vaccination was used longer until 2008, targeting farms as stated above. Since 2009, it has been replaced by targeted vaccination limited to caged kampong chickens in high-risk areas (Regents Regulation 2007; DLS Bogor District 2010). The determination of high-risk areas is done by officers of the UPDT.

c) Policies on banning of poultry from residential areas

Increasing reports of human deaths in Jakarta and the Greater Jakarta Area forced the local government of Jakarta to adopt strict movement controls for managing and monitoring poultry rearing and distribution. These resulted in several measures. In March 2006, Jakarta residents were asked to keep their poultry in cages. Further regulations followed with the Peraturan Gubernur, Perda (Governor Regulation) No.15/2007 (Pemprov DKI Jakarta 2007a) and Perda (Regional Regulation) No. 4/2007 (Pemprov DKI Jakarta 2007b), which mandated that Jakarta communities ban the rearing of poultry in residential areas, while slaughtering of local poultry must take place in specialized areas in the city. More specifically, any poultry raising for the

purpose of consumption needs to be licensed and poultry caged with a minimal distance of the cage to residential areas of at least 25 metres (Perda No. 4/2007, Chapter II, Art. 4). The distance requirement made it practically impossible to raise poultry in many parts of Jakarta. For other birds (e.g. pet/fancy birds), only a health certificate is required.

For Bogor, similar regulations were implemented for poultry (including ducks) raised for consumption, requiring a minimal distance of the caged birds to residential areas of 10 metres (Regents Regulation 2007). The shorter distance required allowed more poultry to be kept in residential areas compared to Jakarta.

In April 2007, the West Java Government also declared Governor Regulation No 19/2007 (Pergub Jawa Barat No 19/2007) concerning intensification and control of HPAI in West Java. This regulation instructed district governments to make local regulations to control HPAI in poultry and humans.

Similar to Jakarta, the local government of Bogor City has also announced plans to relocate poultry slaughter points in Pondok Rumput to the poultry slaughterhouse in Bubulak on the outskirts of Bogor City. Furthermore, DLS Bogor stated that efforts are being made to build new slaughterhouses with a capacity of around 2000 birds/daily and operating in the line with current Standard Operating Procedure to supply Jakarta with chickens in future (DLS Bogor District, 2010).

In 2007, the local government of Bogor municipality provided an IDR 10 billion fund as compensation for poultry culled during HPAI eradication and IDR 650 million for human recovery from HPAI diseases (www.bogorkota.go.id 2007), while the West Java government provided IDR 5 billion for checkpoint facilities in Gunung Sindur, Bogor District (www.jabar.go.id, 27 April 2007). This fund was allocated for HPAI vaccine application and compensation for poultry depopulation due to HPAI. Compensation of poultry ranged from IDR 7500-10,000 per bird depending on the live weight. However, according to DLS Bogor District, compensation was rarely applied at any time since the introduction of HPAI (personal communication, DLS Bogor District 2010).

Bogor local government regulation concerning HPAI eradication has been focused primarily on sector 4 kampong chicken farmers. There is no fixed regulation in transporting and selling of live birds by traders; there has been no significant change in the poultry market chain in Bogor as a result of HPAI outbreak.

5. An assessment of risk hotspots in the poultry value chain

5.1 Identification of potential risk hotspots in the poultry sector

The analysis of the Bogor poultry sector and its principal value chains is ultimately intended to provide insights for the control of HPAI by revealing those activities and actors potentially associated with risk of spreading the disease, and their capacity and incentive to adopt practices and behaviour that would effectively mitigate the risk and contribute to reducing the incidence of the disease. As explored in the previous chapters, mapping the structure and relevant actors, describing production and marketing systems, getting a sense of the volumes and values handled, and understanding the relationships between actors, distribution of power within value chains, and differential impacts of HPAI all contribute elements to this analysis. In addition, actors interviewed during the 2009 data collection were asked directly about four key indicators related to their role in controlling HPAI; these concern ability to recognize HPAI, use of disinfectants, disposal of dead poultry and reporting suspected HPAI cases.

Ability to recognize HPAI

Actors in the poultry value chain who handle live or recently dead birds need to be able to recognize HPAI if timely action is to be taken to report the disease and respond. A recent study on epidemiological risk of HPAI in poultry markets in Bogor indicated that most respondents in that study knew the clinical signs of the disease (FAO 2008). In the present study, respondents' knowledge about the clinical signs of HPAI was also assessed by asking the respondents to describe at least three obvious HPAI clinical signs. Respondents who knew the clinical signs of HPAI in poultry described sudden death; 'bruised' and swollen wattles and comb; and runny nose and eyes. However, they admitted that the HPAI clinical signs were not definite. The results are shown in Table 27, and indicate that significant portions of actors handling kampong chickens and ducks are not able to recognize HPAI; a smaller portion of actors in the broiler chain are likewise unfamiliar with the symptoms. Some respondents argued that the obvious indicator of the presence of HPAI is a mass die-off, such as with IBD or Gumboro outbreaks. The findings show an improvement in awareness compared to findings from a 2007 survey in North Sumatra which found only 46% of actors interviewed in the poultry value chain knowing the clinical signs of HPAI, with lowest rates found among collectors (McLeod et al. 2009). The results for sector 4 farmers are also consistent with findings from an Academy for Educational Development (AED) survey in mid-2008 assessing the impact of HPAI communication messages; that survey reported 70% of respondents being aware of HPAI and understanding how it spreads and appropriate control measures, though the need for more information on HPAI symptoms was highlighted (AED 2008). Note that there are no clinical signs of HPAI disease in ducks, but duck farmers and traders should still be informed about HPAI clinical signs so that they can recognize it in other poultry that may interact with the ducks. Such lack of knowledge of HPAI is of particular concern among farmers, who have the poultry under their management over the longest duration, and among collectors, who are associated with the most movement of birds.

Table 27. Percentage of respondents considered unable to recognize HPAI in live poultry

Actor Type By Value Chain	N	Unable to recognize HPAI (%)
Sector 4 producers		
Duck	44	23
Kampong Chicken	81	20
Sector 2 and 3 producers		
Broiler	15	7
Layer	10	0
Duck	1	0
Kampong Chicken	1	0
Collectors		
Broiler	7	14
Layer	1	0
Duck	6	33
Kampong Chicken	6	17
Slaughter points		
Broiler	14	14
Layer	2	0
Duck	5	20
Kampong Chicken	3	33
Retailers		
Live broiler	3	0
Live layer	3	0
Live duck	7	43
Live kampong Chicken	9	44
Average		**15**

Reporting suspected cases of HPAI

To help control the spread of HPAI, the government conducted a communication campaign during 2007 through television, radio, posters, newspapers and leaflets on how to handle sudden death in chickens and how to report it to the local livestock services. Respondents who dealt with live chickens (both farmers and traders) were asked if they had reported suspected HPAI cases in their flocks. Only a small proportion (11%) of 81 sector 4 kampong chicken respondents said that they had reported suspected HPAI cases among their dead birds, versus 7% of 15 broiler farmer respondents and 20% of 10 layer farmer respondents (Table 28). A surprisingly large proportion – one third – of actors in the market system said they had reported suspected cases of infection in kampong chickens, but much less for other types of live birds. Interview data showed that most respondents did not know to whom the case had to be reported if an HPAI relevant disease occurred, and this, they said, was the reason why they never reported suspected HPAI infection. The 2008 AED survey mentioned earlier reported 75% of sector 4 farmers stating that they would report an outbreak, attributing the high rate to HPAI media messages (AED 2008).

