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HPAI PRO-POOR HPAI RISK REDUCTION

Poultry, HPAI and Livelihoods in Viet Nam – A Review

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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, multi-disciplinary 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.

With the above in mind, this document aims to provide a brief country economic overview; a review of the poultry sector that examines production, trade, markets and consumption; information on household income, food expenditures and poultry contribution to nutrition. Finally, it describes the course of HPAI and applied control measures, with their concomitant impacts on livelihoods, the poultry sector and the economy at large. This information should provide background information to be used as additional evidence for policymaking processes at national and international levels.

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Disclaimer

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Keywords

Avian Flu, Chickens, Ducks, Highly Pathogenic Avian Influenza, HPAI, Livelihoods, Markets, Market Shocks, Poultry, Poultry Production, Poverty, Smallholder Farms, Smallholders, Southeast Asia, Viet Nam

More information

For more information about the project please refer to www.hpai-research.net.

Executive Summary

The specific purpose of the DFID-funded Pro-Poor HPAI Risk Reduction Project is to promote evidence-based, pro-poor HPAI control measures at national and international levels. With that aim in mind, this document provides a brief economic overview of Viet Nam; a description of the country's poultry sector, and a review of the course of HPAI and applied control measures, with their concomitant impacts on livelihoods, the poultry sector and the economy at large.

Macroeconomic Overview
Viet Nam, with a human population of 88 million, has shifted from a planned to a market-oriented economy. Currently, the industry and service sectors contribute over three quarters to GDP, which stands at US$65 billion. The majority of the population however remains rural, with agricultural activities as their main source of income. Livestock production represents one quarter of agricultural GDP and ownership ranges from 50 to 90 percent. Rising *per capita* income, general population growth and swelling urbanization have fuelled demand for livestock products and the livestock sector has grown faster than any other agricultural sub-sector.

Viet Nam's Poultry Industry
Chicken and ducks are the main poultry species raised in Viet Nam, with a population of around 250 million birds. The two river deltas (Red and Mekong rivers) are the major poultry producing regions. Three main chicken production systems co-exist: (i) traditional, small-scale extensive backyard/household production, (ii) semi-intensive, small to medium scale, market-oriented, commercial chicken production, and (iii) intensive, large scale, industrial chicken production. Similarly to chickens, three major duck production systems co-exist: (i) traditional, extensive free-grazing/scavenging production, (ii) semi-intensive, medium to large scale, periodically confined commercial production, and (iii) intensive, medium to large scale, permanently confined commercial duck production. Poultry trade is seasonal and peaks around religious festivals and celebrations with farm-gate sales of live birds to traders and neighbours dominating. Lowlands have higher levels of poultry and poultry products marketed than highlands partly due to proximity to markets.

Poultry and Livelihoods
Most rural households in Viet Nam own livestock. Because of its low input / low investment requirements, extensive poultry production is practiced by most income strata, but is particularly prevalent in lower income households. Children, women and elderly usually tend care to poultry. Most of the cash revenue from poultry (and other livestock) is derived from sales of live animals rather than sales of products. Poultry-derived income is used to purchase food items for home consumption, clothes, to pay for school fees, transportation and services, and for other purposes. Local chicken varieties command nearly double the price of industrially produced birds, clearly indicating consumer preference for particular product quality attributes.

Poultry also represent a source of protein to improve nutrition of children and adults. Poultry is one of the two most consumed meats in Viet Nam. Consumption of poultry-derived protein has grown from 5.5 g to 6.9 g/person/day over the last decade. In addition to being a source of energy and protein, poultry meat and eggs are a relatively rich source of well-absorbable minerals and vitamins.

The HPAI Epidemic: Course and Institutional Response
The source of HPAI H5N1 in Viet Nam is unknown, but it is suspected that infection might have originated from reservoirs of infection in wild water birds or illegal imports of infected poultry from neighbouring countries. Epidemic waves occurred in similar geographic locations with major foci being the Mekong and the Red River deltas, suggesting the presence of important risk factors for

spread of infection in these areas such as the high percentage of surface water which would support higher densities of ducks, geese, rice paddies and people. The first two epidemic waves were closely associated with the Vietnamese New Year holiday (Tet). Increased movement of people and poultry prior these festivals are possible reasons for this temporal pattern.

The Vietnamese government implemented a wide range of control measures to combat the disease which included large-scale culling, movement controls and closure of live poultry markets, banning poultry keeping in some major cities, campaigns to educate the public about preventive measures, as well as, from 2005 onwards, large-scale vaccination campaigns. The combined effects of the government's measures were effective at preventing major new outbreaks but have not achieved eradication of the HPAI virus.

Social and Economic Impact of HPAI and Control Measures

Immediate impacts result from morbidity and mortality caused by HPAI and from the cost of control measures applied by private and public sectors. From December 2003 to March 2008 a total of 59.3 million poultry died or were culled. Including culling and disinfection costs, it is estimated that the total economic costs of the first wave of HPAI outbreaks reaches US$200 million. After the first HPAI outbreaks poultry prices plummeted and alternative meats experienced price fluctuations with periods of consumer anxiety followed by cycles of high demand and supply shortage.

Worst affected were those farmers for whom poultry raising represented the main income source and who had made substantial investments into their poultry enterprise. Women lost poultry incomes and social standing. Backyard and semi-intensive producers have now reduced access to higher value markets in urban centres and are relegated to supplying local markets within their production districts. The direct impacts of HPAI on producers were propagated up- and downstream through the industry, and, given horizontal linkages, to other sectors as well. For example, rice farmers in the Mekong Delta experienced reductions of duck numbers in rice fields that resulted in increased damage from snails, increased occurrence of viral diseases in the spring-winter crop, and lower net incomes.

Conclusions

Policy and decision makers need to realize that animal diseases and their spread are a result of biological processes and economic behaviours of livestock keepers, traders and retailers. With this in mind, policies to effectively control diseases need to recognize the complex interactions of social and economic institutions. Despite Viet Nam's commendable efforts and success in controlling HPAI, a second generation HPAI control strategy, which is less demanding on public resources, is required. Given that it is hard to envisage the rapid elimination of smallholder poultry production, these producers must be recognized as part of the solution (rather than the problem) to managing HPAI risk, and control efforts need to structure incentives for their active participation.

Research findings indicate that urban Vietnamese markets have the capacity to support demand-driven disease risk reduction measures, because consumers are willing to pay a safety premium for traditional bird varieties large enough to finance HPAI risk reduction. As a market-based policy, a self-financed disease inspection scheme could foster a virtuous quality cycle among small-scale producers, middlemen and retailers, encouraging them to make other quality improvements to raise revenues and at the same time spare significant fiscal outlays.

Introduction

Globalisation has brought an unwelcome problem – increased risk of transboundary diseases. HPAI clearly illustrates that through extending livestock supply chains, local conditions of animal production have repercussions on global human health risks.

For a vast majority of rural households in developing countries, poultry act as an important source of protein and are part of the social fabric, a situation which will not change in the near future. Therefore, global policies toward HPAI and its control necessarily implicate the rural poor majority and these people need to be recognized as part of the solution to reducing human health risk, not the problem.

It has been seen time and time again that prescriptive eradication measures fail to achieve their direct objective and that by driving the problem 'under ground', disease risk actually increases. Because of their diversity and weak institutional linkages in most of the affected countries, national policies cannot be designed and implemented effectively without close attention to local incentives. Despite international pressure to act quickly on control measures, one size will not fit all or even a significant percentage of local conditions.

To ensure effective, affordable and socially fair HPAI control programmes, national and international policy making needs to be based on stringent analysis of risks, consequences and risk management options.

This document is part of a series of documents that aim to provide comprehensive overviews of the economic (macro- and micro-) and institutional environment of countries that have been seriously affected by HPAI, Viet Nam being one of the most seriously affected. The document is divided into six sections. The first section deals with Viet Nam's economy, population, labour force, agriculture and livestock sector. The second section deals with its poultry industry, specifically chicken and duck production systems, as well as marketing and trade. The third section is dedicated to the role of poultry in rural livelihoods, their contribution to income and nutrition as well as consumer preferences for poultry meats. The fourth section reviews the course of the HPAI epidemic in Viet Nam and the structure of the national animal health systems and instituted control measures. The fifth section attempts to systematically compile the available information on the direct and indirect impacts of HPAI and HPAI control measures. Finally, the last section concludes and highlights the need for a second generation of HPAI control measures.

Macroeconomic Overview

The last decade has brought significant economic and structural change to Viet Nam. Initiation of economic and other institutional reforms commenced when the government postulated its goal to transform the country from a planned to a market-oriented economy. The introduction of Doi Moi reforms, starting in 1986, were effective and led to acceleration of economic growth, improving living standards and sharply reducing poverty.

Table 1. Macro-economic indicators for Viet Nam, 1994 and 2004.

Description	1994	2004
GDP at market prices (trillion VN Dong)	178.5	715.3
GDP (billion US$)	16.3	43.9
GDP change from previous year (%)	23.5	11.0
Population (million)	70.8	82.0

Source: GSO, IMF, World Bank and CIA.

The annual growth rate of per capita GDP (in nominal terms) was about 6 percent between 1992 and 2002. Despite the financial crisis affecting the region in 1997, Viet Nam's GDP has consistently grown from 1992 until 2004 (Table 1). The government was aiming for economic growth of 7.5 to 8.0 percent in 2004-2005 and of 8.0 to 8.5 for 2007-2008.

The structure of GDP reveals modest proportional changes occurring in the economy over a decade (Table 2). Agriculture's share declined from 27.4 percent in 1994 to 21.8 percent in 2004, while industry's share has increased to 40.2 percent in 2004, from 28.9 percent in 1994. The share of services has declined from 43.7 percent to 38.0 percent. However, in 2005-2007 a growing and dynamic domestic market created more optimistic expectations for the agricultural sector and services. GDP composition has further changed between 2004 and 2006, as seen below in Box 1.

Table 2. Structure of GDP (percentages), 1994 and 2004.

Sector	1994	2004
Agriculture	27.4	21.8
Industry	28.9	40.2
Services	43.7	38.0

Source: General Statistics Office of Viet Nam, 2008; Website Databases, www.gso.gov.vn

From 2001 to 2005 the total population increased by 1.4 percent per annum and the active population employed in agriculture increased by 0.9 percent annually, while its share of the total labour force remains the largest in the economy at 64.7 percent in 2004. Rural dwellers remain a majority in Viet Nam at 73.5 percent of the total population in 2004, but have been in decline since 1986 (Table 3). As overall population rises, so does population density, currently averaging 260 people per square kilometre (Box 1). Movement from rural to urban settings is prompted by job prospects in the manufacturing sector in suburban areas in major cities.

Table 3. Population and labour force in Viet Nam, 1994 and 2004.

Population segment	1994		2004		Annual Avg Growth Rate (%) 2001-2005
	Millions	%	Millions	%	
Total population	70.8	100	82.0	100	1.4
Urban	14.4	20.4	21.7	26.5	3.6
Rural	56.4	79.6	60.3	73.5	0.6
Total labour force	33.1	100	38.4	100	1.6
Agricultural labour force	21.9	66.0	24.8	64.7	0.9

Source: General Statistics Office of Viet Nam, 2008; Website Databases, www.gso.gov.vn.

Box 1. Country facts.

Official Name	Socialist Republic of Viet Nam
Capital City	Ha Noi
Largest City	Ho Chi Minh
Area	331,690 sq km
Population	87.5 million
Population Density	264 per sq km
Urban Distribution	27%
Rural Distribution	73%
Religion	Mostly Buddhist
Language	Vietnamese (official)
Currency	Vietnamese Dong (VND)
Life Expectancy	71 years
Literacy Rate	94%
General Economic Indices (2006)	
GDP [nominal]	U$60,995 Million (IMF)
	US$60,884 Million (WB)
GDP per capita	U$697 (IMF); $695 (WB)
Agriculture-GDP	21%
Industry-GDP	41%
Service-GDP	38%
HDI [2007]	0.733 (medium)
Poverty Headcount Rate (national poverty line)	28.8%

Agriculture

Agriculture remains the predominant source of income in rural areas. Viet Nam has the highest percentage of land used (7%) for permanent crops (coffee and rubber) of any nation in the Mekong region. The main non-permanent crops are paddy rice and maize. The Mekong Delta is the rice bowl of Viet Nam, with around 4 million hectares of land dedicated to cultivating rice thus contributing around 54 percent to total national production of 35 million tonnes.

Table 4. Composition of agricultural GDP, 2006. (Values expressed in billion US$).

Description	Total	Cultivation	Livestock	Ag. Services
Value (Percent)	12.8 (100)	9.4 (73.5)	3.2 (24.7)	0.2 (1.8)

Source: General Statistics Office of Viet Nam, 2008; Website Databases, www.gso.gov.vn [1 US$ = 15,400 VND]

Key agricultural exports are coffees, teas, rubber, crude oil, peppers, and fishery products; Viet Nam is the world's largest Robusta coffee, cashew nut and pepper exporter, and the 2nd largest rice exporter. In 2006, crop cultivation represented 73.5 percent of agricultural GDP (Table 4).

Livestock

The livestock sector is an important agricultural sub-sector and contributes a substantial (> 20 percent) and growing part to Viet Nam's agricultural output (Tables 4 and 5) and thereby to rural household income. In 2006, livestock raising represented 24.7 percent of agricultural GDP (Table 4).

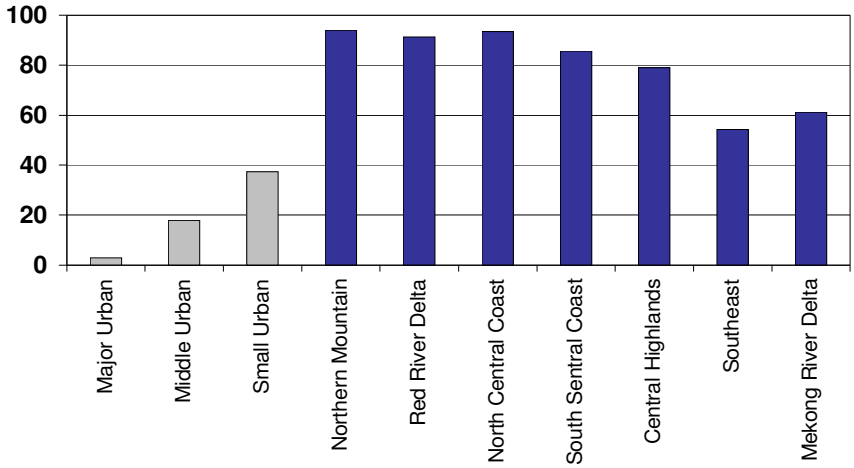
Table 5. Livestock GDP shares (percentages) of agricultural GDP, 1994 and 2004.

Description	1994	2004
Livestock GDP to agricultural GDP	20.2	21.6

Source: General Statistics Office of Viet Nam, 2008; Website Databases, www.gso.gov.vn

In rural areas throughout Viet Nam, the degree of livestock ownership ranges from 50 to 90 percent. Livestock is generally more important in the northern part of the country, where it contributes around one quarter to rural household income, compared to slightly less than 10 percent in southern Viet Nam. Nearly 40 percent of households in small urban areas own livestock, whereas in middle urban areas some 20 percent of households still keep some livestock (Figure 1).

Figure 1. Proportion of Vietnamese households owning livestock by region.



Source: VHLSS, 1998.

Due to growing demand for livestock products, the livestock sector has developed more dynamically than other agricultural sectors over the last decade. Over the last 20 years, livestock has developed at a 5.3 percent average annual growth rate (Table 6). In the last 10 years, the livestock sector has contributed from 17 to 25 percent of total agricultural product value, and this share is estimated to be 30 percent by 2010, and to reach 35 percent by 2015 (Ngoc Que, 2006).

Table 6. Comparative annual growth rates (%) for agriculture and livestock, 2000 to 2005.