Table 28. Percentage of actors who have reported suspected HPAI cases

Actor Type	N	Have reported suspected HPAI cases (%)
Sector 4 farmers		
Duck	44	0
Kampong chicken	81	11
Sector 2 and 3 farmers		
Broiler	15	7
Layer	10	20
Duck	1	0
Kampong chicken	1	0
Collector		
Broiler	7	14
Layer	1	0
Duck	6	0
Kampong chicken	6	33
Slaughter point		
Broiler	14	0
Layer	2	0
Duck	5	0
Kampong chicken	3	33
Retailer		
Live broiler	3	0
Live layer	3	0
Live duck	7	0
Live kampong chicken	9	11
Average		**7**

Disinfectant application

A key practice to improve biosecurity and reduce the spread of HPAI is the regular application of disinfectants during raising and handling poultry. Respondents were asked whether they applied disinfectants or not in their poultry raising/handling. As the results in Table 29 indicate, disinfectants are used only by the more commercially oriented actors in sector 2 and 3 farms, and by collectors in the layer bird value chain. Only a portion of actors in the broiler market system disinfect; the most common use appears to be at broiler slaughter points. Otherwise, no sector 4 farmers and actors in the duck and kampong chicken marketing chains regularly apply disinfectant. This reflects the low-input/low-investment nature of backyard duck and kampong chicken production, which is not commercially oriented. Low rates of use among slaughter points, live poultry retailers and collectors may be caused by a perception that disinfectants are expensive. Based on the research result of Maulana (2008), the cost of disinfectant per application per bird is around IDR 30 (on average IDR 300/m^2 of cage floor space), which when required repeatedly (usually once per month) will significantly increase the cost of production. McLeod et al. (2009) also found low rates (an average 37% not including slaughter points of actors) applying any significant biosecurity measures in North

Sumatra in 2007; rates at slaughter points were higher at an average of 58%. Low awareness about the need for biosecurity may be a contributing factor.

Table 29. Share of respondents using disinfectants

Actor Type	N	Use disinfectant (%)
Sector 4 farmers		
Duck	44	0
Kampong chicken	81	6
Sector 2 and 3 farmers		
Broiler	15	100
Layer	10	100
Duck	1	100
Kampong chicken	1	100
Collectors		
Broiler	7	29
Layer	1	100
Duck	6	0
Kampong chicken	6	0
Slaughter points		
Broiler	14	64
Layer	2	0
Duck	5	0
Kampong chicken	3	0
Retailers		
Live broiler	3	33
Live layer	3	0
Live duck	7	0
Live kampong chicken	9	0
AVERAGE		**35**

Disposal of dead poultry

Respondents were asked how they commonly handled birds that had died in their flocks. Most respondents reported disposing of dead birds to the environment rather than destroying them by burning (Table 30). Birds killed by HPAI remain a source of virus transmission. More than 50% of live bird retailer respondents reported throwing away the dead birds, presumably to open-air waste piles. Slaughter points and sector 4 farmers reported the second highest frequency of handling of dead poultry associated with risk of disease spread; carcases are either thrown away or fed to catfish.

Table 30. Percentage of respondents by method of disposal of dead poultry

Actor Type	N	Disposal of Dead Poultry (% of respondents)			
		Threw away	Buried	Burned	Fed (to catfish)
Sector 4 farmers					
Duck	44	16	61	23	0
Kampong chicken	81	33	38	27	2
Sector 2 and 3 farmers					
Broiler	15	0	86	7	7
Layer	10	0	80	10	10
Duck	1	0	100	0	0
Kampong chicken	1	0	100	0	0
Collectors					
Broiler	7	14	43	14	29
Layer	1	0	0	100	0
Duck	6	0	66	17	17
Kampong chicken	6	17	33	17	33
Slaughter points					
Broiler	14	7	57	7	29
Layer	2	0	100	0	0
Duck	5	20	60	0	20
Kampong chicken	3	33	33	0	33
Retailers					
Live broiler	3	33	0	0	67
Live layer	3	67	33	0	0
Live duck	7	57	43	0	0
Live kampong chicken	9	67	11	11	11
	Average	**21**	**54**	**11**	**14**

Results of these four indicators – two of which focus on surveillance and two on biosecurity – highlight the variation that exists across the different actors and different chains regarding actor behaviour that influences HPAI risk. Clearly, there must be sufficient incentives to adopt practices that improve biosecurity as these inevitably entail incurring added cost of production. Such incentives can be internal to the poultry activity, such as improved profitability as reduced mortality lowers costs per bird despite the added biosecurity costs – or external, such as enforcement of regulation requiring adoption or some type of subsidized provision of the relevant supplies or services. If the actor sees no clear incentive, it is unlikely that the practice will be adopted altruistically just to benefit the public good. Based on the results reported above, it appears that the larger-scale commercial sector perceives such incentives and has adopted better biosecurity, whereas the backyard and less formal production and market systems still lack sufficient incentive. The same appears true for seeking the needed information to recognize HPAI and reporting it when suspected cases occur, though media campaigns appear to have improved this dimension.

5.2 Summarizing by value chain and actor category

Table 31 summarizes the factors influencing HPAI risk that can be identified through this type of analysis of the value chain. Based on this summary, HPAI risk can be reasoned to be non-negligible for each actor category in each chain. Even for the industrial companies in sector 1 and 2 practising rigorous biosecurity, the presence of HPAI in neighbouring areas and the large numbers of birds kept in high density maintains a threat of infection. During the initial outbreaks, the industrial companies suffered substantial losses and quickly adapted their practices to manage the risk. Components in the value chains representing potentially high levels of risk would appear to be particularly the collectors who are exposed to many different farms and flocks, transport live birds in open carriers and vehicles, and mix birds in holding pens. They may also be expected to be more at risk of receiving infected birds as farmers try to sell off sick birds or birds from infected flocks, and in turn to sell off sick or dead birds rather than destroying or reporting them. Depending on the specific nature of their business, they may serve as a link across actor categories and across value chains.

Independent sector 3 farms within each value chain can also be expected to face substantial HPAI risk. Although they practice all-in, all-out systems, these farms are under pressure to remain competitive with industrial and plasma farms by keeping their costs low, and so generally have lower standards of biosecurity in the face of frequent interactions with suppliers and market actors that can introduce the disease. An outbreak in the flock can be catastrophic, but they may be willing to gamble given the possibility appears to exist for selling off their sick, dead and remaining healthy birds.

Sector 4 farmers have had little incentive to change their practices to protect their flocks. Since their flocks are generally small, an outbreak would not be considered catastrophic. While this increases potential risk, they have fewer interactions with suppliers and market actors so their birds may in the end be less exposed to the disease.

Slaughterhouses, slaughter points and retailers may be considered a relatively lower source of risk. While they certainly face the risk of sick birds or contaminated materials being brought into their premises and infecting any birds they hold, those birds are generally destined for slaughter and so may not present a risk to poultry outside the premises (though they certainly present a public health risk to people). The major risk here appears to be the practice of re-selling some poultry in traditional markets to farmers as replacement or breeding stock.

Table 31. Factors influencing HPAI risk, by value chain and actor category

Value Chain	DOC Supplier	Producer	Collector	Slaughterhouse Slaughter Point	Traditional Market	Other
Sectors 1 & 2 – all value chains	Poultry breeding companies: large volumes and high value handled, high investment in biosecurity	Industrial poultry companies: large volumes and high value handled, high investment in biosecurity				
Layer Value Chain						
Spent hens Eggs	Contract farm system (PIR): high volume and value handled, high biosecurity supported by contracts; strong governance links to ensure compliance Independent farm system: small volume/ value handled through poultry shops; biosecurity in shops unknown; repeated informal, relational transactions with small-scale farmers	Large-scale commercial farms: high volumes and values handled, good biosecurity supported by contracts (PIR) and strong governance mechanisms Independent small-scale farms: high volume / value handled, variable biosecurity, relatively strong (albeit informal) coordination with upstream DOC suppliers, with amorphous links to downstream collectors	Live-birds: Large number of dispersed actors, handling variable volumes; generally poor biosecurity (e.g. visits to multiple premises; open carriers during transport; mixing of birds and species from different sources; disposal practices poor); leverage by/towards other actors limited given reliance on arms length transactions Eggs: Large number of dispersed actors, handling variable volumes; generally poor biosecurity (e.g. visits to multiple premises; open carriers during transport); but eggs not likely to be further exposed to live birds; leverage by other actors limited	Large volumes of live birds slaughtered; mixing of birds from different sources, but kept for short duration; variable biosecurity; no live birds re-circulated, but potential for contamination of transport and poor disposal; limited leverage from other actors	Slaughter Points: same as for slaughterhouses, but biosecurity tends to be poor Retailers: small volumes of live birds handled by numerous individual retailers; mixing of birds from varied sources over short-to-medium duration, biosecurity generally poor (open housing; limited disinfection; poor disposal); little leverage potential from other actors	Manure collectors: likely to practice no biosecurity; sale to farms
Male layers	Contract farm system (PIR): high volume and value handled, high biosecurity supported by contracts	Commercial farms: high volume and value handled, good biosecurity supported by contracts (PIR)	Same as for spent hens above	Same as for spent hens above	Most male layers enter traditional markets as carcasses.	Same as for spent hens above

Broiler Value Chain						
Broilers	Contract farm system (PIR): high volume and value handled through poultry shop system, high biosecurity supported by contracts Independent farm system: high volume/ value handled through other poultry shops; biosecurity in shops unknown; limited leverage	Plasma contract farms (PIR): high volume and value handled, good biosecurity supported by contracts (PIR) Independent farms: high volume / value handled, variable biosecurity and leverage by other actors limited	Live-birds: Large number of dispersed actors, handling variable volumes; generally poor biosecurity (e.g. visits to multiple premises; open carriers during transport; mixing of birds and species from different sources; disposal practices poor); leverage by other actors limited	Large volumes of live birds slaughtered; mixing of birds from different sources, but kept for short duration; variable biosecurity; no live birds re-circulated, but potential for contamination of transport and poor disposal; limited leverage from other actors Processing plant: similar conditions, but high biosecurity and high leverage from other actors	Slaughter Points: same as for slaughterhouses, but biosecurity tends to be poor; smaller volumes handled Retailers: most broilers sold as carcasses	Manure collectors: likely to practice no biosecurity; sale to farms
Kampong Chicken Value Chain						
Live birds Spent hens Eggs	Informal breeder system: small volume/ value supplied; biosecurity unknown; limited leverage	Sector 3 commercial farms: small volume and value handled, variable biosecurity supported by contracts only for eggs Sector 4 backyard farms: small flocks kept by large number of dispersed actors; aggregate represents large volume / value handled, low or no incentive to adopt	Live-birds: Large number of dispersed actors, handling variable volumes; generally poor biosecurity (e.g. visits to multiple premises; open carriers during transport; mixing of birds and species from different sources; disposal practices poor; some re-sale back to sector 4 farms); leverage by other actors limited (some by slaughter points, restaurants) Eggs: Large number of dispersed	Small-to-medium volumes of live birds slaughtered; mixing of birds from different sources, but kept for short duration; variable biosecurity; no live birds re-circulated, but potential for contamination of transport and poor disposal; some leverage with collectors	Slaughter Points: Large volumes of live birds slaughtered; mixing of birds from different sources, but kept for short duration; variable biosecurity; some live birds re-sold to sector 4 farmers; potential for contamination of transport and poor disposal; limited leverage from other actors	Manure collectors: likely to practice no biosecurity; sale to farms

		biosecurity ; little if any leverage by/towards other actors reinforced by *ad hoc* governance and limited coordination	actors, handling variable volumes; generally poor biosecurity (e.g. visits to multiple premises; open carriers during transport); but eggs not likely to be further exposed to live birds; leverage by other actors limited		Retailers: small volumes of live birds handled by numerous individual retailers; mixing of birds from varied sources over short-to-medium duration, biosecurity generally poor (open housing; limited disinfection; poor disposal; re-sale to farmers); little leverage potential from other actors	
Duck Value Chain						
Live birds Spent hens Eggs	Commercial breeding system: small volume/ value supplied; biosecurity unknown; limited leverage	Sector 3 commercial farms: small volume and value handled, variable biosecurity; limited leverage by other actors Sector 4 backyard farms: small flocks kept by large number of dispersed actors; aggregate represents small-to-medium volume / value handled, low or no incentive to adopt biosecurity; duck movements for paddy feeding; little if any leverage by other actors	Live-birds: Large number of dispersed actors, handling variable volumes; generally poor biosecurity (e.g. visits to multiple premises; open carriers during transport; mixing of birds and species from different sources; disposal practices poor; some re-sale back to sector 4 farms); leverage by other actors limited (some by slaughter points, restaurant clients) Eggs: Small number of dispersed actors (commercial farms), handling variable volumes; generally poor biosecurity (e.g. visits to multiple premises; open carriers during transport); but eggs not likely to be further	Not involved in value chain	Slaughter Points: Large volumes of live birds slaughtered; mixing of birds from different sources, but kept for short duration; variable biosecurity; some live birds re-sold to sector 4 farmers; potential for contamination of transport and poor disposal; limited leverage from other actors Retailers: small volumes of live birds and eggs handled by numerous individual retailers; mixing of birds from varied sources over short-	Manure collectors: likely to practice no biosecurity; sale to farms

			exposed to live birds; leverage by other actors limited		to-medium duration, biosecurity generally poor (open housing; limited disinfection; poor disposal; re-sale to farmers); little leverage potential from other actors	

6. Policy implications and conclusions

6.1 Policy implications

The results of the value chain analysis provide evidence of the extensive scale of the poultry sector to the Bogor economy in generating value and employment, as well as providing a supplementary livelihood strategy for lower-income households that keep backyard kampong chickens. More importantly, the results highlight the complexity of the Bogor poultry sector and its large diversity of commodities, actors and production and marketing systems, each associated with varying degrees of potential inherent risk of being exposed to or facilitating the spread of HPAI. Similar results emerge from poultry value chain studies by FAO conducted in North Sumatra (Siagian et al. 2008; McLeod et al. 2009) and Bali (Mastika 2009). That there is no single source of HPAI risk supports the spirit of HPAI control efforts under the revised National Strategic Work Plan (second phase) which has expanded its initial focus from the sector 4 backyard production systems to the full range of other actors (Directorate of Animal Health 2008).