Sector	2000	2001	2002	2003	2004	2005	Mean
Agriculture	5.4	2.6	6.2	4.2	4.2	3.2	4.3
Livestock	6.7	4.2	9.9	8.2	2.3	11.6	7.2

Source: Institute of Policy and Strategy for Agricultural and Rural Development, Viet Nam, 2006.

The majority of demand growth for livestock products comes from within the country and has a strong correlation with rising *per capita* income and increasing urban population share. In the last years, the composition of domestic demand for food has been changing and shifting away from rice toward livestock products, which have higher income elasticities (meat income elasticities across regions vary between 0.9 and 1.2 while for rice varies between -0.6 and 0.4). Moreover, domestic demand growth for animal products in-country is likely to be more sustained in comparison to crops. FAO estimates further growth in demand for all livestock commodities in the next decade. The projections of growth in demand for 2015 are: 40 percent (with respect to 1998 base year) for beef, 73 percent for pork, 114 percent for poultry and 57 percent for milk (FAO, 2005a).

Viet Nam's Poultry Industry

The two large delta regions (Red River in the North and Mekong River in the South) are the major poultry producing areas. Chickens and ducks are the dominant species raised in Viet Nam (GSO, 2004). In the past 30 years, poultry egg production has increased 6 times and chicken meat supply has increased 14 times (Haitook *et al.*, 2003). Chickens predominate in the North while ducks predominate in the South. In 2005, there were 220 million poultry in Viet Nam (Table 7).

Table 7. Poultry population and production values in Viet Nam, 2000 to 2005.

Population	Units	2000	2001	2002	2003	2004	2005
Total poultry	Million heads	198	218	233	254	218	220
Chicken	Million heads	147	158	159	185	159	160
Ducks	Million heads	51	58	64	69	59	60
Poultry meat	Thousand tons	286	323	388	373	316	322
Eggs	Billion units	3.7	4.2	4.5	4.9	3.9	3.9

Source: General Statistics Office of Viet Nam, 2008 and Ministry of Agriculture and Rural Development, 2006.

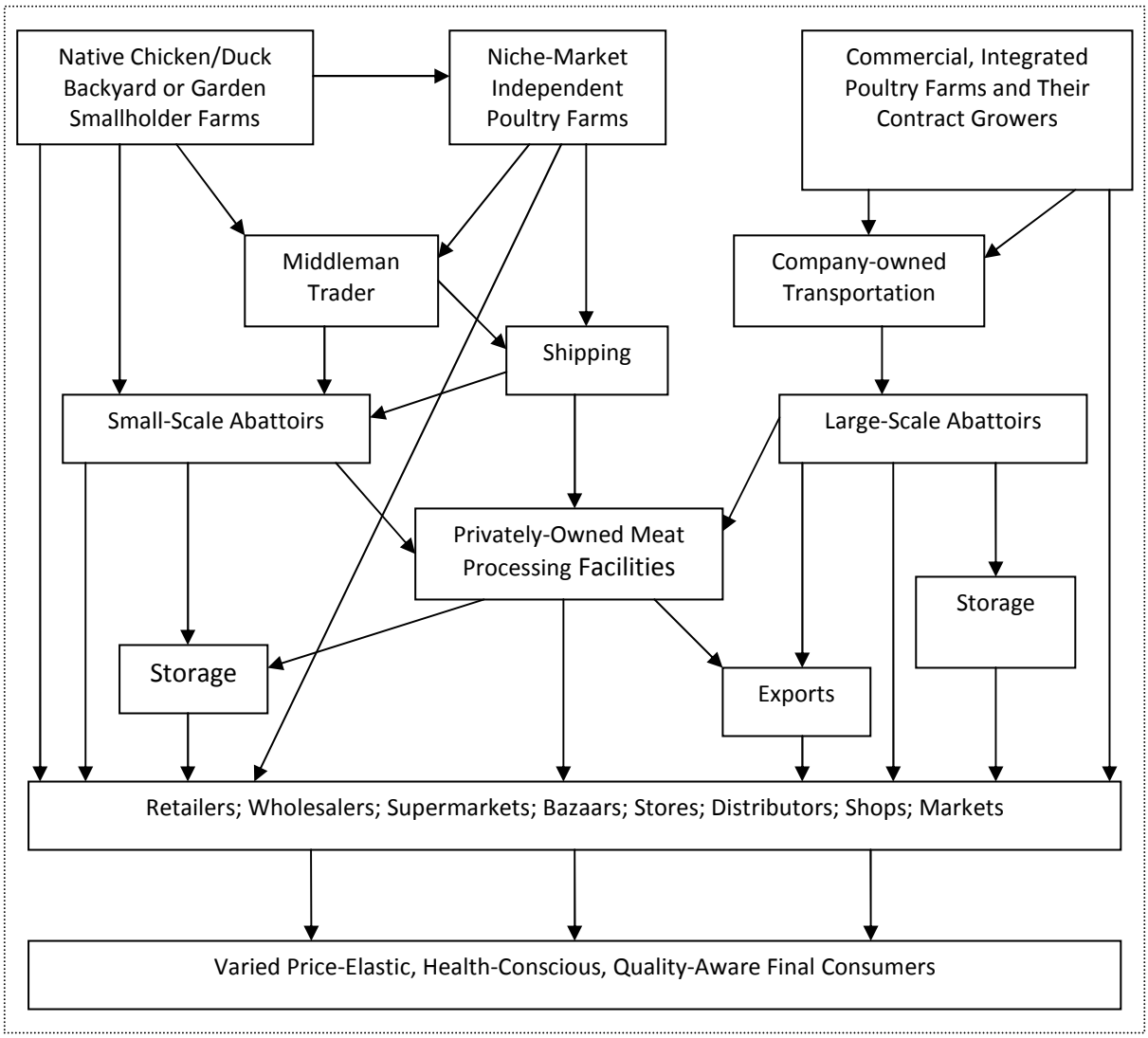
Although there is no available data on quail populations, it is estimated that almost 16 million quails were culled between December 2003 and August 2005 due to HPAI outbreaks in Viet Nam (VSF, 2006). The commercial geese population is negligible, whereas turkey data is scarce.

The poultry industry feeds upstream and downstream into many collateral institutions and professional businesses that are needed to fuel production wheels, some of these include: feed mills, feed additive firms, commodity traders, haulers, railways and trains, veterinarians, veterinary medicine firms, biotechnology firms, primary breeding companies, hatcheries, slaughterhouses, bird traders, lawyers, sanitation professionals, construction companies, shipping firms, plastic packagers, truckers, markets and supermarkets, marketers, marketing firms, analysts, accountants, fuel providers, banks, insurance companies and many more.

These businesses link with their own respective suppliers and purveyors, which also link with many others creating an economic network that depends on the wellbeing of a single industry. These upstream and downstream connections are important contributors to GDP, to sector development and employment generation.

Figure 2 provides a visual display of chicken and duck supply chain flows. Intricately interrelated connections between players depict how this industry moves its main products (meat and eggs) to markets and consumers.

Figure 2. Schematics of chicken and duck supply chain flows.



Source: Adapted from Costales, 2004.

Farmers sell poultry and poultry products at different stages of production throughout the year. Live birds are sold for food, gifts, celebrations, religious practices and festivities. Sale of unfinished birds and products (duck eggs, day-old chicks, growing ducks and growing chickens) is not uncommon in Viet Nam, and they are sold to traders, other farmers in the vicinity and to family members with varying shares and frequency depending on season, purpose and needs (Soares-Magalhaes *et al*., 2007; Ifft *et al.,* 2008). Poultry products, traded and home-consumed, include: meat, eggs, viscera and feathers as well as manure. From here onwards, when referring to poultry products, above items are included.

Chicken Production Systems

While there are various classifications of poultry production systems based primarily on scale, official classification criteria have not been established by the Vietnamese Ministry of Agriculture and Rural Development (MARD). For explanatory ease, this report uses a threefold classification system to describe chicken production: (**A**) traditional, small-scale extensive backyard/household production, (**B**) semi-intensive, small to medium scale, market-oriented, commercial chicken production, and (**C**) intensive, large scale, industrial chicken production.

A broad visual overview of the number of flocks and birds by system before the advent of HPAI is provided in figures 3 and 4, respectively.

Figure 3. Number of flocks by production system in Viet Nam for 2001 (n ≈ 8.3 million).

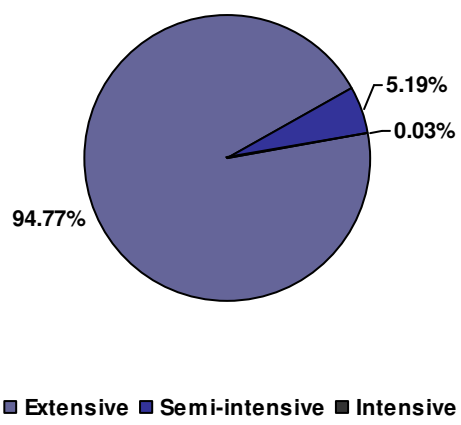
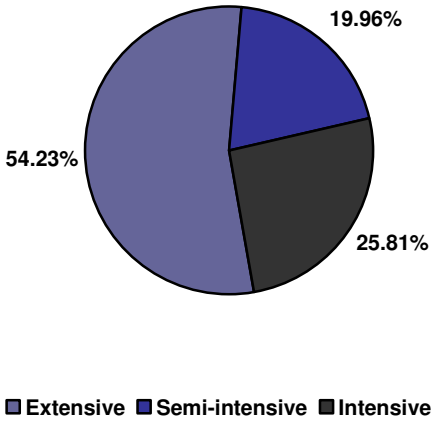


Figure 4. Number of birds by production system in Viet Nam for 2001 (n=218 million).



Source: General Statistics Office of Viet Nam, 2002.

(A) *Traditional, small scale, extensive backyard/household production*

Traditional extensive backyard/household production is by far the most common production system in Viet Nam, where birds are raised in backyards, gardens, orchards and often free to range on neighbouring land (GSO, 2004). This system is considered to be small scale, with flock size of less than 50 birds which derives a large part of their diet from free range scavenging. Birds are also given some locally available feeds and supplemented with limited amounts of home produced grains such as paddy rice or maize, and kitchen waste.

The amount of feed given to birds does not focus on production efficiency but depends heavily on the availability of grains that farmers have in storage for personal use and eating needs of their birds. Chick replacements are generally hatched from own-stock eggs, but sometimes farmers buy replacements from local markets or traders to complement their flocks. Most small and large farmers keep poultry all year round.

In 2005, approximately 8 million households engaged in traditional extensive poultry production, with an average flock size of 32 birds, representing about 94 percent of all producers. Since it is considered a side-line activity, attention to bird safety and health is limited, and mortalities can be high: in bad weather conditions as high as 40 to 50 percent (GSO, 2004).

The most popular local chicken breeds Ri, Mia, Dong Tao, and Ho are raised in the North, and Ta Vang (or Tau Vang) in the South. These local breeds are of lower production potential than foreign-imported breeds but have characteristic yellow-orange feathering and dark skin colour features that are favoured by consumers in both rural and urban areas, particularly for traditional festivals, family gifts and for religious offerings (Hong Hanh *et al.*, 2007).

(B) S*emi-intensive, small to medium scale, market-oriented, commercial chicken production*
Semi-intensive production is of larger scales and higher rates of commercialization than the previously described system, and can follow some practices of the agricultural sectors of industrialized countries. This system combines traditional practices with improved technology and marketing. Poultry are both kept in enclosures and/or are free to range backyards, orchards and gardens. Apart from being given locally manufactured animal feeds, they are also supplemented with alternative feedstuffs, such as brewery waste, soya waste and ensiled shrimp waste (Dong, 2005). Breeds used in this system are either specialized or a mixture of local and exotic imported breeds, with flock size ranging from 51 to up to 2,000 birds.

This mode of production has developed since the onset of the economic reform period, especially in the late 1990's. Also, it represents a transition stage between traditional and market-integrated commercial poultry production. Farmers who are involved in this system mainly represent former government employees, current local officers, or wealthy farmers who have permanent income and some farming skills, especially knowledge of market conditions. It can be inferred that 'know-how' and capital are important factors for development of semi-intensive commercial poultry production (Hong Hanh *et al.*, 2007).

Chicks of imported breeds are bought at local hatcheries and local chicks are obtained at local markets. The majority of semi-intensive farms also keep a certain number of laying hens to produce chicks for fattening. From hatching to one month of age, chicks brood with hens. Older birds are allowed to scavenge in backyards or gardens during the day and brought back to their housing in the evenings. The cages vary from permanent to makeshift enclosures, made mainly from local primary building materials, such as brick or bamboo, or tree branches. Gardens are fenced with netting or bamboo material or walled with bricks.

Measures for disease prevention, treatment and management are given more attention compared to traditional household production. Besides reliance on naturally available feed resources such as worms, insects, pests, vegetables, and grass that birds can scavenge, they are also fed broken grains and/or commercial feeds bought from local feed outlets. This system has production cycles for meat birds of about 70 to 90 days, with intermediate mortality rates and efficiency levels (Hong Hanh *et al.*, 2007).

Because local poultry varieties still form an important share of the stock of these producers, quality of meat and eggs are seen as similar to that of household/subsistence producers. Thus they are suitable for both urban and rural consumers, and for sale into festivals or traditional events. Although these farmers have the financial capacity to buy some concentrated feeds, this system is usually a part-time or supplemental activity, depending on income status of individual producer households. Household members are also engaged in other farming activities like cropping, raising other livestock or off-farm employment. Moreover, about 15 to 20 percent of farm households are currently engaged in this mode of poultry production and by 2006 produced around 28 percent of Viet Nam's chicken, up from approximately 20 percent in 2005 (Hong Hanh *et al.*, 2007).

(C) *Intensive, large scale, industrial chicken production*
Intensive, industrial poultry production in Viet Nam is modelled after modern industrial poultry systems found in OECD countries. Poultry is kept indoors. Facilities are well equipped and relatively mechanized, including both semi-automatic and automatic equipment. In-house cage systems are designed to accommodate internal feed systems, water supply, controls for humidity, air, and waste management. Some systems have more extensive automation, including remote monitoring and control. This production system has emerged over the last 10 years in Viet Nam. Initially, the industrial production model was promoted through large-scale foreign direct investment (FDI), and aided by structural enlargements.

Multinational agro-food conglomerates expanded their networks through contract farming with more established local agricultural interests. Local studies explain that larger domestic farms are the primary recipients of genetic material, technology, health services, and marketing support by FDI companies. Because of large initial costs, as well as economies of scale, foreign partners have shown a strong preference for established, larger scale enterprises (i.e., flock sizes of more than 2,000 and up to 100,000 birds). Farms with automatic equipment have sizes in the 8,000 to 15,000 bird range and above, and partnership is limited to the more experienced and higher income local farming interests. This mode of production is intensive with higher levels of investment in animal health standards, house maintenance and flock productivity. The main products are eggs, meat, and breeding stock, which are sold to different buyers like assemblers, traders or wholesalers, and consumers (Hong Hanh *et al.*, 2007).

In 2006, according to Viet Nam's statistics office, 2,837 intensive industrial poultry production farms operated in Viet Nam. Of these, 1,950 were chicken farms (mainly broilers but also layers), 668 were duck/geese farms, and 219 were chicken and duck breeding farms. Provinces in proximity to urban areas have large numbers of farms.

Within the industrial poultry sector, flock sizes in the range of 2,000 to 5,000 birds account for 69 percent of chicken operations and 73 percent of poultry breeding operations, while operations with more than 11,000 birds only account for around 6 percent of industrial operations. Farms under contract with foreign investors, international conglomerates and large domestic companies commonly have flock sizes ranging from 4,000 to 5,000 birds (Hong Hanh *et al.*, 2007).

Breeds raised in industrial-scale farms are mainly imported (i.e. Cobb 500, Ross 308, Hubbard Classic, and Cobb 700). In the case of broilers, production cycles are between 42 and 45 days (~6 weeks) and birds weighing about 2.2 to 2.4 kg when finished, while layers produce 270 to 280 eggs per year. Marketing is based on three main channels: through assemblers, company abattoirs (both foreign and domestic companies) and marketing cooperatives. Marketing through foreign-owned abattoirs (i.e. slaughterhouses) represents about 45 to 50 percent of industrial poultry market flows. Marketing poultry products through farmer-based marketing cooperatives has recently been established in several provinces such as Hai Duong, Ha Tay, Bac Ninh, Hung Yen, Thanh Hoa, Ho Chi Minh city, and Tien Giang (Hong Hanh *et al.*, 2007).

Average investment in an industrial chicken farm is about 50 to 60 million VND (3,060 – 3,670 US$) per 1,000 birds. To meet this entry requirement, chicken farm owners have to mobilize capital from different sources such as commercial banks, credit institutions, savings and relatives. Similar to the semi-intensive sector, there are different types of entrepreneurs establishing industrial poultry enterprises such as wealthy farmers, retired government officials, ex-army officers and consummate professionals.

Production costs are contained through the use of family labour (Hong Hanh *et al.*, 2007) and only about 30 percent of industrial farms recruit part-time labour from outside. The scale of this off-site employment depends on flock size, and normally hire from 2 to 8 labourers. Overall, about 14 to 20 percent of industrial farms hired 2 to 3 labourers, 6 to 7 percent hired 5 to 8 labourers, while the largest farms hire 15 to 20 labourers (Hong Hanh *et al.*, 2007). Since the majority of employment in these industrial farms still stems from family or neighbour sources, labour costs are not very different from those of other poultry production systems in Viet Nam, although concentration of these facilities in peripheral urban areas may sometimes imply higher labour costs.

Family member workers in operations of this scale are more likely to be engaged full time in poultry work, rather than dividing their attention between poultry and other farming activities. The main

dividing line between 'workers' in these three systems described is thus not family or village affiliation, but probably education and training. Industrial systems may employ fewer workers per unit of output, but these workers acquire specific human capital by working with more advanced hard and soft technology, increasing their future productivity, labour skills and earning capacity (Hong Hanh *et al.*, 2007).

Waterfowl (Duck and Geese) Production Systems

Ducks account for more than one quarter of Viet Nam's poultry and make up more than 90 percent of the domesticated waterfowl in Viet Nam, with around 2 million households engaged in duck production. Duck is the common name for a number of species in the Anatidae family of birds. They are mostly aquatic, both fresh and sea water, and smaller than their relatives (i.e. swans and geese). Out of the 60 million ducks accounted for in 2005, muscovy ducks comprise 7 to 8 million, which is close to 11 to 13 percent of the entire population; while geese comprise only 2 to 4 percent.

Ducks exploit a variety of food sources such as grasses, aquatic plants, fish, insects, small amphibians, worms, and small molluscs. In Viet Nam, as in other East Asian countries, duck raising has been intimately integrated with rice production for centuries. Currently, similar to chicken, three major duck production systems co-exist in Viet Nam: (**A**) traditional, extensive free-grazing / scavenging production, (**B**) semi-intensive, medium to large scale, periodically confined commercial production, and (**C**) intensive, medium to large scale, permanently confined commercial duck production.

(A) *Traditional, extensive, free-grazing (scavenging) duck production*
This duck production system is closely linked to rice production cycles (see Table 8 for rice production cycles in different regions of Viet Nam) and exists in two variants: (i) small-scale, short distance, scavenging duck production by farming households where ducks (5 to 50 / 75 head) mingle with chickens and other livestock species (porcine, bovine, and caprine) all year round, and (ii) medium to large scale (50 / 75 to 4,000 head), medium to large distance, specialized, free-grazing duck production, where duck producers rely on their experience and networks and contacts to move their flocks between provinces and even into Cambodia for optimal exploitation of feed resources on pre- and post-harvest rice fields.

Ducklings are driven into rice fields 20 days after rice transplantation and until the start of flowering, thereby controlling pests that attack rice early and fertilizing the fields. The small body size of ducklings allows them to avoid harming rice plants. At the start of rice flowerings, ducks are driven out of rice fields into canals, ditches, lakes and swamps to spend time in water. In the Mekong delta, during cases of heavy Golden Apple Snail infestation, ducks are herded in paddy fields prior to transplanting rice, as well as 30 to 45 days after transplanting in order to clear fields from snails and their eggs. Older ducks are integrated with rice harvesting whereby ducks are herded in paddy fields during the day to scavenge on weeds, crop residues, snails and freshwater crustaceans (~250 kg/ha) and are brought home late afternoons. Ducks reared under this system are then sold at 2 to 3 months of age for consumption. Local breeds (Tau ducks) are reputed to be better scavengers than 'improved' breeds as they exhibit a smaller body size and more active foraging capacity. Although productive performance under these conditions is generally low, the utilization of no-cost / low-cost feeds (< 5% of farms buy feed) makes this system highly profitable.

Table 8. Monthly calendar for rice planting and duck herding in Viet Nam.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Red River Delta												
Ducklings												
Adult ducks												
North East												
Ducklings												
Adult ducks												
North West												
Ducklings												
Adult ducks												
North Central Coast												
Ducklings												
Adult ducks												
South Central Coast												
Ducklings												
Adult ducks												
South East												
Ducklings												
Adult ducks												
Mekong River Delta												
Ducklings												
Adult ducks												

Source: IFPRI, 2000 as quoted by VSF, 2006.

In the case of small-scale scavenging duck production, the ducks mainly stay within farm premises, but may roam around village land. Ducklings come from own stock and the birds are mainly raised for home consumption. Prior to the advent of HPAI almost 90 percent of duck flocks in the Mekong region (approx. 400,000 to 600,000 flocks totalling around 4 million ducks) were maintained in this system.

Large-scale scavenging duck production involves flocks of 200 to 400 ducklings or up to 3,000 laying ducks. Duck producers use their experience and networks to plan the movements of their flocks for optimal exploitation of pre- and post-harvest feed resources. Flock movements between and within provinces normally take place from November to March, with maximum activity in December. It has been estimated that in 2003, prior to the incursion of HPAI, around 50,000 to 75,000 medium to large-scale nomadic flocks were maintained in the Mekong delta alone (Men 2007), accounting for almost three quarters of the duck population. Around 80 percent of these ducks are layers. Owners of these medium to large duck flocks may load them onto floating boats three or four times a year and travel to vacant paddy fields littered with grains of rice amid the dry stubbles of recently cut stalks. The ducks are driven or boated into rice fields during the day and back to pens, cages or sheds near the households at night; this is also seen in other SE Asian countries (VSF, 2006). For a small fee (12 to 15 US$/ha), the ducks forage a month and a half before going home, consuming forage equivalent in value to US$1,500 and in return ridding the fields of pests and providing manure thereby reducing or even eliminating the need for chemical fertilizers and pesticides.

The duck breeds and strains are developed by traditional breeders who have a long experience of producing ducklings to meet local requirements, but who do not use specific techniques for planned breeding or quality control of ducklings. These breeders use simple hatcheries to incubate duck eggs in the rural areas, with up to a million duck eggs hatched annually per hatchery.

(B) *Combined free-grazing (scavenging) and confined duck production*
Traditionally, layer ducks for the production of table eggs are also raised in temporary confinement. Kien Giang is a province where the laying ducks are mainly raised by this system. Farmers keep 500 to 3,000 laying ducks in confinement (open, not housed) on the banks of canals, with access to water but without access to scavenging areas on the rice fields. Feeds include rice grains, shellfish gathered from the beach or canals, with supplementary commercial feed, especially for the high-producing laying flocks. Post-harvest the ducks will however be driven into the rice fields to look for their feed, during which time supplementary feeding is not needed (Men, 2007).

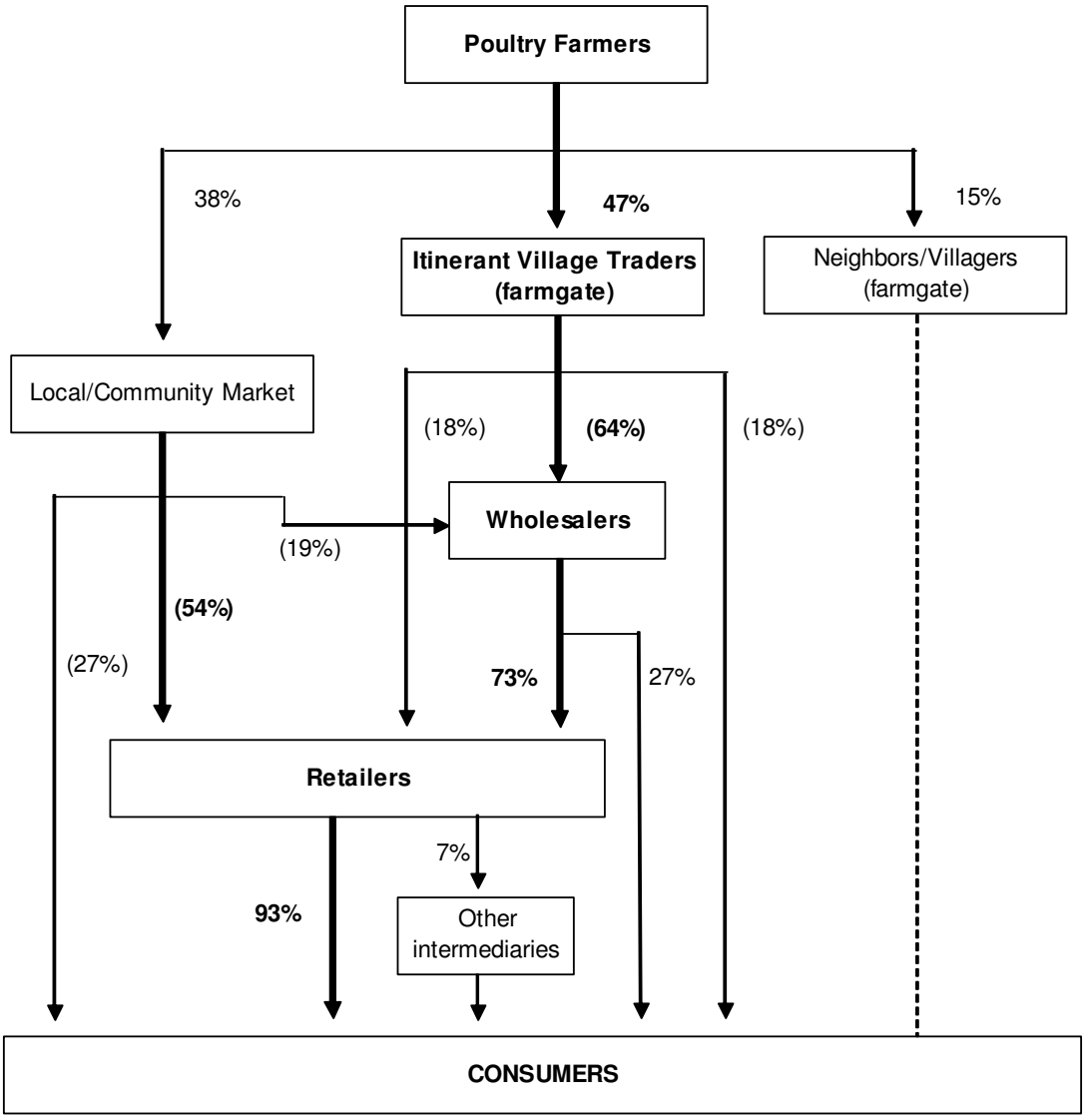
(C) *Intensive, medium to large-scale, permanently confined duck production*
In the Mekong Delta this system is common for exotic breeding ducks and for growing / fattening meat-type ducks in the dry season. Ducks are kept confined (not housed) at all times and are fed mostly energy-dense feeds. Breeding ducks (i.e. CV, Super M) imported from England and their crossbreds are raised in confinement and integrated with fish, with commonly 1,000 to 4,000 breeders in each farm. Often producers combine traditional techniques and incubators for hatching the ducklings. The system requires high initial investments and good knowledge for marketing the ducklings. Exotic and crossbred ducks for meat are usually fattened in permanent confinement, with flocks of 200 to 400 ducklings. This production system has developed rather slowly and only represents a minority of farms in Viet Nam (VSF, 2006; Edan *et al.*, 2006).

Poultry Trade and Markets

Many channels exist for the sale of backyard-grown poultry and poultry products; however, farm-gate sales to traders and neighbours seem to be dominant, followed by local market sales. The choice of product marketing is multifactor, with geographical location, distance to markets, density of traders, transportation networks, product price and transaction cost as its main determinants.

Figure 5 provides a visual description of market outlets and supply chains for smallholder poultry producers in northern Viet Nam. The boxed bolded titles and lines imply bigger flows, that is, were most of the poultry goes through to reach consumers. Poultry farmers sell their poultry products to traders who resell to wholesalers and retailers at market locations, and these are the purveyors to final paying-consumers.

Figure 5. Market outlets and supply chains of poultry in North Viet Nam, 2003.



Source: Tung and Costales, 2007.

Traders are divided into three categories based on transaction modes: assemblers, wholesalers and retailers. In rural areas of northern Viet Nam, the majority (62%) of poultry products passed through intermediaries, such as assemblers and neighbours, and the remaining (38%) through local open markets (Tung, 2005). Prices paid to small-scale traditional farmers were lower than those paid to semi-intensive commercial poultry farmers due to the quantity sold per transaction. A majority of respondents cited a marketing constraint in smallholder poultry production as being the small quantity of poultry products sold per transaction.

Transportation cost constitutes the bulk of transaction costs (56.1%) for all agents participating in smallholder poultry marketing, and the reason for this is due to numerous daily farm purchases they have to make, rising fuel costs, long distances to/from markets and poor road conditions. The second largest is material cost (25.8%), which includes ropes, baskets, feed for live birds, cushions for eggs and various plastic containers.

Dispersed geographical locations with different agro-ecological conditions within a country also represent a constraint for poultry-product marketing, especially due to accessibility to driveable roads and distance to/from markets. To this effect, Tung and Costales (2007) found that more

difficult agro-ecological conditions (i.e. highlands as compared to lowland valleys) and limited infrastructure in Viet Nam highlands have a strong negative impact on the overall financial performance and product quality of poultry producers; this is irrespective of whether they are small-scale traditional or semi-intensive/semi-industrial enterprises.

The substantially higher proportions of marketed live poultry and poultry products by smallholder producers in lowlands (98%) relative to highlands (9%) clearly exemplify the advantages of proximity to market centres. This is not only because products can be sold more easily, but other food items, different from poultry, can also be more easily purchased from poultry-derived income (Tung and Costales, 2007; Tung, 2005).

The traditional poultry supply chains support the livelihoods of not only small producer households, but also other low income households. The results of pilot surveys of poultry market participants (chicken farmers, chick producers, commune traders, wholesalers, slaughterhouses, and retail vendors) within and around Hanoi reveal a variety of salient characteristics which are relevant to pro-poor livestock policy design (Ifft *et al*., 2008). Small enterprises owned by low income households have a significant presence at every stage of poultry production, distribution, processing, and marketing. Thus, farmers are only one category of poor people who obtain income from participation in these supply chains. The surveys indicate that income from poultry is significant for households in each category, reflects long established small enterprise experience, and represents an important link between livelihoods of the urban and rural poor. For this reason, policies that affect smallholder poultry producers are likely to have strong collateral effects on other poor households in peri-urban or urban areas. Moreover, the surveys consistently reveal price premia for local varieties at every stage of the supply chain, compounding benefits of small enterprise participation.

Like their production systems, local bird varieties, and the long established consumer preferences for backyard chickens, smallholders and small enterprise intermediaries are deeply embedded in customary traditions. This apparently includes market interactions, which are almost universally governed by informal contracts and verbal agreements. While this approach may have benefits of lower transactions costs and flexibility, it has many disadvantages from both private and public policy perspectives. These traditional market dealings are in sharp contrast to the way big supermarket chains, the dominant marketing formats in industrialized countries, operate. Comparatively, the Asian region relies heavily on open markets, where bartering, wrangling and haggling are common person-to-person negotiation mechanisms to buy any sort of item displayed; whereas next to nothing or very little poultry products produced by smallholder rural farmers reach established supermarkets in major cities.