There are two competing narratives with respect to HPAI control that emerge from the analysis: the commercial narrative with actors that have the incentive, capacity and institutionalized coordination mechanisms to adopt improved biosecurity on their own; and the informal narrative involving smaller-scale commercial or informal actors with little incentive, if any, to invest in mitigating HPAI risk. These narratives are relatively mutually exclusive, although the small-scale layer chain has a combination of coordination upstream between breeders and farmers and more amorphous transactions downstream by traders and retailers. At the same time, market-based interactions between each potentially compromise the biosecurity of the sector as a whole, with interventions needed that understand these dynamics.

The first set includes the large industrial poultry companies and the farmers and other actors associated with them through the vertically coordinated contract farming system. The industrial companies suffered large losses during the initial outbreak and quickly adapted their practices to protect their core business, and this has been extended to the farmers associated with them through the PIR contracts. This occurred without government involvement, but can certainly be strengthened yet further through collaboration with public HPAI control efforts. Given the high degree of coordination within this system, such collaboration should lead to meaningful compliance among the relevant actors.

The second set of actors has made only minor changes to their practices in the face of HPAI outbreaks. For many, poultry production and trade may be their core business, but their capital base is much shallower and their viability is based on using low-cost methods. For others, especially the sector 4 backyard farmers, their poultry activity is a minor component of their business or livelihood, and they do not have the capacity or the motivation to make the major changes required to improve the biosecurity of their activities. In these systems, HPAI control is likely to be viewed as similar to Newcastle Disease (ND), for which vaccination exists but has known only spotty uptake.

For this latter set of actors, public intervention and incentives justified by the public health dimension are likely to be required to stimulate the desired changes. With limited coordinating mechanisms, either through trade associations or other forms of social capital, a heavy reliance on

informal, market-based transactions and limited financial return from improved biosecurity, designing such interventions will be extremely challenging. Particular bottlenecks include traders, who may operate as mobile individuals rather than fixed businesses, and informal market retailers, whose knowledge and awareness of better biosecurity practices is often limited. Imposing biosecurity through regulation is one option, but not likely to be effective: enforcement would be nearly impossible with existing public resources. With the lack of coordination and leverage within these value chains, actors might be encouraged to 'go underground' and shift into the informal sector, potentially modulating disease risk even further. Another option considered for HPAI control has been restructuring the value chains to concentrate more of the production and trade within the more coordinated actors; the restructuring of live bird markets in Jakarta is an example of this. Here, the government faces the critical trade-off of reversing its long-time and extremely successful promotion of small-scale poultry enterprises as a mechanism for broad-based development and income generation, and replacing it with higher industrial concentration, exacerbating income disparities and reducing resilience among lower-income groups. In particular, given that the informal poultry trade provides a source of 'quick cash' for many in sector 4, a third option would entail 'smart' interventions carefully designed to create or align with actor incentives to enhance compliance, either through subsidies or through schemes that increase coordination and leverage among the actors in the value chain, such as creating professional associations with certification schemes. This option will require empowering chain-level 'champions' engaged in activities that can better coordinate the value chain to meet specified market needs. An often overlooked partner in such an option is the consumer, finding ways to tap into latent concerns about food safety and public health, for instance. Organizing chains in a bottom-up, organic manner that provides opportunities to value-add production, improve biosecurity and target key consumer attributes are likely to be more sustainable over time than top-down mandates, particularly in chains as amorphous and constantly evolving as those in the informal poultry sector.

Policymakers and their development partners have come to appreciate these characteristics, constraints and challenges as HPAI control strategies have evolved since the outbreak began in 2003. The first epidemic wave imposed losses throughout the poultry sector, and the disease then became endemic, causing localized flare-ups as with ND. Efforts initially focused on controlling the disease in sector 4 production systems through conventional strategies of vaccination campaigns and response to outbreaks with depopulation and decontamination, and subsequent investment in improved surveillance and response (Participatory Disease Surveillance and Response), but with only modest reduction in disease incidence. Initial proposals for phase 2 of the National Strategic Work Plan give more emphasis for improving control in the commercial production sector, accompanied by restructuring of marketing chains to convert as much as possible the trade of live birds to trade of poultry meat, especially in more densely populated areas and urban centres (Directorate of Animal Health 2008). In the meantime, the government and international agencies led by FAO are implementing a range of new programs of interventions more appropriately designed to encourage improved biosecurity among producers and market agent (e.g. AusAID in South and West Sulawesi), including a mass poultry vaccination program by DLS Bogor District and a monitoring program of poultry health for inter-regional poultry transportation.

6.2 Conclusions

The following points summarize the key findings emerging from the study:

- The Bogor poultry sector is very complex, composed of several major value chains for the various poultry products and their associated production and marketing systems, involving a range of larger-scale commercial companies and a multitude of smaller less formal enterprises and individual actors. Extremely conservative estimates suggest that the poultry sector injects at least IDR 350 billion into the Bogor economy, and possibly as much as 1% of regional GDP. Value added through the poultry value chains is shared by producers as well as the traders, processors and retailers in the marketing system.

- The potential impact of HPAI on large-scale industrial companies and actors associated with them through vertical coordination arrangements is large, but they have demonstrated the capacity to maintain adequate biosecurity and manage the risk of disease. Improved collaboration between the government and this sector will further support HPAI control.

- The smaller-scale sector 3 and 4 producers and the bulk of actors involved in poultry commodity marketing systems operate more informally, and though HPAI can cause substantial losses to their business they generally do not have the capacity or sufficient incentive to invest in or practice better biosecurity. Lack of coordination and leverage among actors within this portion of the poultry sector makes control through regulation problematic, and necessitates carefully designed public interventions to create incentives for uptake of improved biosecurity.

- Risk of HPAI appears to be non-negligible across all actors. Potential risk hotspots are those related to the movement and mixing of live birds by collectors and the sector 3 farms with high bird densities, frequent interactions with other actors and lower biosecurity standards.

Again, these findings are consistent with and serve to confirm results reported by the FAO value chain studies in other regions of Indonesia, as well as the general experience to date and evolving understanding of HPAI in the Indonesian context.

A final conclusion relates to the methodology itself. Value chain analyses have been adopted as an important tool for understanding certain dimensions of the socio-economic context in which HPAI and its control occurs. Descriptive mapping of the various poultry value chains aids in understanding the complex web of actors and their relationships, which serves as key background information for analyzing the dynamics of HPAI and its control. There has also been an expectation that value chain analysis can also identify components of the value chain where HPAI risk is particularly high or critical, which some analysts have referred to as ‘critical control points’. Our experience suggests that more caution is needed in recognizing the limitations of value chain analysis, particularly in the guise of a rapid assessment, in this respect; whereas value chain analysis can point out risky practices and actors that appear to display risky behaviour, whether those practices and behaviour actually translate into significant disease risk must be subsequently evaluated using standard epidemiological techniques. The science of risk assessment has made it very clear that presence of a

hazard does not necessarily translate into significant risk meriting investment in control. Unless confirmed by epidemiological studies, there is a danger of over-interpreting results from value chain studies for identifying critical control points. As noted by a recent FAO evaluation of the PDSR programme in Indonesia:

> Those engaged in the pilot [PDSR] project apparently drew the conclusion that the commercial sectors of the poultry industry were largely free from HPAI infection, protecting their flocks by a combination of biosecurity and vaccination, and that the main problem was in backyard poultry, belonging to the so-called sector 4. They concluded very rapidly, and without any apparent structured investigation, that the key to HPAI control in Indonesia was the removal of the risk of transmission from sector 4. As time progressed, there became a greater recognition of the role of sector 3, small-scale commercial poultry enterprises, but the focus of PDSR has remained – and still remains – on sector 4. (Perry et al. 2009)

In this case, jumping to a conclusion without follow-up confirmatory epidemiological studies led to an over-investment and emphasis on the suspected 'critical control point'. In the context of HPAI where understanding about the disease has been evolving, preliminary decisions must certainly be made, and findings from value chain analyses can contribute useful information. We strongly caution, however, against confusing such information with results generated from rigorous risk assessments. McLeod et al. (2009) provide an excellent model of appropriately couching risk-related results from value chain analysis by tentatively referring to 'potentially high risk points' rather than presenting them as conclusive.