In the private context, lack of enforceable contracts or product certification undermines property rights, contributing to moral hazard and adverse selection. The uncertainty that prevails in traditional markets exerts a burden of risk that discounts average product values, undermining incentives to invest in quality or overcome costly barriers to expanded market access. In the context of animal health, these information failures can lead to serious escalation of disease risk and compromise biosecurity and food safety in other ways. Informal contractual systems make behaviour very difficult to predict, monitor contemporaneously, or reliably analyze ex post. All these challenges weaken market or health regulation systems. Simply mandating formal systems, like health certification, is an imperfect solution to this problem, as it may create adverse behaviour such as fraud or concealment. If markets are to be formalized effectively, regulators must find a way to reduce the transactions costs associated with these mechanisms.

In Viet Nam, there are many types of markets ranging in size, scope and theme. For example, the Ha Vi wholesale market in the outer districts of Hanoi is the biggest (of seven) live poultry markets (also known as wet markets) in northern Viet Nam with an average of around 10,000 bird transactions per

day. Overall, between 7 to 20 tons of live birds of different species are sold daily, and during peak season, sales can reach up to forty tons of live weight, which is equivalent to approximately 20,000 birds. Around three hundred semi-intensive, commercial smallholder farms (Figures 6 and 7) from Ha Tay and Ha Nam provinces are responsible for nearly half of the live poultry sold through the Ha Vi market (Soares-Magalhaes *et al*., 2007).

Figure 6. Number of birds (thousands) and share (%) by farm type sold through Ha Vi market.

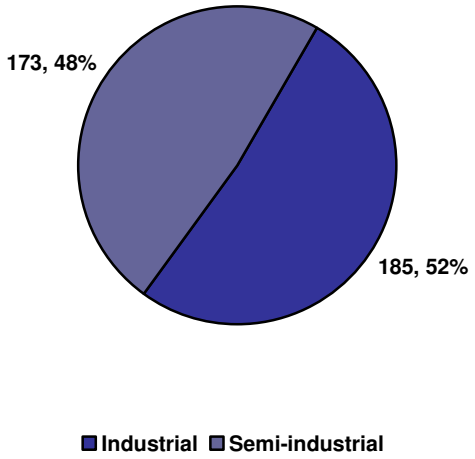
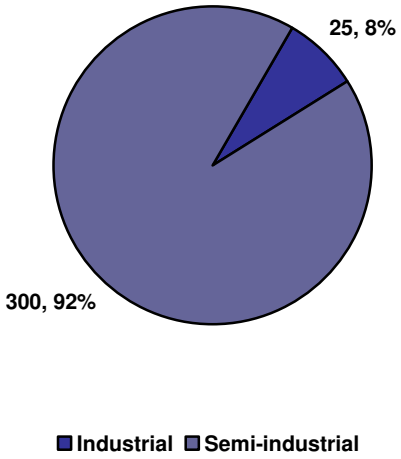


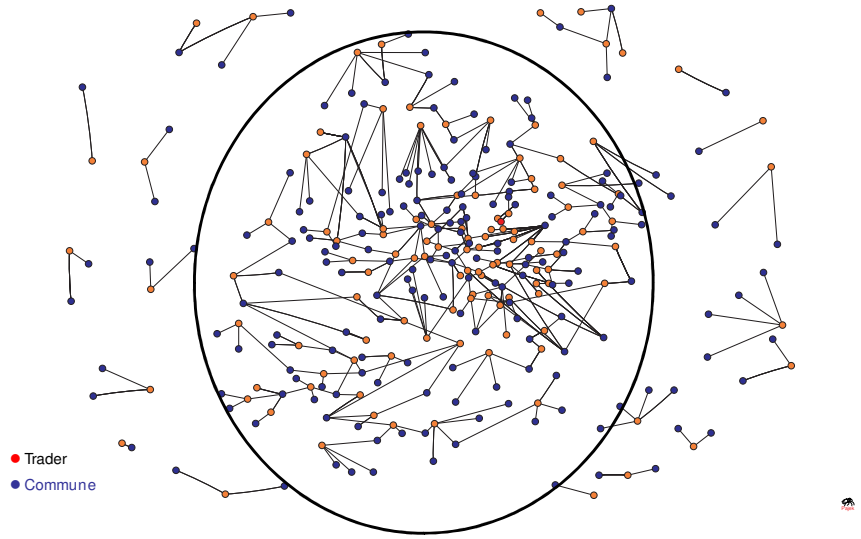
Figure 7. Number and share (%) of farms by type supplying birds to Ha Vi market.



Source: Authors' calculations based on the work of Soares-Magalhaes *et al*., 2007.

Figure 8 shows the linkages between communes in the vicinity of Hanoi, and clearly shows how the majority of communes are directly and indirectly linked through traders (Soares-Magalhaes *et al*., unpublished).

Figure 8. Poultry trade network linking communes in a sub-population close to Hanoi (circle indicates network of communes connected directly and indirectly through traders).



Source: Soares-Magalhaes *et al.* unpublished.

Chickens (mostly white commercial broilers) constitute around 60 percent of total poultry flowing through Ha Vi market, and birds are usually coming from Thai-owned CP group, Japa and Luong-My

poultry farms, with some other purveyed at local provinces. Many of the semi-intensive smaller commercial farms also produce white commercial breed chickens. Local ducks and Muscovy ducks account for 30 and 10 percent of poultry sold in Ha Vi market respectively, and many of these come from a state duck farm in Phu Xuyen district in the Ha Tay province (Kim Lan *et al.*, 2007). Quail, geese and turkeys volumes are too low to be accounted for in estimates, however, these do occur and supplies vary with seasons.

Kim Lan and collaborators (2007), with field data from a rapid rural market appraisal, ascertained that the price for local coloured chickens is 44,000 to 45,000 VND/kg (US$2.75 to US$2.81/kg), whereas white broilers are much cheaper at 23,000 to 24,000 VND/kg (US$1.44 to US$1.50/kg). The price for French crossed Muscovy ducks is 32,000 VND/kg (US$2.00 per kg). Chicken feathers are sold for 7,000 to 10,000 VND/kg (US$0.44 to US$0.63/kg) to Ho Chi Minh city traders who sell it to fertilizer-producing plants in Southern Viet Nam, while local duck and Muscovy duck feathers are dried and sold at 50,000 VND/kg (US$3.13/kg) to middlemen who export it to China (Kim Lan *et al.*, 2007). Prices received from visiting traders at farm gates are higher than those received from buyers in the commune markets.

Poultry trade is seasonal and peaks around the Tet festival, which is the biggest celebratory holiday in Viet Nam starting in early February. Poultry and poultry product sales are highest before and during this period, with 5 to 10 percent increases relative to other months of the year. Specifically for chickens, sales of unfinished birds increase 17 to 20 percent three months prior to Tet. Ducks, which are more frequently traded as unfinished birds than chickens, have higher trading frequencies 1 to 2 months prior to Tet holiday (Soares-Magalhaes *et al*., 2007).

Poultry and Livelihoods

Most households in rural areas of Viet Nam own livestock (Maltsoglou and Rapsomanikis, 2005). Livestock ownership is particularly high in mountainous areas, in the Red River delta region and along the Central coast. Households mostly own pigs and chickens, followed by cattle, ducks and 'other' animals. Overall, pigs are owned by 47.6 percent of households and 51.6 percent of households own chicken. In the rural Northern Mountains, Red River delta and Central coast areas, approximately 7 out of 10 households own pigs and chickens as part of their diversified livelihoods portfolio.

Contribution of Poultry to Household Income

Total household income in rural areas is considerably lower than household income in the urban areas. For example, households living in rural areas report a mean annual total household income of 743 US$ per year or 163 US$ per capita per year; while total household income in urban areas on average amounts to 2,497 US$ per annum or 584 US$ per capita per year (Maltsoglou and Rapsomanikis, 2005).

As shown in Figures 9 and 10, close to 50 percent of bottom quintile (Q1 and Q2) households practice extensive poultry production, whereas this only the case for 20 percent of the richest income quintile (Q5). The remaining 67 percent of non-poultry income in Q5 comes from alternative sources (i.e. paid jobs and other livestock). Intensive poultry raising occurs almost exclusively in Q5. Extensive poultry production is practiced in most income brackets, because it is a low input activity.

Figure 9. Poultry keeping and production system by income quintiles (values for 2001).

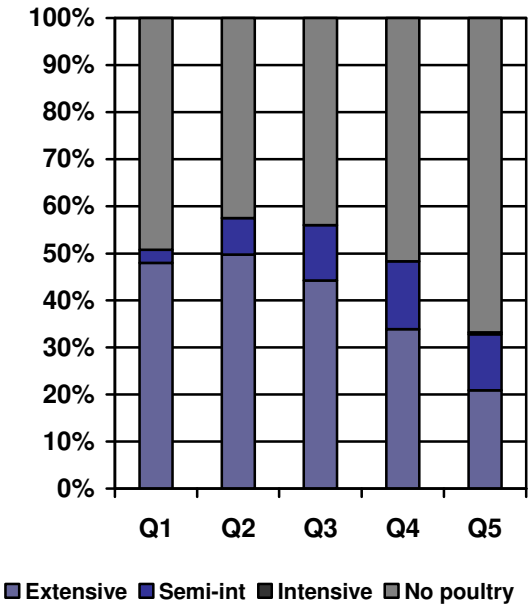
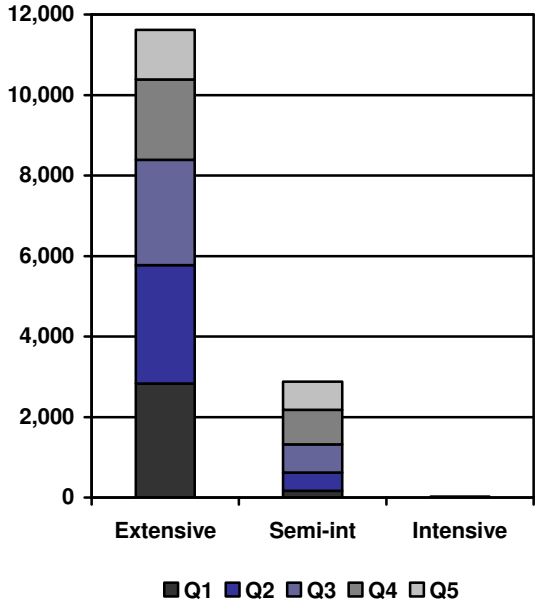


Figure 10. Income quintile status by poultry production system (values for 2001).



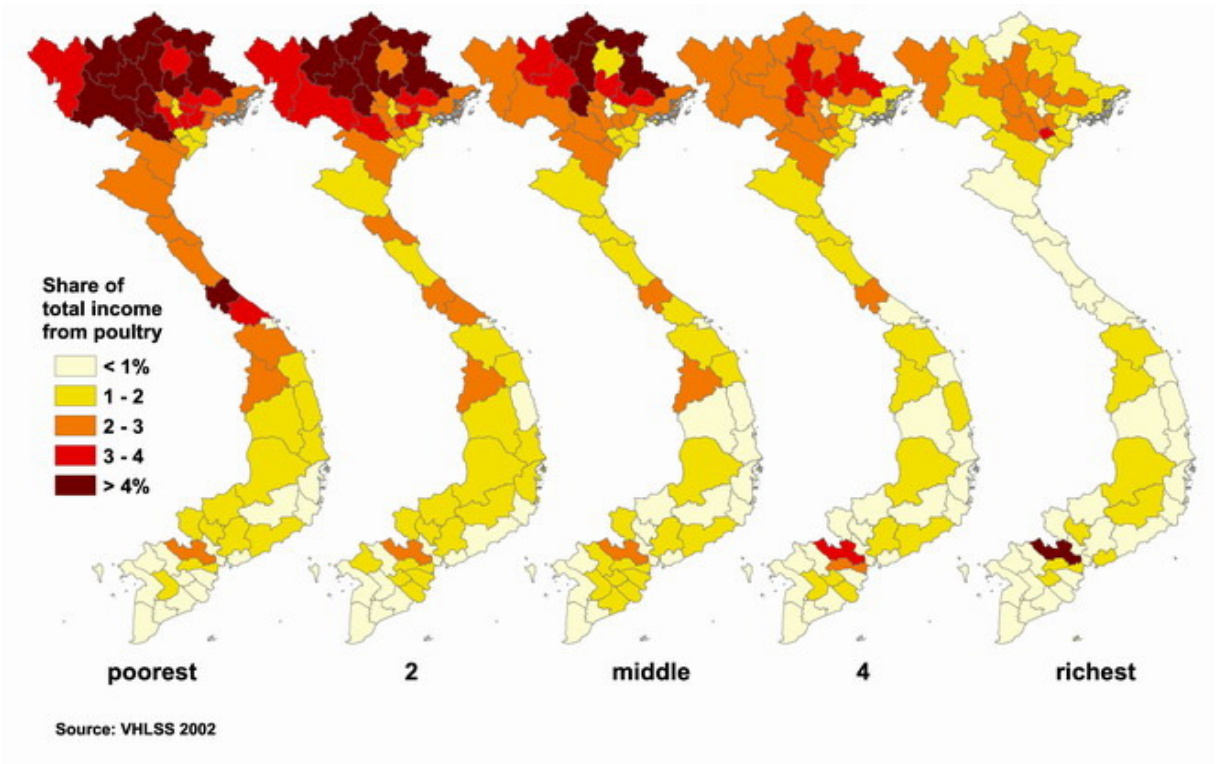
Source: Calculations based on VHLSS, 2002.

Pigs generate the highest average livestock income, with poultry accounting for around one quarter of the total income from livestock. Most income generated by pigs is realized through direct sales while home consumption constitutes only 10 percent or less of income from pigs across all household types. In Viet Nam, pigs are common livestock in households.

For chickens, the opposite is the case, with home consumption accounting for 64 to 95 percent of the income derived from chicken. Virtually all (>90%) cash revenue from livestock are derived from the sales of live animals rather than sales of livestock products (Maltsoglou and Rapsomanikis, 2005). This is also seen throughout SE Asian countries.

As with livestock overall, poultry production tends to be more important in the North compared to the South, ranging from 27 percent of rural livestock income in the northern uplands, to 18 percent in the Mekong River Delta, and more important for lower income groups (Figure 11).

Figure 11. Geographical shares of poultry income by income quintile.

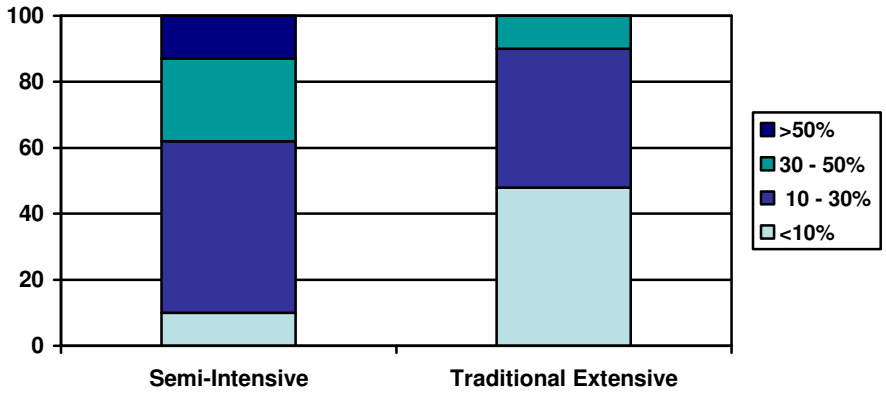


Source: Epprecht, 2005.

If one focuses exclusively on the poorest quintile in figure 10, it is striking to notice that the highest share of total income from poultry is found in the highlands and midlands of northern Viet Nam. It has been hypothesized that this compartmentalization of poverty could be due to several factors, including long distance to markets and poor market access, inexistent primary infrastructure, improper price communication channels as mobilization incentives, and higher distribution costs related to difficult agro-ecological zoning.

Figure 12 graphically contrasts the contribution of income from traditional extensive and semi-intensive poultry production to total household income.

Figure 12. Poultry-generated income as proportion of total household income.

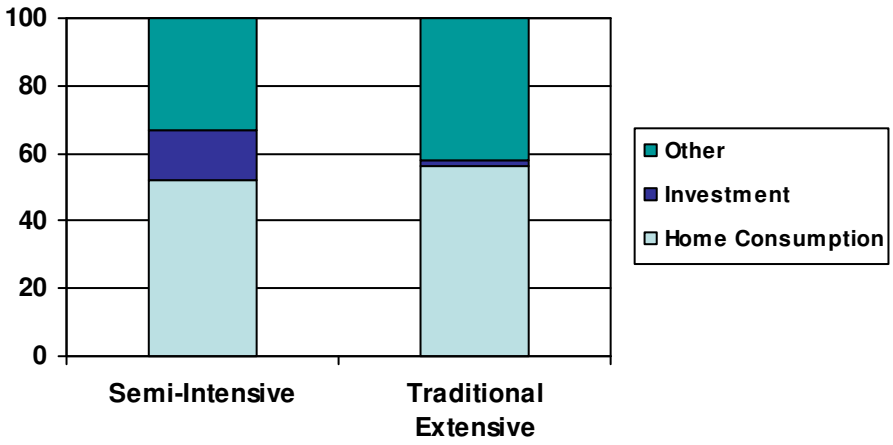


Source: Viet Nam General Statistics Office, 2004.

The above figure illustrates that the economic aspects of poultry raising are different between production systems. For smallholder farmers engaging in traditional extensive poultry production, this activity represents a source of protein to improve nutrition of children and adults but also serves as a 'sell-for-cash' tool, whilst poultry production very rarely constitutes more than 30 percent of household income. By contrast, small-scale semi-intensive producers usually derive proportionally more income from poultry (often more than 30%) due to their investments in intensification and their market orientation.

Poultry-derived income is used to cover various household expenditures, such as purchase of other food items for home consumption, school and construction materials, clothes, shoes, furniture, medications, fuel, replacements, transportation, repairs, asset and non-asset investments, and for many other purposes. For this reason, allocations into home consumption, investments and other expenses are separated, as seen in Figure 13.

Figure 13. Use of poultry-derived income.



Source: Viet Nam General Statistics Office, 2004.

As seen in the figure above, backyard-traditional extensive farmers use most poultry-derived income for home consumption, food purchases, and other purposes (95%), with little assigned to asset and non-asset investments. Semi-intensive farms are very similar in their spending patterns and allocations, as 40 to 50 percent of poultry-derived income is used for home consumption, 20 percent

for investments and the remaining 30 to 40 percent to cover other various expenses. It is evident that poultry, regardless of production system, is a preferred food.

Household Food Expenditure and Food Consumption Patterns

In a recent study, Maltsoglou (2007) examined expenditure patterns of Vietnamese households. Rural households have lower expenditure levels and higher food budget shares compared to urban households (Table 9). Rural households spend slightly more than 50 percent of their total income (in cash and kind) on food items, of which livestock derived food products account for slightly above 10 percent (i.e. for around 5 percent of total household expenditure). The bulk of the expenditure on livestock products is for meat, followed by eggs. Average annual per capita meat consumption in rural households is less than 7 kg (i.e. less than 20 g/day). Most (> 75%) of the meat consumed is pork, followed by poultry. The alternation of pig and poultry meat allows for flexibility in times of scarcity.

The share of fish, another source of highly valuable protein, in the food basket is nearly as high as that for livestock while the amounts consumed per year are larger than the respective amounts of meat (15.6 and 14.3 kg in urban and rural households respectively).

Table 9. Household expenditure shares in Viet Nam in urban and rural locations.

Variable	Unit	Urban	Rural
Household Size	Persons	4.3	4.5
Total Per Capita Expenditure	Int $	2,498	977
Food Share of Total Expenditure	%	41.3	52.6
Livestock Share of Food Expenditure	%	12.4	11.1
Meat Share of Livestock Expenditure	%	81.9	84.1
Egg Share of Livestock Expenditure	%	15.7	15.6
Annual Per Capita Meat Consumption	kg	10.3	6.7
Fish Share of Food Expenditure	%	9.6	9.7
Annual Per Capita Fish Consumption	kg	15.6	14.3

Source: Maltsoglou, 2007.

As income increases, these discrepancies in expenditure levels between urban and rural households increase while food budget shares decrease. Further evidence of this can be seen in figures 14 and 15, where food expenditures increase with income, but more so for non-food items (i.e. food budget share drops), especially in the highest income quintiles of urban and rural households. Higher food expenditure brings about a rise in red meat and fish consumption, but the increment in consumption of fish is much more pronounced in rural compared to urban settings. Regardless of income quintile, urban households consume a steady amount of fish throughout the year. Although not apparent from the data, one could imply that the nutritional profiles are better in urban areas and that they improve by income quintile.

Figure 14. Average total per capita expenditure by income quintile. (Values in International $). (Left = urban; right = rural households).

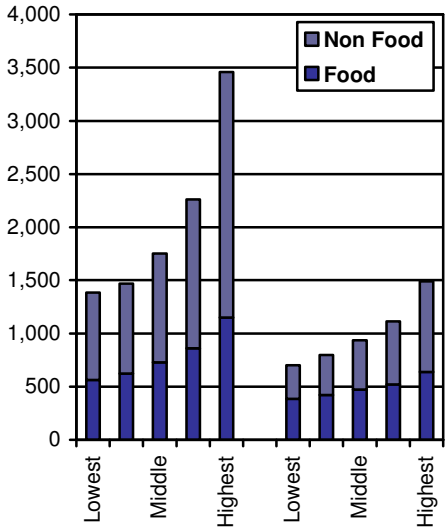
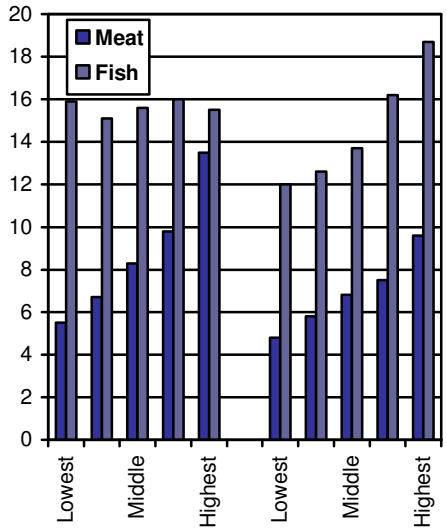


Figure 15. Annual per capita consumption of meat and fish per capita (kg) by income quintile. (Left = urban; right = rural households).



Source: Maltsoglou, 2007.

From 2004 - 2007, both pork and poultry are the two most consumed meats in Viet Nam (Table 10), consumed by more than 80 percent of households.

Table 10. *Per capita* meat consumption and percentage contribution in Viet Nam, 2004-2007.

Variable	2004	2005	2006*	2007*
Total (kg/yr)	20.9	23.1	24.5	26.0
Pork (%)	82.2	83.3	83.0	82.7
Poultry (%)	12.7	11.5	11.9	12.1
Beef (%)	3.5	3.7	3.7	3.7
Buffalo (%)	1.4	1.3	1.3	1.3
Other Meats (%)	0.1	0.2	0.2	0.2

Source: IPSARD, 2006 and MARD, 2004; * represents estimates.

Consumer Preferences for Chicken

Results of consumer surveys conducted in Hanoi (Ifft *et al*., 2007) indicate that the latter are not only very experienced buyers, but also quite discerning. In the household food budget, chicken accounts for about 9 percent of total food expenditure and 14 percent of food expenditure at home.

Three 'varieties' of chicken are available in Hanoi's markets: local varieties, industrial chicken, and crossbred birds that combine some characteristics of both. At the time the surveys were conducted (mid-2007), 54 percent of households consumed local chicken only, 14 percent consumed industrial chicken only, and 5 percent consumed crossbred chicken only. The remaining households (about 25 percent) consumed two or more types of chicken. Overall, only 33 percent of households consumed industrial chicken, of which almost all (>95%) buy cuts only (not whole birds), and none reported buying live chicken. Local varieties command nearly double the price of industrially produced birds clearly indicating consumer preference for particular product quality attributes, a fact that has important implications for demand-oriented policy interventions. In the context of HPAI this is particularly significant because smallholders are the main producers of chicken with these attributes.

In addition to the revealed preference for local chicken, a significant majority of consumers also expressed a willingness to pay a substantial premium for credible health / safety certification of local varieties. Given expressed doubts about public health initiatives, it may be desirable to complement these with private initiatives if these can be responsibly overseen and efficiently decentralized. These findings indicate that urban Vietnamese markets have the capacity to support demand oriented disease risk reduction measures. If consumers are willing to pay a safety premium large enough to finance a bird certification scheme, it could spare significant public expense. As a market based policy, a self-financed scheme would also foster a virtuous quality cycle among producers, encouraging them to make other quality improvements to raise revenue.

The Contribution of Poultry to Nutrition

Concomitant with economic growth, the proportion and number of undernourished has steadily declined between 1990-1992 and 2001-2003 (Table 11) while dietary energy consumption has increased from an average of 2,180 kcal/person/day to 2,580 kcal/person/day over the same period.

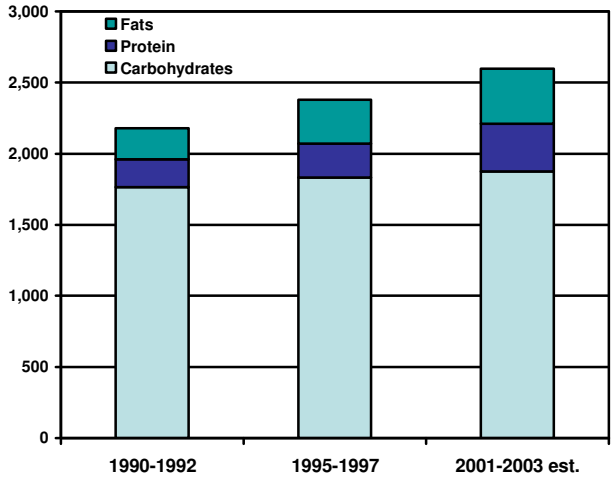
Table 11. Food deprivation in Viet Nam, 1990-1992 to 2001-2003.

Food Deprivation Parameters	1990-1992	1995-1997	2001-2003*
Proportion of under-nourished (% of total population)	31	23	17
Number of undernourished (in million)	21	17	14

Source: FAO – Country Nutrition Profile (Viet Nam). http://www.fao.org/ag/agn/nutrition/profiles_en.stm

Composition of dietary energy has also changed, with an increasing share of energy being provided by the consumption of fats and proteins (Figure 16).

Figure 16. Contribution of fats, proteins and carbohydrates to total energy intake in Viet Nam, 1990-1992 to 2001-2003.



Source: FAO – Country Nutrition Profile (Viet Nam). http://www.fao.org/ag/agn/nutrition/profiles_en.stm

Total protein consumption has increased from 50 g/person/day in 1990-1992 to 63 g/person/day in 2001-2003 while consumption of protein provided by poultry, which has prestige value as its often regarded as the central food around which meals are planned, has grown from 5.5 g/person/day to 6.9 g/person/day over the same period. The share of protein contributed by the consumption of poultry products has remained stable at around 11 percent.

In addition to being a source of energy and protein, poultry meat and eggs are a relatively rich source of well-absorbable minerals (especially Iron) and also improve absorption of iron from other foods. The amino acid composition complements that of many plant foods, and it is a concentrated source of B vitamins, including vitamin B_{12} which is absent from plant foods, as well as folate, thiamin, riboflavin, phosphorus, and zinc.

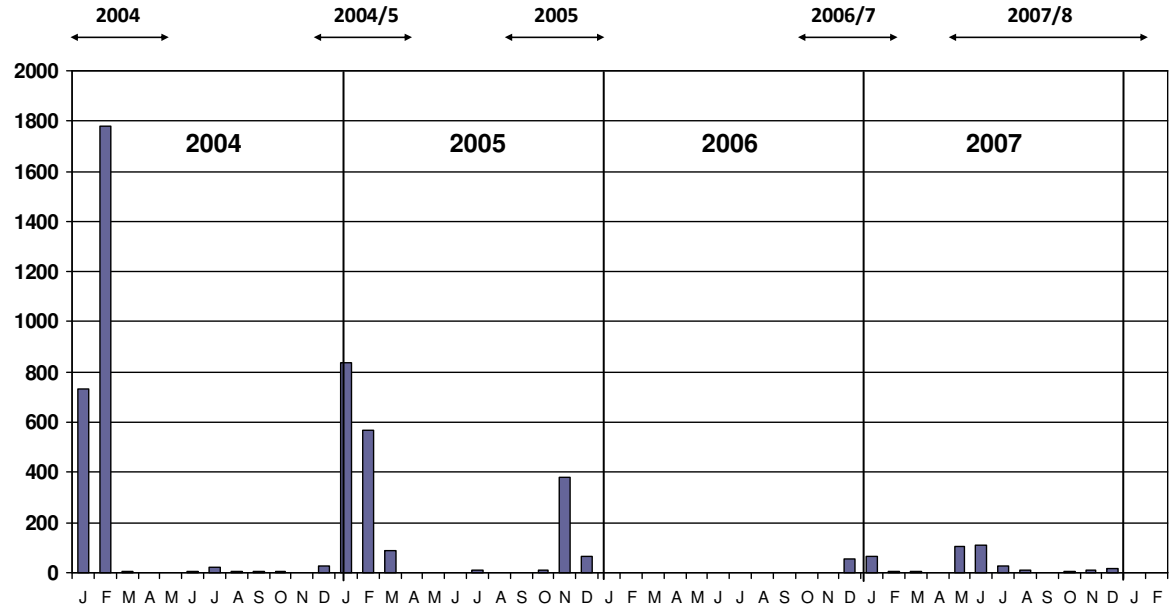
The HPAI Epidemic: Course and Institutional Response

The first strong indications that an epidemic disease was affecting poultry in Viet Nam became apparent in mid November 2003 when poultry farmers started noticing profound respiratory problems and morbidity followed by massive die-offs. After laboratory testing, it was concluded that HPAI was the cause. Since then, many birds have died as a result of disease and many more as a result of culling to contain the disease. The social and economic implications of the epidemic extend to the industrial, commercial and traditional poultry production systems. The government, in an effort to halt disease dispersion and to safeguard the wellbeing of its citizens, levied an array of disease mitigation measures with varying degree of success. Here, we examine the epidemic course and the institutional responses mounted.

Course of the HPAI Epidemic[1]

The source of HPAI H5N1 in Viet Nam is unknown, but it is suspected that infection might have originated from reservoirs of infection in wild water birds or illegal imports of infected poultry from neighbouring countries. Since then, three major waves have occurred in poultry and the country has attempted to control the infection through a range of measures. These waves can be seen in Figure 17. The three major waves were followed by two minor ones in 2006 and 2007.

Figure 17. HPAI outbreak epidemic waves in poultry in Viet Nam, January 2004 to February 2008.



Source: Pfeiffer *et al.*, 2007 and updated using World Animal Health Information Database (WAHID), OIE, 2008.