We should further stress two additional points in this vein. First, value chain analyses provide an initial sketch of the actors, their relationships and what potentially drives their behaviour, but this should be viewed as a first step at guiding more in-depth analysis aimed at the design of appropriate interventions and control strategies. Value chain studies alert policymakers to the chain and systems context of the decisions that need to be made, but still require greater fleshing out of the complexities and behavioural (epidemiological and economic) responses at various interacting nodes. Second, analytical platforms that integrate the epidemiology of disease with its ramifications on chain-level behaviour *and* those feedbacks on the progression of disease are in short supply, but greatly required (Rich 2007). At the end of the day, evaluating the risk of disease in the absence of the behaviour of those modulating that risk potentially misses much of the story necessary to develop appropriate chain-level interventions that sustainably control disease.

References

Academy for Educational Development (AED). 2008. Research summary: Avian influenza in Indonesia, 2008 – Round Two KAP of backyard poultry farmers, Indonesia. Accessed on 1 February 2010 from http://avianflu.aed.org/research.htm

CJ Feed Indonesia. 2008. Market Information. http://cjfeed.co.id. [13th April 2009]

DGLS. 2004. Degree of the Director General of Livestock Services, No.: 17/Kpts /PD.640/F/02.04 concerning Guidance on Prevention, Control and Eradication of Infectious Disease on Poultry (avian influenza). February 2004.

DGLS. 2006. Standard Operational Procedures of DGLS. Director General of Livestock Services. Jakarta. 2006.

DGLS. 2007. Circular letter of the Director General for Livestock Services. Jakarta. April 2007.

DGLS. 2009. Circular letter of the Director General for Livestock Services. Jakarta. 30th September 2009.

Dinas Agribisnis. 2001-2009. Statistik Peternakan Kota Bogor. Dinas Agribisnis Kota Bogor, Bogor.

DLS Bogor District, 2010. Dinas Peternakan dan Perikanan/Livestock and Fisheries Services of Bogor District. Meeting notes based on a meeting held on 31st of March 2010 at DLS Bogor District office.

Disnakan (Dinas Peternakan dan Perikanan/Livestock and Fisheries Services of Bogor District). 2001-2009. Statistik Peternakan Kabupaten Bogor. Dinas Peternakan Kabupaten Bogor. Bogor.

Ditjennak (Direktorat Jenderal Peternakan). 2009. Statistik Peternakan 2007. Departemen Pertanian RI. Jakarta.

Directorate of Animal Health. 2008. National strategic work plan for the progressive control of highly pathogenic avian influenza in animals: proposals for phase 2 for implantation 2009 to 2011. Directorate General of Livestock Services, Ministry of Agriculture, Jakarta.

Dolan, C. and Humphrey, J. 2000. Governance and Trade in Fresh Vegetables: The Impact of UK Supermarkets on the African Horticulture Industry. Journal of Development Studies 37(2), 147-176.

FAO. 2004. FAO Recommendations on the Prevention, Control and Eradication of Highly Pathogenic Avian Influenza (HPAI) in Asia. FAO Position Paper, Rome. Accessed on 29 March 2010 at: http://www.fao.org/docs/eims/upload/165186/FAOrecommendationsonHPAI.pdf.

FAO. 2008. Poultry value chain study and avian influenza risk assessment in Jakarta surrounding area. FAO in Collaboration with CENTRAS, IPB.

FAO. 2010. PDSR reports on HPAI in poultry for Bogor for the years 2004 until 2010. FAO. Personal communication.

Forster, P. 2009. The political economy of avian influenza in Indonesia. STEPS Working Paper 17, Brighton: STEPS Centre.

Gereffi, G., Humphrey, J., Sturgeon, T. 2005. The governance of global value chains. Rev. Int. Pol. Econ. 12(1), 78-104.

Hayami, Y. T., Kawagoe Y., Marooka dan M. Siregar. 1987. Agricultural marketing and processing in upland Java, a perspective From a Sunda village. CEPRT. Bogor.

Humphrey, J. and Napier, L., 2005. The value chain approach as a tool for assessing distributional impact of standards on livestock markets: guidelines for planning a programme and designing case studies. Working paper, FAO AGA/ESC initiative on market exclusion. FAO, Brighton UK: Institute of Development Studies.

Kaplinsky, R. 2000. Globalisation and unequalization: What can be learned from Value Chain Analysis? J. Dev. Stud. 37(2):117-146.

Kaplinsky, R. and Morris, M. 2001. A handbook for value chain research. Working Paper prepared for the IDRC, Institute for Development Studies, Brighton, UK.

Kobayashi, M. 2006 Poultry Value Chain Study: Consultant Report. Unpublished Paper, FAO, Rome (Mimeo).

Matsika, M. 2009. Poultry market chain study in Bali. Unpublished report. FAO in collaboration with Japan Official Development Assistance. Jakarta.

Maulana, M. L. 2008. Revenue analysis of broiler farm with nucleus plasma system. Skripsi. Bogor Agriculture University.

McLeod A., Kobayashi, M., Gilman, J., Siagian, A., Young, M. 2009. The use of poultry value chain mapping in developing HPAI control programmes. World's Poultry Science Journal 65:217-223.

Nuryartono N., Mango N. 2010. The impacts of HPAI on livelihoods of poultry keeping communities in Indonesia – a qualitative assessment. Pro-poor HPAI Risk Reduction Project Working Paper, in preparation.

Pemprov DKI Jakarta. 2007a. Peraturan Gubernur (Pergub) No.15/2007. Tentang Pengendalian Pemeliharaan dan Peredaran Unggas. Pemerintah Provinsi Daerah Khusus Ibukota Jakarta. Jakarta.

Pemprov DKI Jakarta. 2007b. Peraturan Daerah (Perda) No.4/2007. Tentang Pengendalian Pemeliharaan dan Peredaran Unggas. Pemerintah Provinsi Daerah Khusus Ibukota Jakarta. Jakarta. (Local Governmant regulation of DKI Jakarta Province no. 4 of 2007 on poultry raising and movement control)

Perry, B., Isa, K.M., Tarazona, C. 2009. Final report: Independent evaluation of FAO's Participatory Disease Surveillance and Response Programme in Indonesia. Unpublished FAO Evaluation Service consultancy report. Rome.

Regents Regulation. 2003. The Regents Regulation No. 8/2003. District of Bogor. Berdasarkan Perda No. 8 Tahun 2003. Tentang Izin Usaha Peternakan dan Perinakan.

Regents Regulation 2007. The Regents Regulation No. 16/2007. District of Bogor: Intensification, Handling and Control of AI Virus in Bogor Kabupaten.

Rich, K. M. 2007. New methods for integrated models of animal disease control. Selected paper presented at the American Agricultural Economics Association Annual Meetings, Portland, OR, 31 July 2007, found at http://agecon.lib.umn.edu/cgi bin/pdf_view.pl?paperid=26240&ftype=.pdf.