The first two epidemic waves were closely associated with the Tet (Vietnamese New Year) holiday period, and the last finishing one month before Tet. According to official reporting data, the first (2004) epidemic wave in early 2004 involved 2,506 outbreaks and lasted from Jan 10 until Feb 28 (i.e. for at least 49 days – but this is an underestimate by at least 14 days due to the lack of official commune-level records before Jan 10). A total of 38.8 million birds were reported to have been culled during this period. The epidemic had two peaks, one in mid January and the other in early

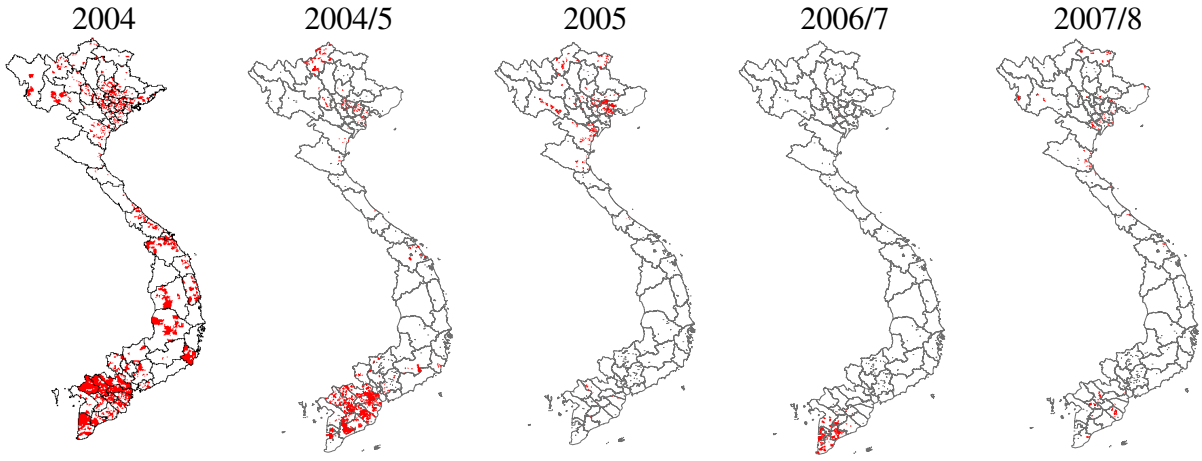
[1] Parts of this section are taken from Pfeiffer *et al.*, 2007, and have been partially updated using 2006-8 outbreak data.

February 2004. The second (2004-2005) epidemic wave commenced on December 4, 2004 and finished on April 1, 2005, it lasted for 118 days, involved 1,511 reported outbreaks, and 2.2 million birds we culled. The third (2005) epidemic wave started on October 20, 2005 and lasted for 58 days until December 17, 2005 with a single peak in mid November. It involved 457 outbreaks, and 0.9 million birds were culled (Figure 17). The fourth epidemic wave (2006/7) involved a much smaller number of outbreaks (n=122), but was similar to the first 2 epidemics with respect to timing prior to the Tet holiday period. There were 8 outbreaks in Feb-April 2007 linking the 4th and 5th epidemic wave. The fifth epidemic period (2007) involved slightly higher numbers of outbreaks, and this time in contrast to all prior epidemic waves the majority of outbreaks occurred in the middle of the year (May-June, n=216), with a tail into Nov-Feb 2007 (n=26).

It is unlikely that the occurrence of the first two epidemic waves was associated with increased virus survival in the environment in winter, as the climatic conditions vary significantly between the north and south of Viet Nam. The south is tropical and remains hot all-year round (26-33˚C), with a wet season from May to October and a dry season from November to April. In contrast, the north has a distinct summer (June to August) and winter period (November to April) with temperatures as low as 10˚C in January. It thus appears that increased movement of people and poultry prior to the Tet festival period was a significant factor for the disease spread during the first two epidemic waves in 2004 - 2005 (Figure 17).

Although a nationwide vaccination campaign was instituted in Viet Nam in the fourth quarter of 2005, outbreaks continued to occur in late 2006, throughout 2007 and one in Feb 2008 (Figure 17). The spatial pattern for each of the five epidemic periods is presented in Figure 18.

Figure 18. Spatial patterns of five HPAI epidemic waves in Viet Nam, 2004 – 2008.



Source: Pfeiffer *et al.,* 2007, updated with 2006-8 data from Department of Animal Health, Hanoi, Viet Nam.

In the 2004 epidemic period, 23 percent (n=2,312) of communes reported at least one outbreak, in 2004-2005 it was 6.3 percent (n=630) and in 2005 only 2.9 percent (n=293). A spatial cluster analysis revealed that there were three clusters of outbreaks in Viet Nam for the epidemic periods 2004 and 2004-5. The primary cluster was located in the Mekong delta south of Ho Chi Minh City. One secondary cluster was identified east of Hanoi and included the city of Hai Phong and another tertiary cluster was found around the city of Da Nang in the central part of the country.

Both, the 2004 and the 2004/5 epidemic waves, occurred in similar geographic locations with major foci being the Mekong and the Red River deltas. This suggests the presence of important risk factors for spread of infection in these areas, such as the high percentage of surface water which would support higher densities of domestic and wild water birds (i.e. ducks and geese) compared with other

parts of the country. The number of communes affected in the 2004/5 outbreak period was less than a quarter of those affected in 2004. The magnitude was even lower between Jul 2005 and Jan 2006 (n=476) and a total of 419 across the whole period Dec 2006 - Feb 2008.

While the disease risk for a commune was reduced, the focus of infection broadly remained in the same geographical locations, suggesting the key risk factors remained the same. The situation changed in the third epidemic wave in 2005 when a smaller outbreak occurred with a single focus in the north seemingly disconnected from the Tet festival. The change in terms of timing and geographical location of this wave compared with previous ones indicates that the relative importance of key risk factors changed from the 2004-2005 to the late 2005, 2006/7 and 2007/8 outbreaks, probably associated with the control measures implemented by Viet Nam's authorities. It is particularly noticeable that the 2007/8 epidemic wave involved much fewer outbreaks, but over a 10 month period starting from May 2007.

The number of infected flocks by size class and approximate risk of contracting HPAI by flocks falling into different size classes during the second (Dec 2004 to Mar 2005), third (Oct to Dec 2005) and fourth (Nov 2006 to Mar 2007) epidemic waves is shown in Table 12. During the first wave, infection status was not determined for all flocks suspected of having HPAI; therefore, no data is presented for the first epidemic wave.

Table 12. HPAI outbreaks by flock size class during the second, third and fourth epidemic waves in Viet Nam.

	Second wave 2004/5		Third wave 2005		Fourth wave 2006/7	
Flock size class	Outbreaks	Outbreaks / 1,000 flocks	Outbreaks	Outbreaks / 1,000 flocks	Outbreaks	Outbreaks / 1,000 flocks
1 – 50	93	0.01	48	0.006	34	0.004
51 – 500	447	1.04	160	0.37	44	0.10
501 – 1,000	211	62.13	77	22.67	19	5.59
1,001 – 3,000	182	91.64	77	38.77	15	7.55
> 3,000	72	100.42	50	69.74	2	2.79
Total	**1005**	**0.12**	**412**	**0.05**	**114**	**0.01**

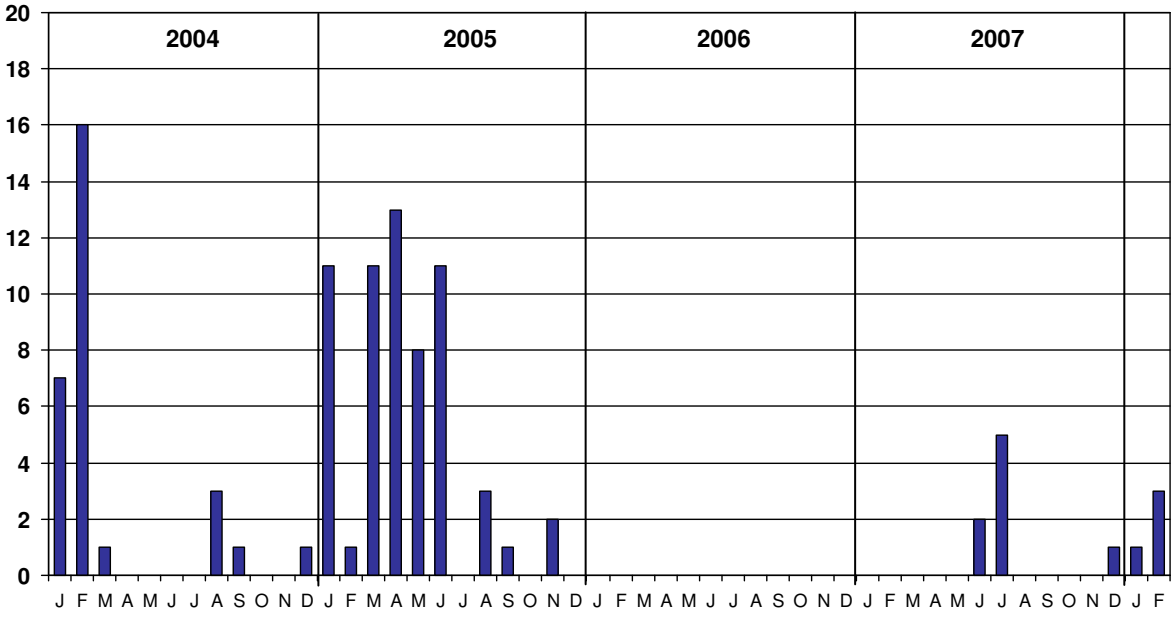
Source: Otte *et al.*, 2008.

The duration of the first three epidemic waves was between 2 and 4 months, but it should be recognised that the 2005 epidemic wave only involved comparatively limited spatial spread, even in the absence of vaccination. The 2005 epidemic wave commenced towards the end of the vaccination campaign, and occurred only in the north forming a cluster that had already been observed in 2004. These findings suggest that the combined effects of the government's measures had been effective at preventing an outbreak in 2005 in the southern and central parts of Viet Nam. The data do not allow unequivocal attribution of this result to vaccination, since other control measures were applied at the same time. The 2005 epidemic wave in the north, which commenced around the time of the completion of the vaccination campaign, might have been caused either by poor vaccine efficacy or the movement of vaccinators between flocks resulting in spread of existing infection. It is unclear why a similar effect was not observed in the rest of the country, but it should be noted that there are likely to be differences in the delivery of control measures between the north and the south of Viet Nam, and also within provinces in a same region. In contrast to 2005, the 2006/7 epidemic wave occurred in the South of Viet Nam, whereas 2007/8 involved very small numbers of outbreaks both in the North and South. These patterns can probably be attributed to breakdowns in vaccination coverage. But they also demonstrate that the vaccination coverage together with other control measures was able to maintain infection at very low levels.

Consistently across the first three epidemic wave periods, however, risk decreased with increasing distance from higher density human population areas. This effect may be associated with decreased local trade of poultry, or less sensitive disease reporting. Also, increasing values for proportion of land area used for rice paddy fields, density of domestic waterbirds and chickens were associated with a higher risk of outbreaks. These findings lend support to the hypothesis that the contact structure within poultry and particularly domestic duck populations within the rice paddy production system of the river delta areas is important for the maintenance and spread of HPAI virus. Assuming that the increased movement of people and live poultry prior to the Tet festival was a key risk factor for the first two epidemic waves, the occurrence of smaller outbreaks between the main epidemics and the recurrence of epidemics in 2006/7 and 2007/8 supports the hypothesis of the presence of a fairly widespread infection reservoir in Viet Nam, possibly in domestic and wild birds.

From late 2003 until early 2008, there have been a total of 105 confirmed HPAI cases in humans with 51 deaths, resulting in a mortality rate of 48.6 percent. The bulk of cases and deaths occurred during 2004 and 2005, specifically during the months of December to March. Confirmed HPAI cases in humans follow a similar temporal pattern to the one occurring in birds (Figure 19). This is probably due to the close proximity of birds and humans in Viet Nam urban and rural households and the lack of standard hygienic practices before, during and after preparing meals. Most of these cases occurred after individuals cared, handled or played with sick birds. Some cases did not have immediate contact with birds, but they did have contact with a sick relative in home for which they where tending medical care.

Figure 19. Human cases of HPAI in Viet Nam, 2004 – 2008.



Source: World Health Organization, 2008.

Animal Health Services and Institutional Response

Viet Nam's animal health system is structured as follows: The Department of Animal Health (DAH) under the Ministry of Agriculture and Rural Development (MARD) coordinates national disease control policy, while six Regional Veterinary Centres manage their particular territories. Each province has a sub-Department of Animal Health (PSDAH), and there are more than 600 District

Veterinary Services (supervised by the PSDAHs). D'Andlau *et al.* (2004) find that in Viet Nam, in contrast to many developing countries, geographical coverage with respect to animal health professionals is quite good. Delquigny *et al*. (2004), however, report a lack of coordination between central and provincial levels resulting in difficulties in applying national decrees, while animal health inspectors frequently report a general lack of staff to keep up with inspection needs. The public animal health system is supplemented by a network of private para-veterinarians, but there is little public-private coordination.

In January 2004, Viet Nam established the *National Committee for Avian Influenza Disease Control and Prevention* as the national coordination mechanism for HPAI planning and supervision. It is chaired by the Minister of Agriculture and Rural Development. Ministries of Health, Public Security, Transportation, Trade, Foreign Affairs, Culture and Information, Science and Technology, and Natural Resources and Environment are members. This Committee meets on a weekly basis to brief the Government on the evolution of the disease situation and report on the implementation of the control measures. The Prime Minister and Deputy Prime Minister have chaired several of these meetings. The National Committee has also been entrusted with the responsibility for Government – Donor coordination.

More specifically for the human health aspects, a *National Steering Committee for H5N1 Avian Influenza among Humans (NSCAI)*, chaired by the Minister of Health, evolved from the *National SARS Steering Committee* established in 2003 (MARD, 2006). In September 2005 the NSCAI prepared a National Preparedness Plan in response to Avian Flu Epidemic H5N1 and Human influenza Pandemic, which was approved by the Prime Minister in November 2005. This integrated plan designed responsive measures under WHO's pandemic phases and scenarios, and allocated responsibilities and actions for ministries, People's Committees at all levels and other organisations. In February 2006, the government established a National Task Force under the NSCAI, whose main task has been to develop the *Integrated Operational Program for Avian and Human Influenza.*

The Vietnamese animal health services implemented a range of control measures to combat the disease. These included large-scale culling, movement controls and closure of live poultry markets, banning poultry keeping in some major cities, campaigns to educate the public about preventive measures, as well as, from 2005 onwards, large-scale vaccination campaigns (see Box 2).

The culling policy was been revised after the first epidemic wave (44 million birds culled) as it became clear that extensive culling based on pre-established geographic criteria (i.e. 1-km radius ring culling) was expensive and hard to perform given that farmers were not willing to give up apparently healthy birds. In addition to the direct cost of culling, farmers demanded compensation, which also represented a major fiscal burden (Anh Tuan, 2007). In subsequent waves, targeted culling of high-risk bird populations immediately adjacent to infected farms was employed, dramatically reducing the number of birds culled. By late 2005, voluntary culling with compensation was instituted with mixed results.

Following to two pilot vaccination campaigns in the provinces of Tien Giang and Nam Dinh in August 2005; the first systematic large-scale vaccination campaign was conducted from late September to the beginning of November 2005, focussing mainly on the high risk areas in the Mekong and Red River deltas with around 85 million chickens, 39 million ducks and 79 million domestic water birds being vaccinated. A second vaccination campaign took place in 2006 with more than 180 million doses applied. A third campaign, which covered 63 provinces, was completed in September 2007 (Table 13). A total of 165 million poultry were vaccinated during this period (see Annex 2 for details).

Table 13. Avian Influenza vaccination campaigns and rounds*, 2005 – 2008**.

Year	2005	2006	2006	2007	2007	2008	2008
Rounds	1st	1st	2nd	1st	2nd	1st	2nd
Chickens	84.6	64.6	58.8	87.4	90.9	-	-
Ducks	39.0	28.2	32.3	77.0	66.1	-	-
Doses***	-	-	-	-	-	250	500

Source: Vietnamese Department of Animal Health and World Health Organization, Jan 2004 – Dec 2007.
Notes: * values in millions; ** 2008 data provided by J. Hinrichs; *** No. of poultry vaccinated not yet reported.

Vaccination rounds in 2008 are more expansive than previous ones. This is because booster vaccines need to be given to previously vaccinated birds, but also because lessons have been learned about how to implement nationwide campaigns, plus the higher acceptance towards vaccination as a prevention measure by farmers. Although the actual number of poultry vaccinated is yet to be released by Vietnamese veterinary authorities for 2008, it is already known that vast amounts of vaccine doses are going to be used (from 250 to 500 million). The vaccines used are manufactured in China and sold at a discount to Viet Nam (US$1.6 cents per dose). Viet Nam is attempting to establish a national vaccine manufacturing capacity. Preliminary plans are set to start vaccine manufacture by mid-2008.