Rich, K.M., Baker, D.A., Negassa, A., Ross, R.B., 2009. Concepts, applications, and extensions of value chain analysis to livestock products in developing countries: A review and research agenda. Presentation at the International Association of Agricultural Economics Meetings, Beijing, China, August 2009, found at http://purl.umn.edu/51922.

Rich, K. M. and Wanyoike, F. In press. An assessment of the regional and national socio-economic impacts of the 2007 Rift Valley Fever outbreak in Kenya. Am. J. Trop.Med. Hyg.

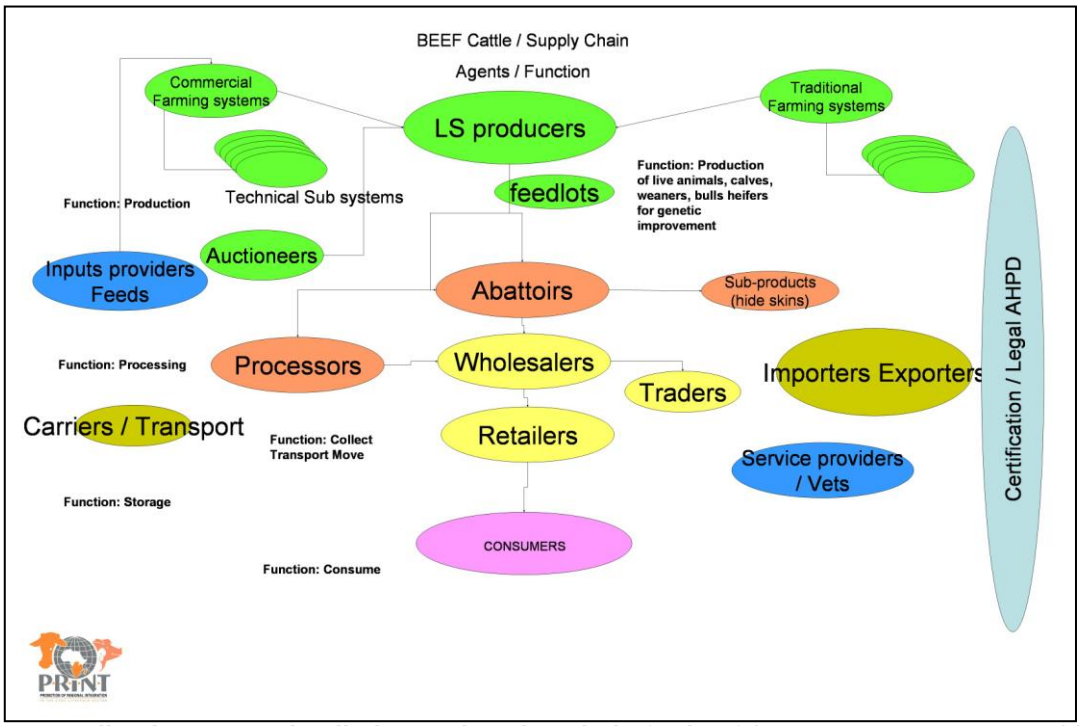
SADC, 2009, A Handbook for VAIMS – Value Adding Information Management System, SADC-PRINT Consortium, Bloemfoentein (check the full cite with Derek).

Siagian, A., Sembiring, P., Siregar, Z., Tafsin, M., Hanafi, N.D., Rasmaliah, Suryanto, D., Hasibuan, R. 2008. Poultry market chain study in North Sumatra. Unpublished report. FAO in collaboration with Japan Official Development Assistance and Unit Bantuan Kemanusiaan Sagiva Usu. Jakarta.

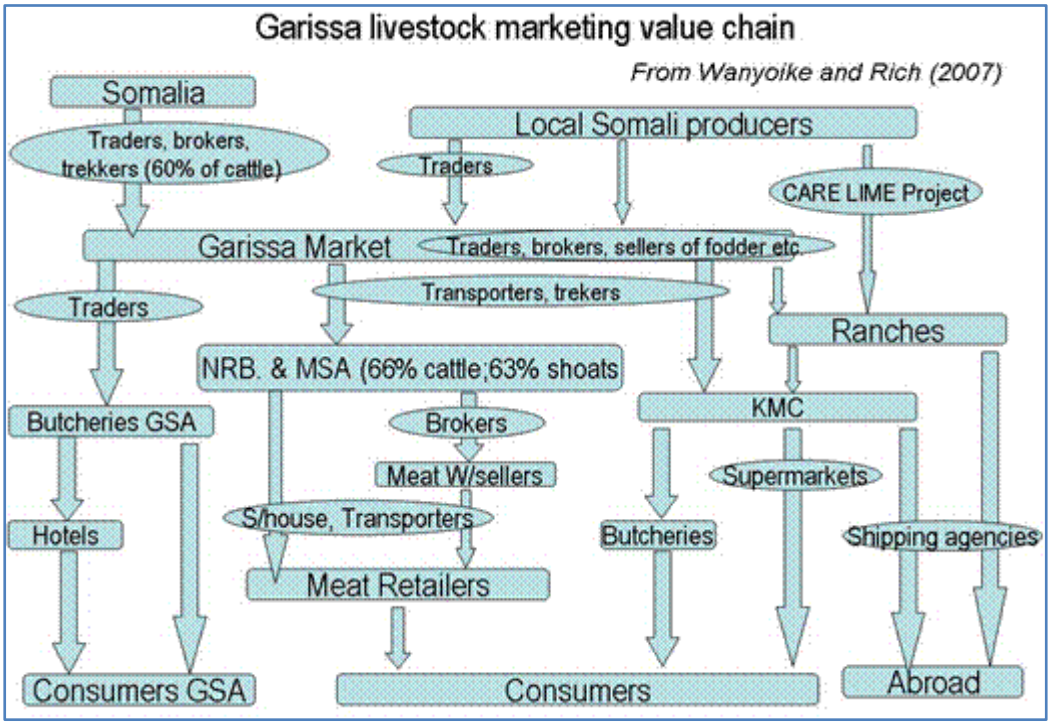
Taylor, N., Pinto, J., Rushton, J. 2008. Combining epidemiology and economic analysis: linking value chain analysis with epidemiological risk assessment in order to identify efficient disease prevention and control interventions - - with reference to poultry value chains and Highly Pathogenic Avian Influenza (H5N1). Unpublished report based on consultancy work for FAO and the Wellcome Trust, VEERU, University of Reading.

UNCTAD. 2000. Strategies for Diversification and Adding Value to Food Exports: A Value Chain Perspective. UNCTAD/DITC/COM/TM/1.14 November 2000. Geneva, United Nations Conference on Trade and Development.

Appendix 1. Examples of livestock value chain maps



Appendix Figure 1. A detailed generic value chain for beef (Source: SADC-PRINT Public-Private Partnership Workshop Proceedings, 2-3 November 2006)



Appendix Figure 2. A value chain mapping of livestock markets in Northeast Kenya (Source: Wanyoike and Rich in press)

Appendix 2. Calculations using the Hayami Method

No	Output, Input, Price	Unit	Broiler				
			Retailer	Collector	Slaughter Point	Slaughter point + Retailer	Collector + Slaughter point
1.	Output	Bird	75.00	1,470	490	63.70	490
2.	Input of main row material	Bird	75.00	1,500	500	65.00	500
3.	Input of Labour	Man day (MD)	1.00	4.00	5.00	1.00	6.00
4.	Conversion factor		1.00	0.98	0.98	0.98	0.98
5.	Labour factor		0.01	0	0.01	0.02	0.01
6.	Price of output	IDR/bird	24,000	16,000	21,000	24,000	21,000
7.	Average wage labour	IDR/MD	22,500	25,000	33,000	26,000	20,000
	Income, Profit						
8.	Price of main row material	(IDR/bird)	22,000	13,400	14,583	15,200	13,800
9.	Other input	(IDR/bird)	209	365	1,535	1,744	1,900
10.	Value of output	(IDR/bird)	24,000	15,680	20,580	23,520	20,580
11.	a. added value	(IDR/bird)	1,791	1,915	4,463	6,576	4,880
	b. ratio of added value	%	7.46	12.21	21.68	27.96	23.71
12.	a. Labour opportunity cost	IDR/ekor	300	66.67	330	400	240
	b. Share of labour	%	16.8	3.5	7.4	6.1	4.9
13.	a. Profit	(IDR/bird)	1,491	1,848	4,133	6,176	4,640
	b. Share of profit	%	6.2	11.8	20.1	26.3	22.5
	Opportunity Cost of Input Factor						
14.	a. Margin	(IDR/bird)	2,000	2,280	5,998	8,320	6,780
	b. Labour income	%	15.0	2.9	5.5	4.81	3.54
	c. Share of other input	%	10.4	16.0	25.6	21.0	28.0
	d. Institution profit	%	74.6	81.1	68.9	74.2	68.4

No	Output, Input, Price	Unit	Layer				
			Retailer	Collector	Slaughter Point + collector	Slaughter point + Retailer	Slaughter point + Collector + retailer
1.	Output	Bird	50	75	50	10	200
2.	Input of main row material	Bird	50	75	50	10	200
3.	Input of Labour	Man day (MD)	1.00	2.00	2.00	1.00	2.00
4.	Conversion factor		1.00	1.00	1.00	1.00	1.00
5.	Labour factor		0.02	0.03	0.04	0.10	0.01
6.	Price of output	IDR/bird	24,000	18,000	22,000	25,000	24,000
7.	Average wage labour	IDR/MD	22,500	25,000	33,000	20,000	25,000
	Income, Profit						
8.	Price of main row material	(IDR/bird)	21,000	15,000	16,000	19,000	15,000
9.	Other input	(IDR/bird)	209	365	1,535	1,744	1,900
10.	Value of output	(IDR/bird)	24,000	18,000	22,000	25,000	24,000
11.	a. added value	(IDR/bird)	2,791	2,635	4,465	4,256	7,100
	b. ratio of added value	%	11.6	14.6	20.3	17.0	29.6
12.	a. Labour opportunity cost	IDR/ekor	450	667	1,320	2,000	250
	b. Share of labour	%	16.1	25.3	29.6	47.0	3.5
13.	a. Profit	(IDR/bird)	2,341	1,968	3,145	2,256	6,850
	b. Share of profit	%	9.8	10.9	14.3	9.0	28.5
	Opportunity Cost of Input Factor						
14.	a. Margin	(IDR/bird)	3,000	3,000	6,000	6,000	9,000
	b. Labour income	%	15.0	22.2	22.0	33.3	2.8
	c. Share of other input	%	7.0	12.2	25.6	29.1	21.1
	d. Institution profit	%	78.0	65.6	52.4	37.6	76.1

No	Output, Input, Price	Unit	Duck			
			live bird retailer	collector	slaughter point + Retailer	Slaughter point + Collector + retailer
1.	Output	Bird	20	100	15	50
2.	Input of main row material	Bird	20	100	15	50
3.	Input of Labour	Man day (MD)	1.00	1.00	2.00	3.00
4.	Conversion factor		1.00	1.00	1.00	1.00
5.	Labour factor		0.05	0.01	0.13	0.06
6.	Price of output	IDR/bird	40,000	35,000	40,000	40,000
7.	Average wage labour	IDR/MD	25,000	25,000	30,000	20,000
	Income, Profit					
8.	Price of main row material	(IDR/bird)	35,000	30,000	32,000	28,000
9.	Other input	(IDR/bird)	209	365	1,744	2,109
10.	Value of output	(IDR/bird)	40,000	35,000	40,000	40,000
11.	a. added value	(IDR/bird)	4,791	4,635	6,256	9,891
	b. ratio of added value	%	12.0	13.2	15.6	24.7
12.	a. Labour opportunity cost	IDR/ekor	1,250	250	4,000	1,200
	b. Share of labour	%	26.1	5.4	63.9	12.1
13.	a. Profit	(IDR/bird)	3,541	4,385	2,256	8,691
	b. Share of profit	%	8.9	12.5	5.6	21.7
	Opportunity Cost of Input Factor					
14.	a. Margin	(IDR/bird)	5,000	5,000	8,000	12,000
	b. Labour income	%	25	5	50	10
	c. Share of other input	%	4.2	7.3	21.8	17.6
	d. Institution profit	%	70.8	87.7	28.2	72.4

No	Output, Input, Price	Unit	Kampong chicken			
			live bird retailer	collector	slaughter point + retailer	Slaughter point + Collector + retailer
1.	Output	Bird	30	70	50	120
2.	Input of main row material	Bird	30	70	50	120
3.	Input of Labour	Man day (MD)	1.00	1.00	2.00	3.00
4.	Conversion factor		1.00	1.00	1.00	1.00
5.	Labour factor		0.03	0.01	0.04	0.03
6.	Price of output	IDR/bird	30,000	25,000	32,000	30,000
7.	Average wage labour	IDR/MD	25,000	25,000	35,000	40,000
	Income, Profit					
8.	Price of main row material	(IDR/bird)	24,500	22,000	24,000	20,000
9.	Other input	(IDR/bird)	209	365	1,744	2,109
10.	Value of output	(IDR/bird)	30,000	25,000	32,000	30,000
11.	a. added value	(IDR/bird)	5,291	2,635	6,256	7,891
	b. ratio of added value	%	17.6	10.5	19.6	26.3
12.	a. Labour opportunity cost	IDR/ekor	833	357	1,400	1,000
	b. Share of labour	%	15.8	13.6	22.4	12.7
13.	a. Profit	(IDR/bird)	4,458	2,277	4,856	6,891
	b. Share of profit	%	14.9	9.1	15.2	23.0
	Opportunity Cost of Input Factor					
14.	a. Margin	(IDR/bird)	5,500	3,000	8,000	10,000
	b. Labour income	%	15.2	11.9	17.5	10.0
	c. Share of other input	%	3.8	12.2	21.8	21.1
	d. Institution profit	%	81.1	75.9	60.7	68.9

No	Output, Input, Price	Unit	Egg	
			Retailer	Collector
1.	Output	kg	116	1,161
2.	Input of main row material	kg	116	1,161
3.	Input of Labour	Man day (MD)	1.00	4.00
4.	Conversion factor		1.00	1.00
5.	Labour factor		0.01	0.00
6.	Price of output	IDR/kg	13,500	12,500
7.	Average wage labour	IDR/MD	17,667	20,000
	Income, Profit			
8.	Price of main row material	(IDR/kg)	12,500	12,000
9.	Other input	(IDR/kg)	209	365
10.	Value of output	(IDR/kg)	13,500	12,500
11.	a. Added value	(IDR/kg)	791	135
	b. Ratio of added value	%	5.9	11
12.	a. Labour opportunity cost	IDR/kg	152	69
	b. Share of labour	%	19.3	51.2
13.	a. Profit	(IDR/kg)	639	66
	b. Share of profit	%	4.7	0.5
	Opportunity Cost of Input Factor			
14.	a. Margin	(IDR/kg)	1,000	500
	b. Labour income	%	15.23	13.78
	c. Share of other input	%	20.88	73.08
	d. Institution profit	%	63.89	13.14