Box 2. Chronology of HPAI control measures implemented by Viet Nam's animal health services.

Year	Month	Measure
2004	March	• Decision to compensate 5,000 VND per mature bird, 2,000 VND for other poultry, 500 VND for quail and 300 VND for eggs
	April	• Decision to provide financial support of 5,000 VND (compulsory culling) and 2,000 VND to buy DOCs for restocking • Animals and their products, when transported in large quantities out of districts, must be declared by owners to veterinary agencies
	October	• Areas infected with HPAI are immediately subject to quarantines, and the application of control and eradication procedures
2005	March	• No livestock, its products, animal feeds, tools and animal waste are allowed to be introduced into or removed from epidemic areas
	June	• Decision to provide financial support of 15,000 VND (compulsory culling) and 3,000 VND to buy DOCs for restocking
	July	• Local animal inspectors can contain infected sites by creating temporary veterinary stations to monitor movements • Clothes, implements, facilities, vehicles, buildings and carcasses in contact with AI infected birds must be cleaned and disinfected • Volumes of: 50 poultry destined for slaughter, 100 chicks for raising, 30 kg of fresh eggs and 500 kg of egg powder require inspection • The sale of any animal products that does not carry veterinary hygiene seal is prohibited
	August	• Implementation of two pilot vaccination campaigns in Tien Giang and Nam Dinh provinces
	September	• Start of large scale vaccination campaign using inactivated H5N1+H5N2 vaccines in high risk areas of the Mekong and Red River deltas
	October	• Hatching prohibition of all poultry eggs for at least three months; compulsory vaccination of DOCs • Affected poultry farmers get 1-yr loan payment suspensions; entitlement of preferential rate loans for risk diversification purposes • Ban on poultry farming and sales of live poultry in 15 towns and cities; monitoring of incoming birds

Year	Month	Measure
	November	• Only slaughter birds can be marketed in urban areas; bans trade in live birds and their slaughter at market places • Transport of live poultry and unprocessed products is banned 21 days after the last outbreak day; use quarantine stations at entrances • Transport vehicles need to be cleaned before and after each transport batch; illegal to slaughter animals in unauthorized locations • End of large scale vaccination campaign (85M chickens and 79M water birds) • Decision to provide financial support of 10,000 VND (voluntary culling) and 3,000 VND to buy DOCs for restocking • Inspectors entrusted with ensuring adherence to laws and standards on food hygiene, handling and safety; fines can be issued
	December	• Slaughterhouses need be 1000m away from poultry houses; health certificates should be presented for poultry products sold at markets • Waterfowl and chickens should be kept apart and slaughtered separately by different individuals; sick birds not allowed to enter • Concentrated slaughtering should be integrated with industrial poultry rearing following strict veterinary and food safety standards • Prohibits trade in animals infected with pathogenic agents, any degenerated and contaminated food, and un-inspected animals • Farmers are obliged to implement hygienic regulations, facilitate relevant inspections and inform authorities in the event of disease • Poultry sold must be healthy, clearly sourced and inspected by veterinary authorities; sale of blood curd is forbidden
2006	February	• Breeders at large scale farms resume egg hatching; duck and geese hatchings remain banned through Feb 2007
	September	• Veterinary inspections of locally issued seals is enhanced and enforced
2007	February	• Commercial waterfowl egg hatching and raising farms as ducks, muscovy ducks and geese are not to be located within municipal and urban areas; eggs hatched need to be declared and registered; free-range geese raising is not allowed; backyard poultry raising only with a surrounding fence.
	October	• Stricter conditions for poultry incubation are levied, especially with registration and hygiene issues; water fowl raising only allowed for vaccinated animals.

Poultry sales were twice completely stopped in Hanoi in February 2004 and in November-December 2005.
Source: Ministry of Agriculture and Rural Development, Decrees and Legislations, 2004-2008.

Although extension services exist throughout Viet Nam, a study by VSF (2004) reported their presence in only around 30 percent of villages. Furthermore, public extension services have traditionally not focused their support to poultry because for most producers it is an '*activity involving little outlay of capital or time*' (ACI, 2007).

Social and Economic Impact of HPAI and Control Measures

The quantification of the impacts of avian influenza (and of other epidemic diseases) is complicated by the fact that direct impacts on livestock producers will propagate up- and downstream through related supply and distribution networks, that short-term reactions are likely to be followed by longer-term adjustments, that impacts include direct cost elements and revenue foregone, and that losses to the poultry sector will, at least to some extent, be 'externalized' on the one hand and, on the other hand, be compensated for by gains in other livestock sub-sectors.

Immediate Impacts through Mortality and Public Intervention

Immediate impacts of HPAI result from morbidity and mortality caused by the disease and from the cost of control measures taken by producers and the public sector. In Viet Nam, the latter include major culling exercises, marketing bans, and mass vaccination and information campaigns. HPAI and HPAI control measures not only result in direct losses through asset destruction but also in indirect losses through downtime and forgone income. Compensation payments and other public mitigation measures implemented by the Government of Viet Nam (GoV) transferred some of the financial burden from the private to the public sector.

From December 2003 to March 2008 a total of 59.3 million poultry died or were culled (see Table 14). The bulk of poultry died or were culled during the first HPAI wave (around 20 percent of the standing poultry population was culled) and GoV reported a resulting loss of 1,200 billion VND (approximately US$ 75 million) from culled poultry and another 1,800 billion VND (app. US$112.5 million) lost as a result of production and marketing bans (FAO/MARD, 2007). Including culling and disinfection costs, the Department of Agriculture estimated the total economic costs of the first wave of HPAI outbreaks to reach more than US$200 million (Giao and Son, 2004). Although this loss was less than 1 percent of national GDP, severe distributional impacts occurred within the poultry sector.

Table 14. Poultry lost (dead and culled) from HPAI outbreaks (millions).

Poultry lost	1st Wave (Dec03-Mar04)	2nd Wave (Apr04-Nov04)	3rd Wave (Jan05-Apr05)	4th Wave (Dec06-Feb07)	Feb 07 – Mar 08
Number	57.20	0.09	1.80	0.10	0.12

Source: FAO/MARD, 2007 and FAO Viet Nam Database.

Culling, market bans, movement restrictions and temporary poultry price decreases (see next section) led to financial losses throughout the entire poultry sector. Worst affected were those farmers for whom poultry raising represented the main income source and who had made substantial investments into their poultry enterprise. VSF (2004) for instance analysed the case of a 5,000 broiler family farm that lost poultry due to HPAI. The total loss amounted to US$11,748 which includes US$1,270 lost income due to production downtime. The financial impact of market restrictions and price movements on a semi-industrial poultry farm in Northern Viet Nam is reported in FAO (2005b). The farm (800 hens, 1,100 broiler chicken and 1,300 ducks) did not loose poultry due to HPAI, but movement restrictions resulted in delayed sale of the broilers causing losses in the order of US$2,000. Farmers mitigated the impacts of marketing and movements bans by reducing feeding, but nevertheless broiler and layer keepers were still incurring maintenance costs, without receiving revenues from sales, and some farmers resorted to voluntary culling to limit the losses from HPAI control measures (GSO, 2004).

Smallholders also incurred losses, although of a lower absolute and relative magnitude. According to a study conducted during the first outbreak wave in April/May 2004 in villages in the highlands of

northern Viet Nam by VSF (Delquigny *et al*., 2004) smallholders with an average flock size of 60 birds incurred a total loss of US$ 105 through lost birds (US$ 90) and two months of production foregone. The average income from poultry farming in the area studied was of US$ 165 per farm per year. Based on data from Vietnamese household living standards surveys, Roland-Holst *et al*. (2007) estimated that for the vast majority of poor households a total stock loss would represent less than a 10 percent income loss, while based on the same data, Phan Van Luc *et al*. (2007) estimated that traditional smallholder farmers would on average loose 2.1 percent of total income through a total cull of their poultry and 0.8% from a sales ban. It has been reported that smallholders partially offset losses from animal diseases by consuming sick and recently died birds.

In Ho Chi Minh City the number of wholesale egg markets was reduced from 134 to 75 while the number of poultry markets dropped from 1,550 to 7 due to government regulation (ACI, 2007).

In March 2004, subsequent to the 1st outbreak wave, the GoV implemented a compensation policy. The determined per bird compensation payment was 5,000 VND with and additional 2,000 VND for the purchase of DOCs for restocking. On average this only covered 10-15 percent of the poultry market value (Riviere-Cinnamond, 2005). The compensation payment scheme has been revised in June 2005, and the current compensation rate is 15,000 VND per bird and an additional 3,000 VND for replacement DOCs. In November 2005, farmers who voluntarily culled their poultry became eligible for compensation at a rate of 10,000 VND per bird (FAO/MARD, 2007).

A substantial share of the HPAI control costs in Viet Nam result from the mass vaccination campaigns. The GoV covers most of the expenses of two campaigns per year, which currently cost GoV around US$20 million a year (FAO/MARD, 2007).

Immediate Direct Impacts through Consumer / Market Reactions

Although there is no evidence for food-borne transmission of HPAI; demand for poultry was severely affected leading to a domestic market shock. During the first months of the 2004 HPAI outbreaks poultry prices plummeted: Prices of eggs dropped from 900 VND to 500 VND while prices of birds dropped from 15,300 VND to 8,000 VND per kg live weight (FAO, 2005b). The second outbreak wave in early 2005 also resulted in a 50 to 60 percent price drop and 50 percent drop in sales of poultry in Vietnam (ACI, 2007). Overall, HPAI has resulted in marked price fluctuations with periods of consumer 'anxiety' followed by periods of high demand and supply shortage. Thus, the price of industrial chicken meat sold in Hanoi markets was 38,000 VND before the crisis in December 2003, 60,000 VND in summer 2005, and about 55,000 VND in January 2006 (Figué and Fornier, 2005 and VietNamNet, 2007).

Overall, the amount of poultry meat consumed dropped as consumers substituted poultry meat with other types of meat and fish as an alternative protein source, leading to increasing prices for the latter. In the first 3 months of 2004, the foodstuff price index of the whole country increased by 9.9 percent relative to December 2003 (GSO, 2004). A sharp increase in demand for pork meat resulted from shortages of poultry meat supply and in 2005 pork wholesale prices increased by an average of 21 percent in 2005 over 2004 (FAS, 2006). Total meat production (and consumption) in Viet Nam did not decrease during the HPAI crisis.

In major cities, shifts in demand for poultry and poultry products were also accompanied by changes in purchase location. In Ho Chi Min City for example, purchase of backyard chicken from market stalls dropped from 34 percent to 12 percent while purchases of chicken eggs from market stalls dropped from 56 to 32 percent. On the other hand, the proportion of households sourcing their chicken and eggs in supermarkets increased. Urban households also changed the purchase form of chicken

products. Before HPAI 40 percent of sample households reported buying live chicken while with the advent of HPAI this proportion dropped to 15 percent (Phan Ti Giac Tam and Reardon, 2007).

Short-term Indirect Flow-on Impacts

The direct impacts of HPAI on producers were propagated up- and downstream through the poultry industry, and, given horizontal linkages, to other sectors as well.

The reduction of poultry operations was severely felt by the feed industry, where individual producers faced drops in demand as high as 90 percent (ACI, 2007). The construction of CP's fourth feed factory in Viet Nam was suspended for two years (*Bangkok Post*, March 25, 2004). Similarly, the demand for DOCs declined sharply and the farm gate price for day-old chicks dropped from US$ 0.25 to US$ 0.10 in northern Viet Nam (FAO, 2005b) and Cargill Viet Nam was forced to close down its chick breeding farm in 2005.

After the Vietnamese government banned the sale of chicken, Thai-owned Kentucky Fried Chicken franchised stores in Viet Nam had to close shops for weeks before reopening and changing the menu to serve fish instead of chicken (*Financial Times*, January 29, 2004).

As ducks are important for pest control in paddy rice, rice farmers in the Mekong Delta complained that the reductions of duck numbers in the rice fields resulted in increased damage from golden snails, increased occurrence of viral diseases in the spring-winter crop in 2006, and as a result lowered their net incomes (Men, 2007).

Mitigation measures to cope with liquidity problems of poultry farms were implemented by the GoV and the Viet Nam Bank for Agriculture and Rural Development (VBARD). The maturity of existing loans was extended and the ceiling for loans without collateral was increased from US$ 1,900 to US$ 3,170 (Ngoc, 2004). Nevertheless, effective access to new loans decreased after the first wave of outbreaks while at the same time the share of farms using informal credit sources increased. HPAI outbreaks had increased the economic risk in the poultry sector which led to both decreased demand for new credits and restricted issuance of loans by formal institutions (GSO, 2004).

The threat of animal-to-human transmission of HPAI could have implications for the rapidly growing tourism sector in Viet Nam. However, there was no indication that the tourism industry was adversely affected to any significant extent in 2004 when cases of HPAI in humans were reported from Viet Nam.

Medium- to longer-term Impacts and Adjustments

In contrast to the substantial losses faced by specialized poultry farmers, more diversified farmers were able to adjust their production portfolio to take advantage of other, more profitable, activities. All poultry producers were faced with substantial losses from plummeting poultry product prices during the first months of the outbreak, but, if they could absorb this shock, benefited form higher prices subsequent to the first outbreak wave. Since prices for other meats increased, farmers keeping not only poultry but also pigs were less affected. Farmers partially replaced or substituted the decreasing returns from poultry with those from other livestock. Phong *et al*. (2007) compared the gross margin of 90 households in the Mekong Delta between December 2002 and December 2004. They found that the HPAI crisis had not affected the gross margin of the surveyed farms. In 2004, 23 percent of the farmers had stopped raising chicken and 30 percent had stopped raising ducks compared to the situation in 2002 but had intensified the aquaculture and pig components to compensate for the decreased returns from poultry.

While industrial poultry producers have been affected significantly during the outbreaks themselves, they have recovered substantially in post-outbreak periods and remaining market chain participants are receiving greater returns than before. The main impacts of government and consumer responses to HPAI have been on the market outlets and trade flows. Backyard and semi-intensive producers have reduced access to higher value markets in urban centres and are relegated to supplying local markets within the district of production (Phan Van Luc *et al.*, 2007). Furthermore, there is evidence that within value-chains downstream players (slaughter houses / companies) are capturing an increasing share of the overall benefits.

With regard to consumer adjustment, it appears that Viet Nam has reached stage '5' as described in Beardsworth and Keil (1997), namely '*fading public concern creating a new equilibrium state characterized by chronic low-level anxiety*' (cited by Figué, 2007), where the impact of HPAI is mainly manifested in the frequency of consumption and quantity of poultry consumed. Whereas 60 percent of the surveyed population used to consume poultry several times a week in 2003, in 2006 the majority of respondents consumed poultry a few times a month.

Conclusions

Despite significant economic and structural change in Viet Nam over the past decades, agriculture remains the predominant source of income for the majority of the Vietnamese people absorbing around 65 percent of the nation's labour force and being the predominant source of income in rural areas, in which still nearly three quarters of the population live.

Within agriculture, the livestock sector is one of the fastest growing sub-sectors, outperforming agricultural growth as a whole by a substantial margin. Although large-scale, industrial livestock production is growing fast, the bulk of livestock production, be it pigs or chicken, the preferred source of meats in Viet Nam, is in the hands of smallholder producers, relying on traditional extensive or semi-intensive production methods. For poultry, it appears that over the past decade small to medium scale, semi-intensive production units have increased their share in national production vis-à-vis traditional extensive as well as large-scale intensive poultry production units. Thus, despite rapid growth of the poultry sector, smallholders still constitute the vast majority of poultry keepers, keeping the majority of poultry, which are in most cases marketed through associated informal trade networks.

Policy makers need to realize that animal diseases and their spread are a result of biological processes and economic behaviour of livestock keepers and traders. For this reason, policies to effectively control diseases need to recognize the complexity of its interactions with social and economic institutions. This is particularly important in the context of managing HPAI disease risk along Viet Nam's poultry supply chains, even if many of the stakeholders involved have alternative sources of income. Ultimately, the effectiveness of disease prevention and response is determined by the commitment of the primary producers and their supply chains to implement risk management protocols and the central question becomes how to motivate producers to take appropriate actions which have a cost to them but benefits beyond them.

Viet Nam has been one of the countries most severely affected by HPAI and notwithstanding tremendous control efforts has suffered from recurring outbreaks over the past four and a half years. It is one of the very few countries that have embarked on systematic, large-scale vaccination campaigns, which are very likely to have dramatically reduced the number of outbreaks in poultry and consequently human exposure, but have not resulted in elimination of the H5N1 HPAI virus. It appears that H5N1 virus sub-lineages dominant in southern China since late 2005 (Fujian-like influenza viruses) are now also dominant in northern Viet Nam, indicating repeated introduction, probably related to illegal cross-border poultry movements, while the sub-lineage responsible for the initial HPAI wave in 2003 (H5N1 Z-genotype virus) continues to be isolated in southern Viet Nam (Nguyen *et al*., 2008). The latter suggests local virus reservoirs, which might well be related to the intensive rice-duck systems in the Mekong river delta as proposed by Gilbert *et al*. (2008). Thus, despite Viet Nam's commendable efforts and success in controlling HPAI, relaxation is likely to result in severe resurgence of disease and a second generation HPAI control strategy, less demanding on public resources, is required.

As a very large number of households, many of which are poor, are affected by HPAI and control measures, their behavioural responses to HPAI and HPAI control measures are an important determinant of public health locally, nationally, and even globally. Given that it is hard to envisage the rapid elimination of smallholder poultry production in Viet Nam (and other low to medium income countries), smallholders must be recognized as part of the solution to managing HPAI risk, and control efforts need to structure incentives for their participation accordingly. To date, the mode of policymaking, however, reflects a lack of inputs in the process from farmers and businesses (Vu,

2008) and, appears to suffer from a bias against smallholder backyard producers. Neither data from Viet Nam, Nigeria (Williams *et al*., 2008) nor Thailand (Gilbert *et al*., 2006) support the notion that backyard chicken are at higher risk of HPAI than those kept in commercial units.

Consumer surveys indicate that in Viet Nam, as elsewhere, consumers - and not only wealthy consumers - will pay substantial premia for food quality and safety. They perceive local chicken varieties as distinctly superior to industrial or crossbred substitutes, and pay average premia of over 50 percent for them. These birds are predominantly raised and marketed by the rural poor and small enterprise intermediaries, and this trade has pro-poor multiplier effects that extend well beyond the smallholder farm gate.

It therefore seems that there is potential to combine publicly-funded disease control interventions with market-based incentives for HPAI risk reduction, which allow privatization of the related costs. Market-based risk reduction strategies, which include appropriate monitoring and traceability systems, could even be used to improve the terms of market access for the rural poor. To achieve this positive outcome they must however incorporate extension and marketing services that transfer standards and technology upstream, and product quality and diversity downstream, a feature that stands in contrast to currently advocated HPAI control measures.

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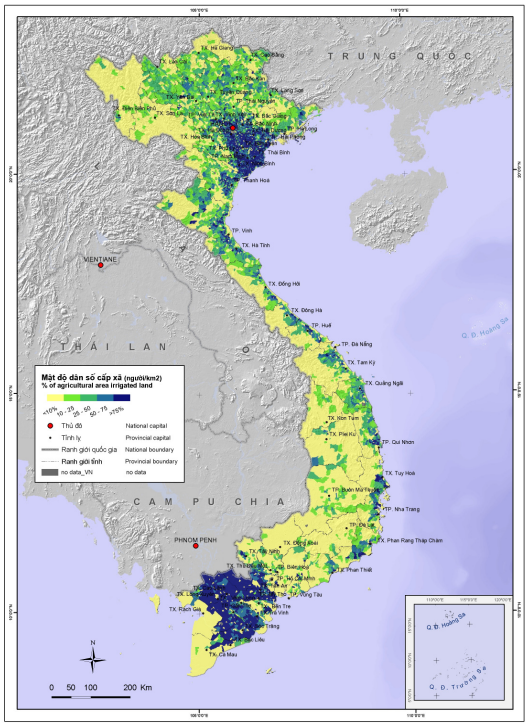
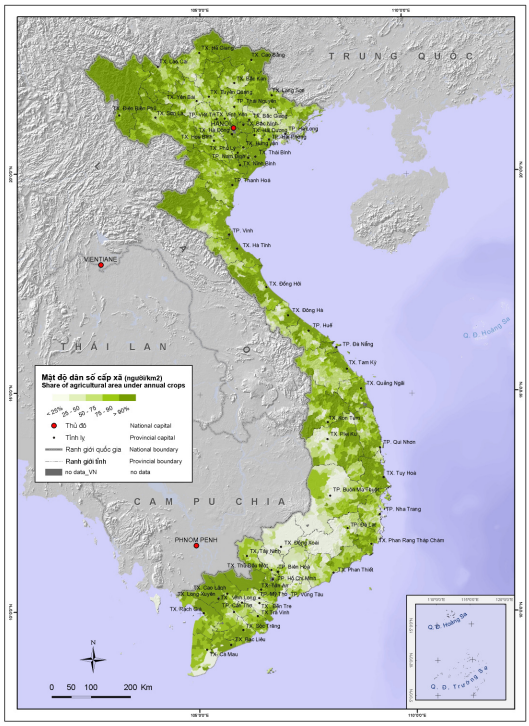
ANNEX 1. Maps

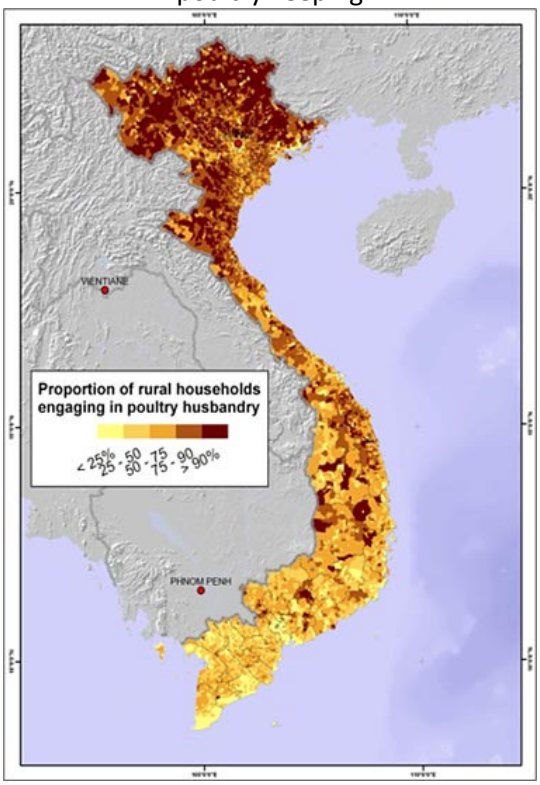
Map 1 Proportion of agricultural area under irrigation



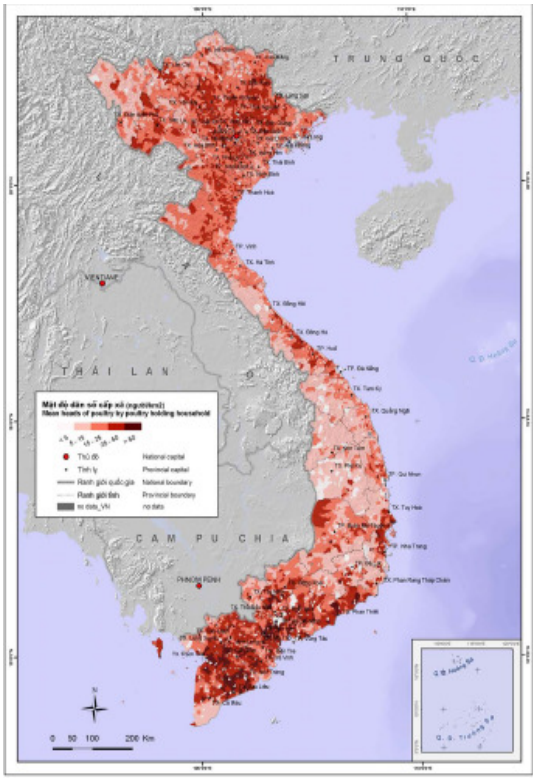
Map 2 Proportion of agricultural area under annual crops



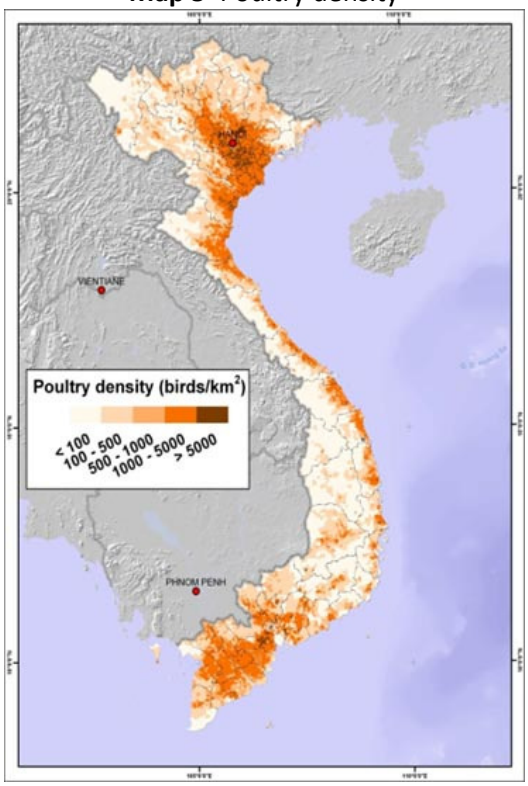
Map 3 Share of households engaged in poultry keeping



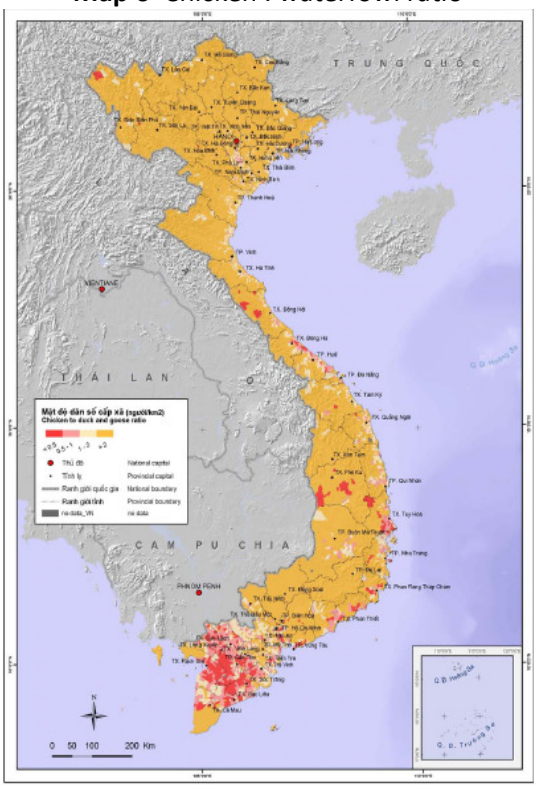
Map 4 Average poultry flock size



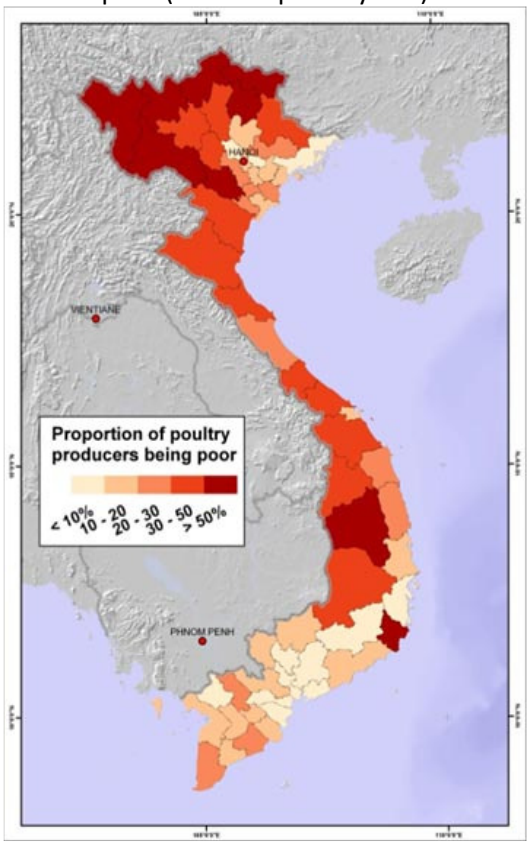
Map 5 Poultry density



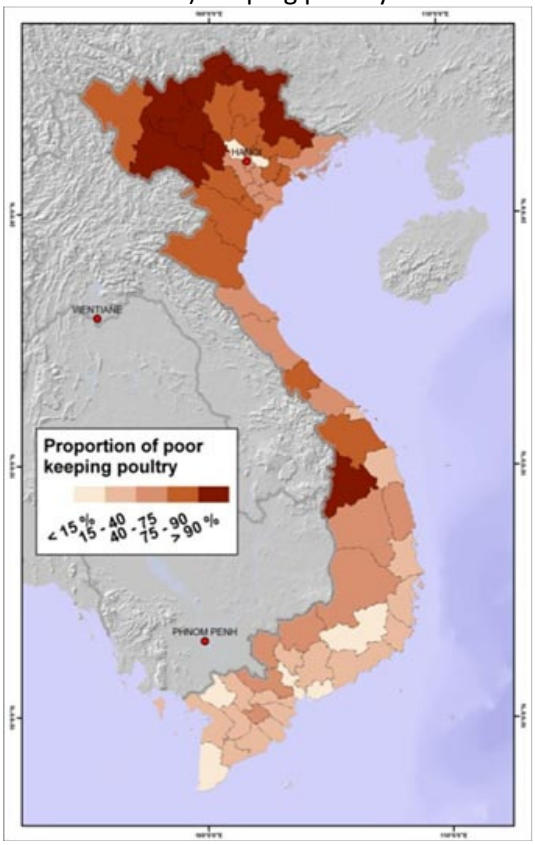
Map 6 Chicken : waterfowl ratio



Map 7 Proportion of poultry keepers being poor (national poverty line)



Map 8 Proportion of poor (national poverty line) keeping poultry



Sources: Epprecht and Robinson, 2007 (maps 1-6) and Epprecht *et al*, 2007 (maps 7-8).

ANNEX 2. Viet Nam's Vaccination Campaign for 2007

The country's first avian influenza vaccination campaign for 2007 was completed in September for 63 provinces, where a total of 164.47 million poultry were vaccinated (87.42 million chickens, 73.15 million mallard-type ducks and 3.90 million muscovy ducks). More than 42 million doses of vaccine were administered by private livestock firms. Analysis of post-vaccination surveillance data in 41 provinces and cities indicated a protection rate of 65.4 percent (47,037 tested samples) and 72.05 percent based on tested flocks (1,753 tested flocks). Analysis of post-vaccination surveillance data on 15 breeding farms managed by the central government showed that the overall protection rate was 81 percent (3,474 tested samples). Based on serological testing (haemoagglutination inhibition test (HI)), analysis of serum samples for virus activity in unvaccinated domestic waterfowl (ducks and muscovy ducks) showed that the overall positive rate was 4.58 percent (14,427 tested samples) and 13.95 percent based on tested flocks (681 tested flocks). Based on real-time reverse transcriptase Polymerase Chain Reaction (RT-PCR) of swab samples taken from markets and slaughtering points in 25 provinces and cities, the overall rate for virus occurrence was 1.75 percent.

Source: FAO-AIDE News, situation update 50, 11 February 2008, page 6.