No	Output, Input, Price	Unit	Egg of duck Retailer
1.	Output	kg	43
2.	Input of main row material	kg	43
3.	Input of Labour	Man day	1.00
4.	Conversion factor		1.00
5.	Labour factor		0.02
6.	Price of output	IDR/kg	20,800
7.	Average wage labour	IDR/man day	20,000
	Income, Profit		
8.	Price of main row material	(IDR/kg)	17,600
9.	Other input	(IDR/kg)	209
10.	Value of output	(IDR/kg)	20,800
11.	a. added value	(IDR/kg)	2991
	b. ratio of added value	%	14.4
12.	a. Labour opportunity cost	IDR/kg	465
	b. share of labour	%	15.6
13.	a. Profit	(IDR/kg)	2,526
	b. Share of profit	%	12.1
	Opportunity Cost of Input Factor		
14.	a. Margin	(IDR/kg)	3,200
	b. Labour income	%	14.5
	c. Share of other input	%	6.5
	d. Institution profit	%	78.9

No	Output, Input, Price	Unit	Egg of Kampong Chicken Retailer
1.	Output	Kg	95
2.	Input of main row material	Kg	95
3.	Input of Labour	Man day (MD)	1.00
4.	Conversion factor		1.00
5.	Labour factor		0.01
6.	Price of output	IDR/kg	25,000
7.	Average wage labour	IDR/MD	20,000
	Income, Profit		
8.	Price of main row material	(IDR/kg)	20,000
9.	Other input	(IDR/kg)	209
10.	Value of output	(IDR/kg)	25,000
11.	a. added value	(IDR/kg)	4,791
	b. ratio of added value	%	19.2
12.	a. Labour opportunity cost	IDR/kg	211
	b. share of labour	%	4.4
13.	a. Profit	(IDR/kg)	4,581
	b. Share of profit	%	18.3
	Opportunity Cost of Input Factor		
14.	a. Margin	(IDR/kg)	5,000
	b. Labour income	%	4.2
	c. Share of other input	%	4.2
	d. Institution profit	%	91.6

Appendix 3. HPAI outbreak data for Bogor, 2003-2010

Appendix Table 3.1. Reported outbreaks of HPAI for Bogor 2006-2010 (source: PDSR database, FAO 2010)

Year	Month	HPAI	Village visits
2006	February	0	2
	March	2	15
	April	4	14
	May	3	14
	June	4	11
	July	0	34
	August	2	21
	September	6	37
	October	4	32
	November	1	32
	December	3	48
2007	January	5	64
	February	2	45
	March	2	41
	April	1	23
	May	1	30
	June		25
	July	1	43
	August		33
	September		43
	October	1	33
	November	4	29
	December		30
2008	January	2	28
	February	5	30
	March	4	38
	April		9
	May		8
	June		6
	July		7
	August		6
	September		11
	October		9
	November		10
	December	3	11
2009	January	3	10
	February	1	10
	March		8
	April	1	14
	May	1	13
	June	2	9

Year	Month	HPAI	Village visits
	July		7
	August		19
	September		14
	October		16
	November		12
	December		13
2010	January		12
	February		10
	March	1	9

Appendix Table 3.0.2. Situation of HPAI in Bogor District and control efforts, 2003-2008 (Source: DLS Bogor, as reported in Nuryartono and Mango 2010)

Status	Sub-district	Location	Species	Total Cases (no. birds)
2003				
Infected	Gn. Sindur	Curug Village Gunung Sindur Village Pangasinan Village Cidokom Village Pabuaran Village Rawa Kalong Village Padurenan Village Tegal Wangi Village	Not specified	359,000
	Parung	Waru jaya Village Lebak Wangi Village		69,700
	Jasinga	Sipak, Tegal Wangi, Jasinga Villages		2,336
	Cileungsi	Pasir angin Villages		2,100
	Tamansari	Tamansari Villages		40,000
	Rumpin	Sukamulya Village Kertajaya Village Tamansari Village Rabak Village Cibodas Village		209,200
	Cigudeg	Sukaraksa Village		5,000
	Jonggol	Jonggol Village, Sukasirna Village, Singajaya Village		60,000
	Kemang	Tegal, Pondok Udik Villages		7,670
	Bj.Gede	Kalisuren Village,		6,000

Status	Sub-district	Location	Species	Total Cases (no. birds)
		Tajur Halang		
	Cariu	Cariu, Giri		2,051
		Mekar Villages		
	Cibinong	Harapan Jaya Villages		200
2004				
Infected	Rumpin	Tamansari Village		80,000
2005				
Infected	Pr. Panjang	Salma Village	Pigeon	50
		Gentung Village		
	Cibinong	Pabuaran Village	Native Chicken	200
		Sukaraja Village	Native Chicken	20
		Pakansari Village	Native Chicken	217
	Cileungsi	Pasir Angin Village	Native Chicken	200
	Klapa Nunggal	Klapa Nunggal Village	Native Chicken	100
	Dramaga	Cibeureum Village	Native Chicken	200
	Gunung Putri	Gunung Putri Village	Native Chicken	9
2006				
	Cibinong	Ciriung Village	Native Chicken	10
		Harapan Jaya Village	Native Chicken	33
		Pabuaran Village	Native Chicken	10
		Nanggewer Village	Native Chicken	40
		Pakan Sari Village	Native Chicken	7
		Nanggewer Mekar Village	Native Chicken	62
	Sukaraja	Cilebut Timur Village	Native Chicken	31
		Cimandala Village	Native Chicken	40
		Pasir Jaya Village	Native Chicken	50
		Pasir Jambu Village	Native Chicken	20
		Cijujung Village	Native Chicken	22
		Cikeas Village	Native Chicken	59
	Bbk. Madang	Cijayanti Village	Native Chicken	110
		Sumur Batu Village	Native Chicken	32
		Sentul Village	Native Chicken	47
	Kemang	Kemang Village	Native Chicken	20
	Klapa Nunggal	Cikahuripan Village	Native Chicken	11
	Lw. Liang	Cibatok I Village	Native Chicken	150
	Cijeruk	Cipicung Village	Native Chicken	59
	Bj. Gede	Paburan Village	Native Chicken	3
2007				
	Cibinong	Harapan Jaya Village	Native Chicken	33
		Ciriung Village	Native Chicken	3
		Tengah Village	Native Chicken	15
		Pakansari Village	Native Chicken	18

Status	Sub-district	Location	Species	Total Cases (no. birds)
	Sukaraja	Pasir Laja Village	Native Chicken	113
	Citeureup	Tarik Kolot Village	Native Chicken	23
	Ciseeng	Ciseeng Village	Native Chicken	34
	Cibungbulang	Cibatok Village	Native Chicken	9
		Situ Udik Village	Native Chicken	11
	Pamijahan	Ciasmara Village	Native Chicken	70
	Ciomas	Ciapus Village	Native Chicken	2
	Ciampea	Benteng Village	Native Chicken	39
2008				
Infected	Cibinong Tajur Halang Ciomas Nanggung Tenjolaya Pamijahan			416

(Source: Nuryartano and Mango 2010)